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VOLUME XVII, 1938

INFORMATION DEPARTMENT
AMERICAN TELEPHONE AND TELEGRAPH COMPANY
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The "Plan for Employees' Pensions, Disability Benefits and Death Benefits" Completes Twenty-five Years of Service

A QUARTER century ago, on January 1, 1913, the Bell System Plan, to afford a substantial degree of assurance and assistance in economic exigencies associated with sickness, accident, death, and retirement, went into effect. This Plan is provided by the companies without any direct or indirect cost to employees. It was conceived and prepared to apply to all employees alike who meet reasonable eligibility requirements, by establishing benefit and pension payments on an equitable basis according to service and wage histories.

It is interesting to recall the point of view of the Plan's creators during the period of study that led to its adoption. These viewpoints, characteristically, had their genesis in the feeling of responsibility for the protection of the service. Those charged with the duty of investigation and recommendation regarding the Plan were considering a complex business that rendered an essential public service which by its very nature must be a continuing enterprise—a business that, for its adequate functioning, required a loyal organization having sustained vitality. To insure such an organization it was necessary to recognize and make reasonable provision for those hazards of life which interrupt earning capacity and bring about unexpected and sometimes heavy burdens. It was also necessary to meet the problem of aging of personnel through an appropriate retirement plan so that the vitality of management and organization could, at all times, be maintained and the expense, which would result from continuing in service those who become superannuated, be avoided.

In the consideration of these factors it was recognized that—

"It is but natural that every employee should desire to assume the normal responsibilities of life and to surround himself and those dependent upon him with the things that make life complete and enjoyable. Unforeseen happenings may make these responsibilities heavy burdens, and whatever may be put aside for the day of misfortune must, in the beginning, be small and accumulated slowly. A realization that obligations must be met in times of misfortune, as well as in times of prosperity, has made the need of something beside merely an old age pension appear absolutely vital.

"Employers buy and employees sell service. Perfect service is only to be found when fidelity and loyalty are reciprocal in employer and employee. It is this relationship that brings satisfaction and success to both.

"The intent and purpose of the employer in establishing a plan of benefits, is to give tangible expression to the reciprocity which means faithful and loyal service on the part of the employee, with protection from all the ordinary misfortunes to which he is liable; reciprocity which means mutual regard for one another's interest and welfare.

"This is justice, and without justice and sympathetic interest, we cannot hope to do a thoroughly good piece of work."

By those who are familiar with Bell System policies, the above quotation might be given a current date and be fully accepted as applying to the motive that exists today—"to do a thoroughly good piece of work." However, these excerpts are taken from the letter which Theodore N. Vail, then President of the American Telephone and Telegraph Company, sent to employees of the Bell System a quarter century ago in announcing the Plan for sickness, accident and death benefits and pensions which went into effect at that time. The importance of this far-sighted vision is emphasized when one considers that these steps were taken many years before such practices were generally recognized and, of course, long before the recent trends in social security, as now provided through legislation.

Twenty-five years' experience in this comprehensive and uniform program of employee benefits, designed to provide substantial protection to telephone employees against the economic hazards of life, has fully demonstrated the value to employees and the company of these humanitarian principles as applied to the efficient operation of the business. These results are especially pertinent to telephone service which involves the human element to such an unusual degree and which can only function satisfactorily through well-trained forces maintained at a high level of morale and efficiency. The Plan has aided materially in attaining this desirable end by providing for a sense of security to offset, to a reasonable extent, the fear and uncertainty regarding financial need which are ordinarily associated with superannuation, physical impairment, and death.

Previous Relief Measures and Development of Plan

Prior to the adoption of a System Plan, various relief measures were used to meet emergencies arising from disability and death. However, such practices as were followed were mostly informal arrangements which varied greatly between different companies and between departments of the same company. In all instances, the extent of relief was quite restricted and was based entirely on discretionary treatment by the companies in individual cases.

During the decade preceding the adoption of the Plan, careful study was made of the underlying conditions and the fundamental principles which should apply to a well-designed plan intended to meet, on a sound business and social basis, the needs of the telephone industry. It was believed that such a plan should apply uniformly to all employees who fulfill reasonable eligibility requirements by virtue of their employment and should not be considered or designed as a means for dispensing relief on a charitable basis. It was also necessary to provide for a uniform plan in all the Bell System Companies with an arrangement for interchanging benefit obligations so that employees might aspire to work anywhere in the System with uninterrupted benefit privileges and any company might obtain any employee it needed without affecting his service record or other factors relating to eligibility that he had previously acquired. Accordingly the Plan, as adopted and as since amended from time to time, provides benefits and pensions on a unified basis in a reasonable degree to assist in meeting the ordinary hazards of life to which the respective payments apply.

The most essential element of any plan of this kind is its security and payments provided by the Plan should not exceed such amounts as are appropriate for the purposes intended or which might affect its continuing character. In view of these essential elements, the Bell System Plan does provide liberal and reasonable protection against the stated vicissitudes of life, which interrupt or terminate earning capacity, on a basis which is advantageous to the employee, consistent with sound business principles and in accord with social thought.

General Description of Plan and Its Administration

Briefly, in the "Plan for Employees' Pensions, Disability Benefits and Death Benefits" the Bell System Companies undertake to provide for the payment of definite amounts to employees when they are disabled by accident or sickness or when they are retired from the service because of such disability, or in the event of death, to their dependents. As previously stated, the full cost of these benefits is met by the company, no contributions being required from employees. All payments under the Plan, except service pensions, are charged to current operating expenses when and as paid. As will be explained later, service pensions are paid from Trust Funds built up on an actuarial basis by annual accruals and these Funds are dedicated solely to the payment of such pensions. The Plan is administered in each company by an Employees' Benefit Committee composed of five members appointed by the Board of Directors. All of the major departments in the respective companies are usually represented on these Committees and close administrative contacts are maintained between Benefit Committee organizations and the various department organizations to insure thorough consideration and understanding of each case, individually.

The Employees' Benefit Committee of the American Company, in addition to administering the Plan for that Company, acts in an advisory capacity to the other companies which have adopted the Plan by way of making interpretations and recommending methods and practices which make for consistency among these various companies. In addition, the centralized preparation of statistical and other pertinent information and the frequent interchange of opinions and suggestions insure a degree of uniformity in the equitable administration of the Plan which could not otherwise be attained so comprehensively and completely.

In order to achieve a degree of flexibility essential to the fair treatment of individual cases, limited discretionary authorities are vested in the Benefit Committee under the provisions of the Plan and certain additional authorities are granted the Committee for making supplementary or special payments outside the Plan in exceptional cases of long duration or in cases involving unusual circumstances which cannot be covered by a uniform schedule. However, these discretionary powers of the Committee do not include the right to modify the Plan, except with the consent of the President and the approval of the Board of Directors and, even under these conditions, such changes shall not affect the rights of any employee, without his consent, to any benefit or pension to which he may have previously become entitled under the Plan as in effect prior to such change.

A more complete description of the general classes of benefits provided by the Plan and experience in connection with the administration of these payments during the past twenty-five years seems necessary in order to obtain a comprehensive understanding of the interrelated features of the Plan. As previously indicated, these general features cover sickness disability benefits, accident disability benefits, death benefits, and pensions.

Sickness Disability Benefits and Disability Pensions

In the event of disability resulting from sickness or accidents occurring outside of employment, benefits are payable to all employees who have completed two or more years of service. These payments, which start after a waiting period of seven days, range from four weeks' full pay and nine weeks' half pay for employees who have completed two years of service, to thirteen weeks' full pay and thirty-nine weeks' half pay after ten years of service. Experience shows that about 83 per cent of the cases occurring are completed during the full-pay periods and that only about 3 per cent of the cases extend beyond the half-pay periods provided by the schedule. Since the Plan went into effect, approximately $89,770,000 have been paid to employees under its provisions because of sickness disability. In addition, there has been disbursed about $11,500,000 for supplementary need in exceptional cases requiring special assistance, and $31,690,000 charged to departmental accounts for other sickness payments outside the Plan. These amounts, and others hereinafter mentioned, are for all Bell Companies which have adopted the System Plan and interchange benefit obligations, including the Western Electric Company and Bell Telephone Laboratories.

Employees who become totally and permanently disabled after having completed fifteen years of Bell System service are eligible, under the discretionary provisions of the Plan, to receive disability pensions. These disability pensions are designed to provide financial assistance, as based on need, in cases which extend beyond the sickness disability period of fifty-two weeks provided in the Plan, where the disability appears to be of a continuing character. At the present time, there are about 1000 former employees retired on disability pensions and, since the Plan was adopted, the total payments for this class of pensions have amounted to about $3,170,000.

Accident Disability Benefits

At the time the Plan was made effective, there were only a few states which had enacted Workmen's Compensation Laws. The Bell Companies, however, felt the need of making benefit provisions for cases of accidents arising out of and in the course of employment, and, accordingly, these benefits were included in the Plan. In other words, the equitable principle underlying the compensation legislation has been recognized by the Bell System since the Plan began. Although there are variations in different state compensation laws, the inclusion of accident benefits within the formal Benefit Plan makes this element of protection uniform throughout the System.

In cases of total disability, full pay is authorized during the first thirteen weeks and half pay for any period of total disability after the first thirteen weeks, provided that, after expiration of six years of disability payments, the benefits shall not exceed $20 per week. In cases of partial disability, 100 per cent of the difference between full pay at the time of injury and wages which, in the judgment of the Benefit Committee, the employee is capable of earning, is authorized during the first thirteen weeks. Subsequent to the first thirteen weeks, 50 per cent of such difference is paid for a total period of disability payments not to exceed six years. In all, except relatively few cases, these payments are greater than provided for under the compensation laws of the various states and where payments under the Plan are greater than those provided by law, the excess is paid under the Plan. During the last twenty-five years, approximately $18,550,000 have been disbursed in accordance with the provisions of the Plan in accident disability cases.

Death Benefits

In death cases of employees resulting from accidents in the course of employment, the maximum death benefit is an amount equal to three years' pay but not to exceed $5,000 or the benefit which would have become payable if the employee had died from sickness, whichever amount is greater. In addition, the Plan provides, in these cases, for the payment of certain burial expenses. In the event of death from sickness or death from accidents occurring outside of employment, benefits are payable to certain defined beneficiaries of employees whose term of employment amounts to two years or more. The maximum payments under these provisions start at four months' pay in the case of employees having two but less than three years of service, and increase by one month's pay for each additional year of service until they reach a maximum benefit amounting to twelve months' pay in the cases of employees having ten or more years of service.

Payments may also be made at the discretion of the company to the dependent beneficiaries of employees retired on pension up to the maximum amount which could have been paid under the Plan as a sickness death benefit if the employee had died on his last day of active service. Certain beneficiaries of employees who die before retirement, as, for instance, a wife living with her husband at the time of his death, and children supported by the employee, who are less than eighteen years of age, qualify for these payments under the Plan regardless of actual dependency. In other cases, eligibility is contingent upon actual dependency and the facts as to this condition are determined by the Benefit Committee.

The purpose of the death benefit is primarily to provide a continuation of income, for a limited period, to assist the dependent relatives of deceased employees in their readjustment to new economic conditions resulting from the termination of the wages or pension. Since the Plan has been in operation, approximately $21,510,000 have been disbursed in death cases of active and retired employees.

Service Pensions

(*a*) *Purposes*

The remaining general class of payments provided for under the Plan is service pensions. Pensions are of particular importance to those employees who have long service with the System and the general subject is, of course, especially significant because of the current popular interest in this form of security. The provisions for service pensions in the Plan have been developed with due consideration of the other features of the Plan described previously. Aside from its commendable social purpose, the sound business reason for the retirement plan of the Bell System is to further the efficient and economic operation of the business by meeting effectively the problems arising from the aging of the personnel.

The Plan makes possible, after reasonably long terms of service, the retirement of individual employees and the general retirement of all who have reached an advanced age, whether superannuated or not, for the purpose of vitalizing the organization as a whole. The Bell System must retain, in competition with other employers, personnel qualified for the effective operation of its business and, as previously mentioned, must, at all times, maintain a high morale among its people. From a sound business viewpoint, the retirement plan is a definite and important feature in retaining desirable qualified personnel and in maintaining the required morale. The advantages of pension provisions from the employee's personal viewpoint are, of course, quite obvious.

(*b*) *Eligibility Requirements*

To become entitled to a service pension, an employee must have completed a specified term of employment and, for certain classes of pension, have attained a specified age. The expression " term of employment," as provided for in the Plan, means a period of continuous service credited in the company, or in the company and one or more Associated or Allied Companies with which reciprocal agreements have been made for the interchange of benefit obligations. Any absence from the service, without pay, other than absence during a period of disability benefits or leaves of absence or temporary lay-off, as defined in the Plan, constitutes a break in the continuity of service unless the Board of Directors authorizes the Committee to consider such absence as a leave of absence. A rule, approved by the Board of Directors, has been adopted, however, under which breaks in the continuity of employment are "bridged" after an employee has completed ten years of continuous reemployment. In cases where the absence has not exceeded six months, or in breaks in service due to attendance at schools, the Committee is authorized, in its discretion to bridge such breaks prior to the completion of ten years of reemployment.

Retirement on service pension is provided for employees coming under the following classifications:

Class "A"—Employees whose age is 60 years or more (females 55 or more) and whose term of employment has been 20 years or more.

Class "B"—Employees whose age is 55 to 59 years (females 50 to 54) and whose term of employment has been 25 years or more.

Class "C"—Employees whose age is less than 55 years (females less than 50) and whose term of employment has been 30 years or more.

Employees in Class "A" may be retired with a service pension at their own request or at the discretion of the Committee. Employees in Classes "B" and "C," while not eligible to be retired at their own request, may be retired with service pension at the discretion of the Committee and with the approval of the President or a designated Vice President of the company. An employee becoming sixty-five years of age, is retired at the end of the month in which that age is reached. Service pensions, as provided by the Plan, are, of course, granted to those persons so retired who are eligible to such pensions.

(*c*) *Computation of Pension*

The Plan provides that the annual service pension shall be one per cent for each year of service, multiplied by the average annual pay during the ten years preceding retirement, provided, however, that the Committee may, at its discretion, base the pension upon the average annual pay for the ten consecutive years during which the employee was paid the highest rate of wages. The minimum service pension for full-time service is thirty dollars per month. Pensions computed on the basis of average service during the ten years preceding retirement are generally larger and bear a closer relation to salary and living expenses at time of retirement than would result from basing the pension on average pay during the entire period of service.

Under its terms, pensions payable under the laws of any state or country shall be deducted from pensions otherwise payable under the Plan. The Bell System Companies, in 1936, advised their employees as follows in respect to this provision of the Plan:

> "No change is contemplated in the Plan on account of the Federal Social Security Act of 1935 except that if the Act shall remain in effect unchanged until 1942, when payment of Government Pensions begins under the Act, it is expected that the provision now in the Plan that all of the pension paid by the Government shall be deducted from pension otherwise payable under the Plan will be changed to provide that only one-half the pension paid by the Government under the Act shall be deducted. In other words, if the Act remains unchanged, the employee retiring on pension after 1941 will receive from the Government and the Company together the equivalent of his or her full pension from the Company plus one-half of the Government pension, which

half represents, in effect, what the employee has contributed toward the Government pension through the tax on his or her salary or wages."

(*d*) *Pension Trust Funds and Disbursements*

From 1913 through 1926, service pensions, granted under the Plan, were financed on a cash disbursement basis. Where pensions, like other classes of benefit payments, were made from "Benefit Funds" established by the respective companies, amounts necessary each year to restore these Funds were charged to operating expenses. In 1927, the Bell Companies established separate Trust Funds under the Plan, from which all service pensions are now paid. The balances in the "Benefit Funds," aggregating $48,940,333, were transferred to the Pension Funds, and, since then, all benefits, other than service pension disbursements, have been charged directly to current operating expenses, when and as made.

The companies have undertaken to maintain their respective Pension Trust Funds in such amount that when employees become eligible under the Plan to receive service pensions, there will be available in the Pension Funds amounts sufficient to provide for their pensions according to the terms of the Benefit Plan. For the purpose of meeting these obligations and, at the same time, to effect a more even distribution of the cost of pensions over the years with the advantage of interest earnings on amounts funded, the companies adopted, in 1927, an accrual program based on the principle of accruing currently, as charges to operating expenses, amounts which, according to actuarial computations, are designed to make appropriate advance provisions for future pension disbursements.

As provided in the Trust Agreements, the Trustee is required to hold the Pension Funds solely for the payment, as directed by the companies, of service pensions granted by them under the Plan. In cases of termination of the Plan, or in case of revocation or other termination of any Trust Agreement for service pension purposes executed under the Plan, the company, as set forth in the Plan, undertakes to preserve the integrity of the Pension Fund as a Trust Fund to be applied solely to service pension purposes and to take such action as may be necessary or appropriate to insure the application of the entire Pension Fund to service pension purposes. Therefore, the amounts trusteed in the Pension Fund are irrevocably devoted to service pension purposes and no part there of constitutes an asset of the company or can become such an asset in case of termination of the Plan, or termination or revocation of the related Trust Agreement.

Since the adoption of the Plan, about $40,300,000 have been disbursed by the companies for service pensions, and, at the present time, there are about 7,800 retired employees receiving these pensions. After deducting pension disbursements, there is now set aside an aggregate amount of about $223,000,000 in the Trust Funds of the respective companies. The accruals, which are being paid currently to the Trustee to provide for future pensions, amount to approximately $16,000,000 annually. As previously indicated, these figures include amounts for the Western Electric Company and Bell Telephone Laboratories.

Employee and Company Responsibilities

In evaluating security measures of this general nature, it is important to understand that amounts which can properly be disbursed for such protection must necessarily cover large groups on a uniform basis, taking into account wage and service history. Beyond this general coverage the individual should endeavor to provide for himself and dependents according to the circumstances which apply to his particular requirements. Such provisions, which are a responsibility of each individual, may supplement the protection provided by the Plan or may, of course, be amounts which are desirable for other economic purposes of particular interest to the respective employees.

In any event, complete security which is desired to meet all economic conditions becomes a joint undertaking. After the company has made reasonable provisions for the ordinary hazards of life, so far as can be justified by the dictates of sound business judgment, the employee should maintain his individual initiative and responsibility to supplement this protection for the future according to his particular needs. This fundamental principle is as important to the employee in maintaining his individuality as it is to the company in maintaining, on a secure basis, the protection which it provides.

In looking back over the years, one can only be impressed with the enormous good to the employees and the company which has resulted from the Plan. It is to the mutual advantage of both that this important undertaking be carefully safeguarded for the future. This responsibility on the part of both employees and the company involves a broad and comprehensive understanding of the intent and purpose of the Plan and the exercise of good judgment, in order to avoid measures which might affect its security.

Charles J. Schaefer, Jr.

Some Fundamentals in Standardization

(*Editor's Note: This is a section of an address given December 1, 1937, before the American Standards Association, by Mr. Frank B. Jewett, Vice President of the American Telephone and Telegraph Company.*)

THIS Association, which is the direct lineal descendant of the first engineering society standards committees, has come gradually into a position of great power and grave responsibility—greater and graver even than most of us appreciate, I suspect. Not only does your imprimatur influence directly the things of industry with which you are concerned and the affairs of their users, but in many directions it becomes part of the base of statutory regulations, ordinances or laws. It is from this angle that much of your enhanced responsibility for careful, thoughtful and meticulous functioning arises.

The formal ordinances or laws of the State are hardy " beasties," difficult to change and almost impossible of extermination. They spawn argument, conflict and litigation at a prodigious rate and of a kind that gladdens the heart of those who like to fish in muddy water. Since much of this water is now of your making, it behooves us to look well to its quality and filtration before turning it into the public distribution system.

Outside what I have observed of standardization in other fields of applied science, substantially all my ideas concerning it, concerning its possibilities and limitations, concerning the objectives for which it is undertaken, and particularly concerning the basic rules which, it seems to me, should govern approach to the formulation of any standard, have been derived from the experience of nearly thirty-five years devoted to the orderly development of electrical communication. Throughout this entire period, standards and standardization have been looked upon as powerful tools for progress in the communication art. Occasionally, but not often in recent years, they have turned out to be serious obstacles to it.

Having determined many years ago to make the development of telephony and its collateral forms of electrical communication in the Bell System as far as possible an orderly process based on established principles of science and engineering, it was inevitable that standards and standardization should early come in for careful analysis. Because of the peculiarly favorable conditions for unity of operation present in the structural set-up of the Bell System—research, development, manufacturing, installation and operation being all under a common direction, and with all parts of the organization concerned with a common objective—our experience might be considered in the nature of a trial installation of standardization under ideally controlled conditions.

While all of us have subscribed to the common objective of the best and most extensive telephone service which science and art can provide at the lowest cost consistent with financial safety, I would not have you think we have been free from violent differences of opinions in the matter of standards to be adopted or altered. In so far as matters relating to standards were wholly of internal concern, the one thing we have been spared was the conflict of divergent views based on real or assumed differences of objective.

Since the only thing we sell to the public is service, we have in the main been free from the ordinary manufacturer-customer conflict of requirements in our standardization of the material things required for giving that service. To a considerable extent it is immaterial to us which of two things we decide to standardize, provided only that the one chosen, when related to all the other factors which make up final overall cost will give the best life service at the lowest cost. Thus, for example, as between two designs giving equally good operational results, we have no hesitancy in standardizing the one of higher initial cost if it is clear that by so doing we will save much more than the difference on reduced maintenance expense over its useful life.

Early Conclusions Strengthened

My first study of standardization and the function and place of standards led me to certain conclusions, most of which have been strengthened by subsequent experience.

In the first place, it seemed clear that when the telephone art had progressed far enough in any sector to make true standardization feasible, the establishment of standards and rigid adherence to them until they were superseded by better standards was the only certain way to ensure orderly and expeditious progress.

In the second place, it seemed clear that the standards set should take account of *all* the pertinent factors and should so far as possible omit *all* non-essential requirements; in a word, that they should make mandatory only those things clearly necessary in the attainment of a desired result and should leave maximum freedom for variation in all else.

In the third place, it appeared that standards should never be allowed to take on the habiliments of things sacrosanct but should be under continuous critical surveillance; that they should be discarded or modified promptly whenever it was clear that they had ceased to be tools of progress and become hindrances to it instead.

Standards Short-lived

As a result of these and numerous other fundamental considerations which will occur to all of you, standards as we employ them in the Bell System are frequently short-lived affairs. We respect and value them for the help they give us while they live. We refuse to let them dominate our thinking and we discard them without a qualm when they become shackles. I think our attitude toward them might be expressed by saying that, in our picture, today's standards are today's statement of the most we know about the things we employ. Tomorrow's standards may or may not be the same. One thing we do do when discarding an old friend is to be sure that the new one will serve us better and, so far as possible, to have a definite bridge between the old and the new.

Another thing we learned early in our work was that a nice question was involved in determining just when to attempt standardization. If it was attempted too early in the development of a new thing or a new method, we ran not only risk of wholesale use of something inferior to the best attainable, but to a considerable extent we shackled and straight-jacketed development. If standardization was too long deferred, development and use tended to run riot and produce a situation akin to one in which there were no standards or guide-posts to serve as definite points of departure.

On the whole I am inclined to think that the first, *i.e.*, a too early standardization, involves the greater hazard. It is a serious thing to stimulate the use of an inferior thing or method by designating it as a standard. It is a far more serious thing to shackle and delay development by so doing.

The establishment and promulgation of engineering or industrial standards always has a powerful influence on men's thinking and acting. There is universally a tendency to think and work *toward* a standard—seldom away from it, unless those concerned with the thing standardized appreciate fully that the standard is simply a transitory affair. Men will invariably spend more energy and thought in the direction of achieving the standard than they will on breaking new ground beyond it. They have a tendency to exercise their energy and inventiveness largely in devising cheaper ways of attaining standard results.

Where the established standard is distinctly above the average of the things to which it applies, this magnet-like tendency has its advantages since it stimulates those who are in the inferior position to seek a higher level, and, since they are in such case a majority, it acts to raise the general level even when it retards somewhat those who have been most progressive.

With premature standardization also, all the forces involved are marshalled largely behind the status quo. Custom, established methods, money invested in tools or plant—all argue against change. It is so upsetting!! On the other hand, where proper standardization has been delayed beyond the time when it should have been done, the very turmoil and chaos of the resulting situation almost automatically impels conflicting interests to seek a common meeting ground. Further, from the welter of confused experience there is much material that can be salvaged in the making of a standard.

Trial Period Needed

Although I realize the difficulties inherent in the process, it has always seemed to me that the tool of "trial installation" could in many cases be a valuable addition to the machinery of standardization. Possibly in my ignorance of modern standard-making methods, I am advocating something which is already in effect. All that I have in mind is a field trial of the thing proposed on a sufficiently large scale and under sufficiently complete observational control to test thoroughly all the factors involved without committing everybody in advance to the new proposal. In a way the "tentative standard," or whatever you designate it, is along the lines I have in mind, although, as I have observed its operation in some cases, it seems to fall short of what I have in mind. It invites and depends too much on uncontrolled and uncoordinated observation, and so retards final decision and leaves that decision largely involved in a compromise of opinions.

In the Bell System where, as stated earlier, research and development, manufacturing, engineering, installation and use are all looked upon merely as parts of a common problem, and where standardization is undertaken solely to insure the best that the current art affords and to facilitate improvement in the elements involved in rendering service, the controlled field trial has long been an established routine. No new thing of any importance is ever put into general use without it. Primarily designed to bring to light defects or improvements which have either been overlooked in the laboratory or which from their nature can only be determined in the field, it serves almost automatically to determine the requirements of new standards which can and should be established for use until they in turn are supplanted by still better ones. It is, in fact, the use of "industrial guinea pigs." While it does frequently involve experimentation on the ultimate consumer, it is only on a limited group of consumers, so that adverse reactions can never reach major proportions.

When it comes to how standards should be made and who should participate in their formulation, it has always seemed to me that machinery like that of the American Standards Association or some body similar to it is the only sensible kind to employ, except possibly in those fields involving matters of such vital importance to the general population that only political Government has the power to cope with them.

Even here, however, it is hard to see how an organization such as the American Standards Association can fail to be of the utmost assistance. The technical and scientific world has become so complex, and controlling factors in almost every sector are found in such unexpected places, that only by having a forum where every one who has a right to be heard can be heard, are we assured of that final judgment which will command adherence and respect.

Compromise Necessary

Furthermore, it is only from such a voluntary association that we can expect to have that degree of compromise without which no industrial standard, however perfect and desirable it may appear to its makers, can hope to succeed. I have observed that it is the exception rather than the rule when men are reasonably unanimous in acting like rational human beings. Ordinarily we are a perverse lot who greatly dislike being told what we must or must not do even when we know that the prescription is clearly in our interest. If, however, we feel we have had our day in court we are usually ready to give the verdict a fair trial, including a peaceful appeal, when necessary, to the court if we are still dissatisfied.

It is when we feel that our interests have been grossly outraged or our evidence slighted and passed over in the final decision that we put on our guerilla togs and go out on a foray. All of this is just as true in the field of standardization as it is in any other area of human activity. Any standard which is made and promulgated in opposition to the fixed opinions, however acquired, of any considerable group involved in its operation, is foredoomed to hard sledding and almost certainly to failure. Such a group would be more than human if they did not seek to make it fail.

It was considerations such as these which long ago led me to feel that to be successful in the field of standardization, the body responsible for a work which has become increasingly important to industry and commerce and to society generally, should have certain characteristics. It should be a voluntary association with the broadest possible constituency in the field of its interest; its operations should be democratic with all that that implies of much essentially futile discussion and apparent procrastination; it should let facts, so far as they can be obtained, rather than opinions determine the answer; finally, the Association itself should not be clothed with any police powers of enforcing its own findings—it should depend on the proven validity of its conclusions and the recognized standing of its members if it would insure general acceptance of its work.

The Importance of Facts

Apropos of these two last points, I should like to remark that they but paraphrase observations made to me many years ago by two wise men, now dead, who were my friends—General J. J. Carty and Mr. Elihu Root. Early in my career as one of his assistants, General Carty impressed on me the importance of getting facts before forming opinions or drawing conclusions if one wished to obtain a valid and acceptable answer. It was his belief and one he operated on consistently, that the answer to almost any question was 90 per cent automatically self-evident if one took the trouble to assemble and scrutinize the known or ascertainable facts which bore on it. Anyone who was ever involved with him in consideration of some knotty problem will never forget the interminable hours, days, and even weeks or months which he devoted to fact finding. It was soul-trying and patience-trying and it led into most unexpected places and to most unexpected individuals but it got results that were rarely wrong.

Long ago Mr. Root pointed out to me the inherent fragility of action based primarily on legal authority and the almost irresistible power which inhered in the judgment of a body of men possessed of no power to enforce that judgment but who were recognized to be men of ability and character and who formed their opinions with studied deliberation.

My distrusts of Government as a maker of standards that affect commerce and industry, i.e., outside those sectors of public health or safety or national defense where Government alone can act, are more basic than fear of intrusion of political factors. They reside (1) in the belief that the agencies of Government, circumscribed as they are of necessity by the restraints of Government, are not in the best position to obtain and appraise all the facts; and (2) that being agencies of Government, anything they emit tends to appear more important than it really is and more difficult to abandon or modify.

Government Should Participate

In other words, standards made by Government are, it seems to me, more likely to become instruments of restraint to progress than are those emanating from a mobile body like the American Standards Association. When to this is added the almost inevitable tendency that develops in men clothed with apparent authority, to exercise it punitively, it seems to me that the case for the voluntary association in the field of standardization is substantially iron-clad.

Nothing of what I have just said should be construed as a belief on my part that Government should be excluded from participation in the making of standards—quite the contrary. Government should participate largely but, I think, on the same voluntary basis as the other members of the association. Added to its general concern in establishing standards wherever these are clearly in the public interest, Government in times of peace is itself a large consumer and so entitled to be heard. In times of war it is the largest consumer. Anything in the direction of wise standard making in times of peace which will facilitate the functioning of Government and industry in time of war is obviously in the common interest.

I know that all the foregoing is "old stuff" to you and I am not saying it with any thought that it need be said here where all agencies—Governmental and non-Governmental—meet together. What I really had in mind in saying what I have is that possibly my opinion based on long experience may add a pebble to the dyke which periodically has to be raised against a demand that Uncle Sam take on part or all of this standardizing job because he can do it so much better or so much faster. It is usually a plausible tale that is told and it has only one demerit—it is not true.

In concluding I do not know that I can do better than attempt in brief summary to restate my own picture of what proper industrial standards should be, how and by whom they can best be formulated, and some of the things which appear to me we should guard against in their use.

The Life of Industrial Standards

Before doing this I should like, however, to emphasize two things which, while interrelated, are frequently badly confused particularly by the non-technical public. First, industrial standards are essentially different from the so-called "absolute" standards of science—such, for example, as the unit of time. These "absolute" standards if accurately determined and readily reproducible are "absolute" in a very real sense—they are ordinarily not subject to change with advancing knowledge. They are the scale by which we measure it.

Industrial standards on the other hand are akin to the hypotheses of the scientist. They define our present state of knowledge and they live only so long as they continue to define adequately. As soon as they fail so to define, they are for all practical purposes as dead as the ancient Dodo or the Great Auk and like them are of interest only in a museum.

To the non-technical this difference is not generally understood and from the misunderstanding arises much difficulty. To them "standard" has come to denote something fixed, final and generally desirable. They instinctively resent anything which seems to cast doubt on its paternity and they impute base motives to all who advocate change despite the fact that changing industrial standards are the very hallmark of industrial progress.

Now for my summary picture.

To me a proper engineering or industrial standard is a temporary statement which includes all that is really essential of proven current knowledge needed to define the thing standardized. It is a specification which can be met in current commercial practice and a tool by which the art can progress. It carefully excludes everything which is non-essential in order to insure maximum latitude alike to the developer and user. In a word, it is a common meeting place for purchaser and seller, with no signs of *caveat emptor* about.

It is continually under scrutiny by all who have occasion to use it and is subject to ruthless modification or abandonment as soon as it has clearly ceased to function as intended.

It is created by a voluntary association of all groups who have a definite interest in its existence and by representatives of them chosen because of established reputation for competence and ability to weigh evidence, honestly and impartially. The standardizing body itself should be without legal power to enforce its conclusions but like the Supreme Court should depend on the recognized merit of its findings. Where reasonable doubt exists as to the necessity for standards, the Association should err on the side of too few rather than too many.

Where it is known or believed that the standard sought to be established is likely to become adopted into ordinances or laws and so subject to administration by men who have legal authority of enforcement, the obligation on the Association to be meticulous in its final decision is greatly enhanced. Merely to clothe a standard with the habiliments of ordinance or law is to lessen materially our ability to change promptly in the face of changing conditions. With increasing prestige of the American Standards Association there will inevitably be increasing tendency to enact laws based on its authority.

FRANK B. JEWETT

Organizing for Service

IT is generally admitted by those who have had the opportunity for comparison that the United States, with one-half of all the telephones on the globe, has the best telephone service in the world. Not only is the service nationwide in scope, interlinking some 70,000 communities, but there is outstanding excellence in the qualities of the circuits which make for distinctness of the speech transmitted, in the speed with which connections are established, and in the cooperative attitude of the operating forces in their efforts to serve the public.

It is obvious that such a service could not just happen but on the contrary must be the result of many coordinated factors. An underlying reason, however, can be found in what is meant by the single word "organization," which is usually called the characteristic basis of American efficiency.

It is through Bell System organization that it is possible to express and crystallize the accomplishments of scientific research in a constantly changing art, the advances in engineering and operating technique, and the ideals and standards of management. It is because of organization that thousands of scattered groups are capable of immediate mobilization, are responsive to every change wrought by progress, are inspired with a glowing sense of responsibility. Without adequate organization, the human machine that gives the telephone life in the United States could neither adequately understand nor efficiently accomplish its giant task of public service.

As is well known, there is in the Bell Telephone System an integrated organization that functions under federal and state regulation to provide the framework that permits a unified and economical service. Because of this corporate organization the advantages of centralized research, centralized study in the fields of engineering, operating and accounting practice, centralized consideration of personnel problems and centralized manufacture of standardized equipment all flow automatically to the operating units that have the responsibility of knowing and serving the communication needs of their communities.

But this corporate organization does not alone explain the efficient performance of the Bell System's 325,000 men and women as they concentrate on their individual tasks while united in a common vision and objective. Without a carefully planned and properly directed operating organization, there would be no practical way of coordinating the multitude of operations that combine to form "telephone service" as this is known and accepted in our country to-day. It would seem that the creation of such an operating organization constituted the most fundamental of management's problems, and that its existence to-day is in reality among the greatest of management's accomplishments.

The Purpose of Organization

What should determine the form and structure of an operating organization? It should be obvious that the controlling factor is, in the last analysis, *the work which has to be done.* In other words, organization should be thought of as a means to an end, not as an end in itself. The form of organization necessary to do a given job will vary, of course, with the nature of the work to be done, and the arrangement which will produce best results can only be determined by experience. It is one of the most important functions of management to make this determination and to modify the organization from time to time to meet changing conditions.

Careful consideration must be given to the ways in which the different elements of the work are grouped together into working units and to the relation of the number of supervisory people to the total force. This latter relationship, commonly called "overhead," is often misunderstood, the popular assumption being that a low per cent overhead represents an efficient management and a high per cent overhead an inefficient management. If this were true the ideal would be no overhead at all. The result would be an untrained, undisciplined and undirected group of people and it would be absurd and contrary to all experience to expect such a group to produce best results. It follows that there must be some overhead even on the simplest work, the amount of course being dependent on the kind of work to be done. Obviously, the proper amount is that which will get the job done best with the least total cost and this can be determined only by experience. For example, a company with operating costs of $100,000 of which $10,000 or 10% was for overhead organization might find that by spending an additional $10,000 for overhead it could do the job as well or better and reduce its total costs to $80,000. Obviously, it would be good management to provide the larger supervisory organization, even though it resulted in increasing the per cent overhead from 10% to 25%. This indicates the value of careful consideration to overall results in determining for a given kind of work the proper amount of supervision to be provided.

As an example of the way in which organization is set up as a means to an end, let us consider one of the oldest and most familiar types of organization—that of the army. Here we have a large collection of men brought together for the purpose of protecting a country from attack by enemies. We all know that the primary requirement for repulsing an armed attack by an enemy is men placed on the firing line with guns and other military equipment. In a force of, say, 20,000 men, the large majority will be fighters on the firing line. Why should not all the 20,000 be fighters actually on the firing line? Simply because experience has shown that this force can be most effective in repulsing the enemy when divided up into units, each under the direction of a competent leader with adequate provision for training and equipping the men. It is an established military fact that a well organized army of trained soldiers is more effective than many times its number of unorganized, untrained people.

As a result of this experience, we have the fighting men of an army grouped into squads, each under the direction of a Corporal. The squads are grouped into platoons, under the direction of a Lieutenant. Platoons are further grouped to form a company, under the leadership of a Captain. The requirements for training the men and carrying on certain clerical and routine business of the company is cared for by the appointment of Sergeants, of which there are from four to eight per company. Experience has further shown that the activity of these company units can be directed most effectively in the field by grouping them into battalions, under the direction and leadership of a Major or Lieutenant-Colonel. Battalions are, in turn, grouped into regiments under Colonels; a group of regiments constitutes a brigade under a Brigadier-General, and brigades are grouped into divisions under a Major-General. Several divisions constitute an army corps, and a collection of army corps constitutes the entire army, under the leadership of the Commanding General.

Now each of these leaders of companies, battalions, regiments, divisions, etc., must have assistants to help him in the effective discharge of his responsibilities, and staffs are provided for this purpose, the size of which is determined by the needs as developed through experience. It is the staff's responsibility to care for the planning and arrangements necessary to see that the fighting forces are adequately provided with food, clothing, shelter, guns, ammunition, transportation, communication, etc., which are necessary to their proper functioning. These leaders and staffs also study the plan of battle and develop the strategy and tactics which will make the fighting forces most effective.

The man on the firing line is impotent unless he is adequately armed and properly trained, and he needs effective direction and inspiring leadership. Obviously, the organization necessary behind the lines to do these things is just as important a factor in repulsing the enemy as are the men on the firing line. In an Infantry Division of about 20,000 men, roughly 75 per cent are privates, 20 per cent non-commissioned officers and 5 per cent commissioned officers, both line and staff. This relationship is the result of centuries of experience on the part of military authorities in handling troops, and it would be unsound to conclude that this overhead of 25 per cent is wrong because industry conducts its operations with more or with less overhead organization.

The Telephone Army

The organization just described finds something of a parallel in the Bell System. Here we have a group of people enlisted for public service in providing an adequate, dependable telephone service. On "the firing line" we have the business office representatives who take the subscriber's orders for service and transact the Company's business; the installers and repairmen who connect the customers with the System and keep their lines in good order; the operators who work the switchboards to meet the subscriber's demands for telephone connections; the maintenance men who keep the plant in working condition; the accounting clerks who prepare the subscriber's bills, etc.

Just as "the firing line" forces of the army need corporals, sergeants, lieutenants, captains, colonels, etc., these telephone line forces need supervisors, chief operators, foremen, district managers, division managers, etc. Also, as the army needs staff people at various levels to keep the men on the firing line properly armed and trained, so the telephone operation requires groups of staff people to provide the line forces with the things they need to perform their functions—i.e., switchboards, wires, buildings, adequate training, methods for doing their work, etc. These supervisory people, directing heads, and staff assistants are essential factors in meeting the objective of the telephone operation which is to provide the best possible service at the lowest practicable cost. The number of these people and the nature of the groups into which they are organized are the result of management's experience in getting the job done.

Let us examine this matter in somewhat more detail by analyzing the situation in one of the major departments of the business, i.e., the Traffic Department. Primarily, this work involves establishing telephone connections at the switchboards, and the bulk of the personnel consists of carefully trained young women stationed at the switchboards to answer calls and complete connections. There are about 135,000 employees in the Traffic Departments, of which roughly 105,000 are the operators at the switchboards.

Now, we could, of course, put the entire 135,000 at the switchboards, just as in the army example we could have had the entire 20,000 men equipped with guns on the firing line, but experience shows that this is not the right way to get the best job done. It has been ascertained, by carefully conducted trials, that a given number of people in the central office will produce better overall results when one or more of them is assigned as supervisor to assist the operators at the switchboard than when all sit at the switchboard and establish connections without supervision. The supervisor's job is to oversee the work going on in her group, to take care of the special cases which arise calling for treatment beyond what the operator is in a position to provide, and to coach and train continuously the members of her group. The number of such supervisors required in any office is largely dependent upon the number and experience of the operating employees.

Each group of operators and supervisors constituting a central office must, in turn, be under the direction of a responsible head, and this person is known as the Chief Operator. In the administration of her work, the Chief Operator needs assistance in planning force schedules, carrying out details of force assignment, keeping office records, etc., and, therefore, clerks are provided for this purpose.

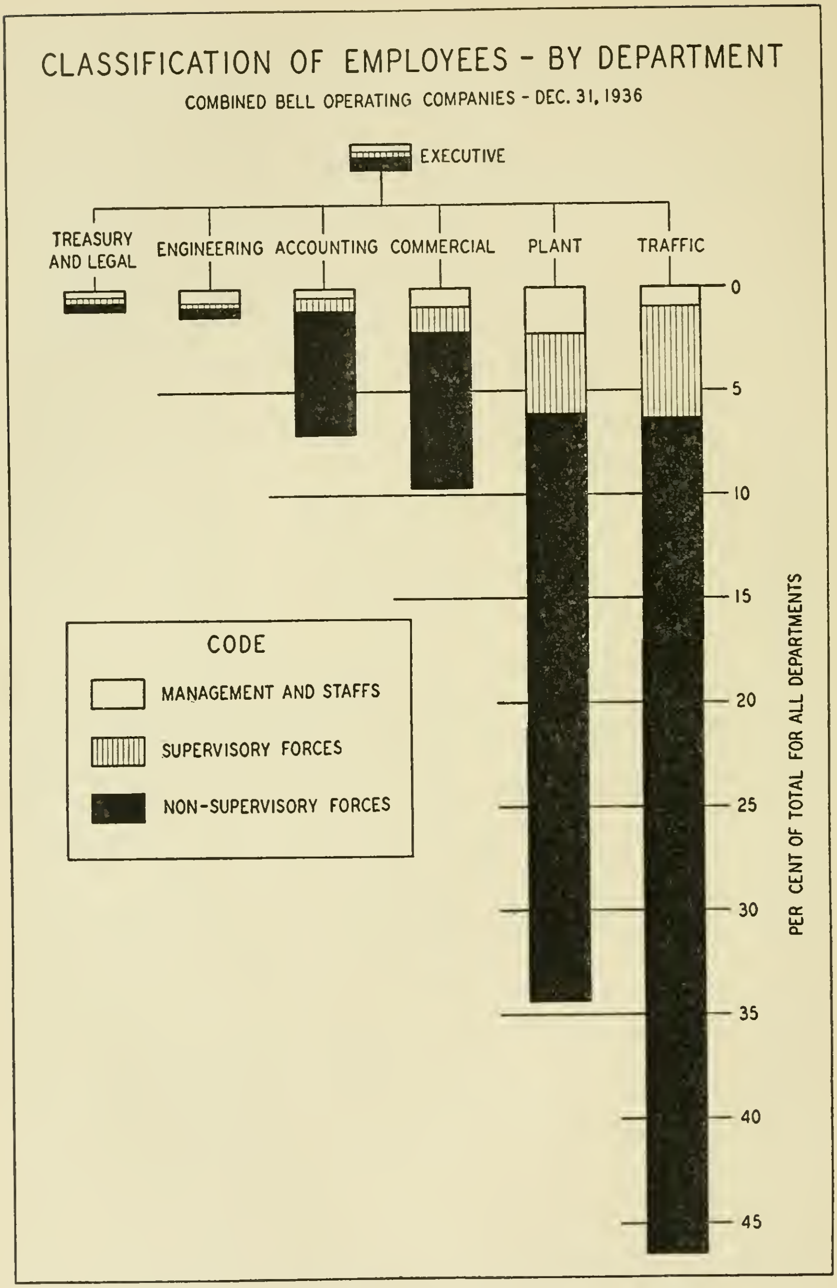
Several central offices taken together are grouped into a district under the direction of a man known as District Traffic Manager. He is responsible for the quality of the service in these central offices, for seeing that the work is carried on at the lowest practical cost, and that interest, enthusiasm and loyalty is maintained among the operating forces. His activities include such things as attention to the adequacy and arrangement of central office facilities, adequate provision of operating and supervisory employees and their proper training and development. To help him he may require staff assistants in caring for the many administrative problems involved. The number of assistants varies as between districts, dependent upon such factors as the number of central offices in the district, the number of employees involved and the amount of detailed administration carried on at the district level.

Districts are generally grouped into divisions under the direction of a Division Traffic Manager. His responsibilities consist largely in supervising activities in the districts, to insure the continued maintenance of satisfactory service and costs. Other activities include coordination of the work between districts, preparation of division budgets, the development of the supervisory personnel, etc. Here, again, discharge of these responsibilities calls for staff assistance. The divisions within a company or operating area are under the direction of a General Traffic Manager, who reports to the General Manager of the company or area. In the General Traffic Manager's organization, staff assistance is provided to assist him in the general supervision of the traffic operations of the company and the direction of a force of a few thousand people. They also provide the division and district forces with the necessary methods and routines for carrying on their work and plan the amount and layout of the switchboards, so as to enable these line forces to maintain a high grade of service economically. The form of these staff organizations differs somewhat as between operating areas, depending on conditions, but the type of organization and quantity of personnel is only that which experience has shown is essential in getting the necessary work done.

This example is typical of the organization of each department of the telephone business. In each of these departments there are the so-called line forces who are putting up connections, building and maintaining the plant, carrying on the business activities, preparing bills, doing clerical work, etc., and there are the supervisory and management people, including staffs, who direct the activities of the line forces and do the planning work necessary to the effective conduct of the job. The chart on the next page is of interest as showing by departments this classification of employees in the Operating Companies of the Bell System.

The black portions of the bars show the people whose work is of a non-supervisory nature, such as plant craftsmen, telephone operators, business office representatives, clerks, stenographers, typists, etc. This group comprises over 83% of the total employees. The lined portions show the people immediately supervising the above forces, including plant foremen, traffic chief operators and supervisors, commercial business office and sales supervisors, supervising clerks, etc. This group comprises about 11% of the total employees. The white portions show the general officers and operating officials, including division and district managers, together with their operating, technical, legal and accounting staffs. The general officers and operating officials constitute about 1% of the total employees of the Operating Companies, and their assistants and staffs, roughly, 5%.

This chart shows the relatively small portion of the total organization in each department which is provided for plan-


CLASSIFICATION OF EMPLOYEES - BY DEPARTMENT
COMBINED BELL OPERATING COMPANIES - DEC. 31, 1936
EXECUTIVE
TREASURY AND LEGAL
ENGINEERING
ACCOUNTING
COMMERCIAL
PLANT
TRAFFIC
CODE
MANAGEMENT AND STAFFS
SUPERVISORY FORCES
NON-SUPERVISORY FORCES
0
5
10
15
20
25
30
35
40
45
PER CENT OF TOTAL FOR ALL DEPARTMENTS

ning, guiding and administering the work of the large organizations which are required. The relationship of the non-supervisory forces to the total varies somewhat as between departments due, of course, to differences in the nature of the work to be done.

Problems of Growth

As discussed before, the type of organization most effective in accomplishing the desired result must be determined by experience, and it is a primary function of management to make this determination. This is well illustrated by changes which have taken place in organization setup within the Bell System since its beginning. In the early days, when the business was in its infancy and the number of customers was small, the equipment and plant layouts were relatively simple, and only a small organization was necessary to provide the plant and to establish connections. All the activities necessary to provide service in a given area could be carried on under the direction of a single person. These people were called "non-functional managers" and they, with a small staff, directed the work of the operators at switchboards, the construction and maintenance men, the business office representatives and, in short, were in complete charge of the telephone service of the communities or areas. As the business grew in size, it was found that every phase of telephone operation became more complex. With the greater number of customers to be connected with each other, the switchboards and the trunk line layout interconnecting them became more complicated, so that the work of engineering and maintaining them was made vastly more difficult. The wire layouts on poles became denser and denser, leading to the use of cables and underground conduits in cities, and these things brought with them an enormous increase in engineering, construction and maintenance problems and in the necessity for a knowledge of technical details on the part of those administering this work. The training of the switchboard operators, which was relatively simple at first, became more difficult, and new problems sprang up in the way of finding means for insuring that just the right number of operators were at the switchboards each hour of the day. Business contacts with customers also increased in complexity as various types of service and equipment were offered to meet varying requirements. The matter of starting new service for customers after the orders had been taken became a more difficult one, involving the effective cooperation of a large number of people within the telephone organization. It became obvious that the requirements of this increasingly complex job could not be met adequately with the early, simple type of organization, wherein the direction of all the activities within a community or area was centered under one head. As a result, the organization was divided up into departments, each department being made responsible for a particular part of the total job as follows:

> The *Traffic Department* was given the responsibility for directing all the work relating to the actual establishment of connections. This included the hiring and training of the switchboard operators and the direction and supervision of the operating work. It also included determination of the amounts of equipment required and its arrangement.
>
> The *Plant Department* was given responsibility for constructing and maintaining the plant and installing telephones on customers' premises. This involved the organization, training, and directing of a large force of plant men with all its related problems.
>
> The *Commercial Department* was given the responsibility for carrying on the company's business relations with customers. This involved, among other things, the maintaining and manning of convenient business offices with its related problems and the conduct of sales and collection activities.

The *Engineering Department* was given the responsibility for planning the layout of buildings, central offices, outside plant, etc., necessary to meet the requirements for telephone service and to study and plan for expansion to meet the growing telephone needs of the public. This involved the training of a force of people in technical processes and engineering detail.

The *Accounting Department* was assigned the responsibility for keeping the accounts and billing the customers and for maintaining the books of the company.

These were the major subdivisions that the work made necessary. Each of these departments, except Accounting, was headed up by one man within a company reporting to the General Manager or Operating Vice President of that company. They were known as Traffic Managers, Plant Managers, Commercial Managers and Chief Engineers. Each of the "operating" departments, namely, Traffic, Plant, and Commercial, in turn found it desirable to break up their organization into divisions and districts for administrative purposes along the lines already indicated. The Accounting department, in addition to a number of smaller general departments, i.e., Treasury, Legal, and Executive, were headed up by officials reporting directly to the President of the company. This form of organization had the advantage over the former simple non-functional organization of bringing each specialized phase of the business under the specific direction of people specially trained in the requirements of that particular work, and for many years this form of organization adequately met the requirements.

As the business continued to grow, new factors came into the picture which made it desirable to consider the possibility of modifying this form of organization in some places. Chief among these was the fact that in some companies the operations covered such a large expanse of territory that the direction of all activities under one General Manager did not permit sufficient attention to be given to the specific needs of all parts of the territory. For example, the problems in the big cities had become so great that they tended to require the larger portion of the time and attention of the General Manager and his department heads to the possible detriment of other parts of the company's territory which, though less important in the company's total operations, were nevertheless important from the standpoint of the customers in those parts.

Because of this situation, a number of the companies modified the former organization by dividing their territory into two or more parts, each under the direction of a General Manager, reporting to an Operating Vice-President. These newly formed General Managers' areas were known as "Operating Areas" and within each the traffic, plant, commercial and engineering activities were headed up by a Traffic, Plant, and Commercial Manager and Chief Engineer reporting to the General Manager of that area. It might seem at first glance that this change which increased the number of directing heads within a company was merely building up more "overhead" and therefore, undesirable and uneconomical. As a matter of fact, this change was made only after management had convinced itself that the net result would be favorable to the service and the business as a whole.

This is a good example of the evolutionary approach to the problem of organization in the Bell System. Fundamental considerations are that:

(1) organization is merely a means to an end;
(2) the proper organization to do a given piece of work can only be determined through experience;
(3) organization must be adapted to the specific needs and changed as the need changes; and
(4) it is a primary function of management to determine that type and quantity of organization required to do the job at any given time.

In addition to the 275,000 employees in the organization of the Operating Companies, which has just been described, there are some 45,000 people in the centralized manufacturing organization and about 6,000 in the General Departments of the American Company and Laboratories. These latter may be compared to the general staff of the Army, which is constantly studying methods and procedures of conducting adequate defense and developing improved equipment for use by the line forces. The same principles of organization apply to them as discussed above for the Operating Companies, namely, that the organization setup, both as to type and quantity, is that which management has determined from experience is necessary to do the work which has to be done. While their function is purely staff, as contrasted with the line function, it is just as essential a part of the total operation as that of establishing connections at switchboards, building a pole line across the country or negotiating with a customer for telephone service.

The Management

In connection with these remarks on the organization setup which makes the Bell System so effective, there is another happy result that is worth pointing out. This is that when responsible and experienced management has created an adequate and basically sound organization, it has provided for its own skilled and trained successors.

The Bell System has found practically all of its management among those trained and proved by firing line experience, with judgment and leadership developed through the lower supervisory positions. The principal Bell operating companies have a top supervisory group totalling 99 officials—presidents, vice-presidents and general managers. The 18 presidents have averaged over 34 years each in the telephone business. Every one of them started on the firing line as a young man and the average starting wage was under $11 per week. The entire group of ninety-nine has a service average of thirty-one years, or more than 3,000 accumulated years of telephone experience. Yet superannuation is no problem, as thirteen achieved their present title by age 40 and only two will reach the automatic retirement age of 65 during 1938.

Three major advantages are derived from an organization setup which constantly feeds upward management replacements:

The resulting management understands the organization required by the business and has a long tradition of service.

The organization has confidence in the management.

Job inspiration is provided throughout the organization when the ladder of advancement is open all the way to the top.

In the group of ninety-nine officials already mentioned, many have gained their first-hand knowledge of organization by working in two or more departments. Thirty-five have had Plant experience, thirty-one Traffic, thirty-one Commercial, twenty-seven Engineering, as well as varied periods in other phases of the business. In addition, intimate knowledge of organization has been promoted by transfers between different territorial sections of a company and to other Bell Companies. Nineteen of these officials have worked in the territories of four or more principal telephone companies. Their present knowledge of other telephone organizations besides their own leads to further progress and closer cooperation.

Employees at lower supervisory levels have confidence in a management which can talk their language, which has previously worked at the very job they are now handling. Telephone executives constantly experience telephone calls or visits from employees in every level of the organization. Red tape has little chance in the face of such personal contact. The man down the line knows that an experienced management is planning the future and that his suggestions and criticisms will be welcomed.

The employee is spurred by the genuine prospects for advancement in his organization, as exemplified by the management group. Democracy of opportunity is self-evident; there are no barriers of birth or education or other artificial factors. Of the above ninety-nine officials, six were born in foreign lands. The rest were born from coast to coast and border to border, in twenty-six different states. They started telephone work as engineering assistants, service inspectors, traffic students, repairmen, installers, night operators, collectors, draftsmen, stenographers, special agents and in a variety of other jobs. Twenty-eight were enlisted in telephone work before they reached voting age.

With such interesting statistics to prove that the management of the Bell System has, and always can "come up from the ranks," it is evident that the System has developed an organization that meets both the demands of the present and the responsibilities of the future. As was said at the beginning of this article, the building of such a structure for service is an outstanding accomplishment of the System's management. Perhaps it is one of the things that a professor at the Harvard School of Business Administration had in mind, when he spoke of the Bell System as "a modern miracle which I can only explain to myself by assuming that the men who conceived, created and have developed the telephone were men of the rare auto-motive type whose driving power came from within."

E. E. Browning, Jr.

Some Unusual Telephone Construction Problems

"MODERN conveniences such as the long distance telephone," recently wrote an editorial writer in a Washington newspaper, "are taken quite for granted. Who for example, ever wonders where the lines connecting Washington and, say, Alexandria, cross the Potomac?"

To ask the question is, of course, to suggest the answer. For nobody wonders about the location or routes of the circuits that stretch in all directions, the significant reason being that in the United States a universal telephone service is accepted as a normal aid to living and working.

In fast moving America it is natural to assume that one can go any where, by telephone, and the use of 3,000,000 toll and long distance conversations every day shows the extent to which this assumption is translated into action. With everyone confident that the circuits are ready, for routine or emergency, it is not surprising that their underground or overhead pathways should be matters of interest chiefly to those engaged in the professional tasks of communication engineering and construction.

A thoughtful traveler, observing through the window of his train or automobile a procession of telephone poles, would of course sense some of the romance of communications if informed that he was viewing one of the transcontinental telephone lines, or that the cable paralleling his travels was bringing to a far flung network of broadcasting stations a radio program addressed to a national audience.

But even such definite information, though possibly suggesting the accomplishments of scientific research, or the alert watchfulness of an army of people whose creed is that "the message must go through," would give no hint of the varied activities that actually presented the communications art to the national service—namely, the actual construction of the telephone facilities that our business and social needs have called into being.

That engineering skill and ingenuity have been needed in full measure is abundantly evident to one who can read the country's map with an imaginative eye. For a message to "go through" it must have an electrical pathway to follow. That pathway may blaze strange trails, may strike across untamed terrain, through swamps, under rivers or over mountains. Means must be provided by which those communication highways may go where telephone engineers want them to go, no matter what nature may say to the contrary nor how much man-made obstacles may hinder.

It may be illuminating to examine a number of specific problems; to see the ways in which they have been attacked, the solutions which have been reached.

Nature in the raw was especially well represented when the transcontinental line construction encountered the Great Salt Desert between Salt Lake City and Wendover. In this region there are two peculiarities: salty mud flats and solid beds of salt, four feet thick and hard as rock. At times, these are covered with as much as twelve inches of water, presumably blown by heavy winds from Great Salt Lake and either blown back to that body of water by a change in wind direction or disappearing slowly through seepage. The salt does tend to preserve poles, though it gives them a curiously cracked appearance; and, of course, it prevents maintenance troubles due to animal life. Those were the only advantages offered by the situation.

Of disadvantages there were many. Fresh water and provisions must be brought to construction camps from Salt Lake City. Line materials must be hauled to the job on trucks equipped with special broad bands to prevent them from sinking in the soft mud. On occasion, only one pole at a time could be loaded and this had to be removed from the trailer which bore it without allowing the vehicle pulling it to come to a complete stop. Salt was so caked on automobiles after the day's work that, to prevent corrosion, it had to be removed with a steam jet. The mud, the salt spray and the unpleasant odor combined to produce difficulties for construction gangs.

In addition to unfriendly ground, there were known to be very high winds at certain seasons. To circumvent trouble from a combination of wind and water "H" fixtures were constructed at every tenth pole and ground bracing was placed at the bottom of certain intermediate poles to keep the line true.

These "H" fixtures, fashioned by setting up two poles connected by cross-arms, are often employed elsewhere when extra strength is demanded. For example, over the Santo Domingo wash in New Mexico two tall "H" fixtures are used to swing telephone wires clear of danger. This section of the inter-city route is a catenary long span, which is a short way of saying it is a special suspension bridge for carrying telephone wires only.

When it rains out in that high plateau country, it pours incessantly. Fearful torrents rush through the larger canyons carrying great boulders and trees in their raging flood. Such rains do not come often, but when they do, everything is swept before them.

Halfway between Santa Fe and Albuquerque lies the Santa Domingo wash, a natural drainway. Crossing it is an important transcontinental telephone route and also the Denver–El Paso circuits. On each bank of the wash are "H" fixtures: one made of sixty foot, the other of fifty-five foot poles. The length of the span between them is 1,024 feet.

These supporting fixtures were assembled on the ground. Poles, saddles, steel crossarms and guy wires were all bolted into position. As a unit it was then raised by special rigging mounted on a winch-equipped truck. Supporting strands (there are four of them) are carried over the saddle and anchored with large concrete blocks. It is important that these anchors do not move in the earth—do not, as it is called, "creep"—under the loads which may be encountered.

The long span, strong enough to withstand storm conditions, swings the line clear of the wash even at the height of a flood. So that the span may be worked on at any time, standard lineman's cable cars are kept in readiness at each end of the section.

The longest open-wire catenary span in the world is that which crosses the Gila River between Duncan and Globe, Arizona. Measured from one 100 foot steel "H" fixture to the other 75 foot one, this span is 2,373 feet long—almost half a mile. The level of the Gila River varies considerably with the rainfall. The catenary span was decided upon instead of either an aerial or an underwater cable, for cable would have necessitated placing loading pots in mid-stream.

Between the two great steel "H" towers, set in enormous bases of concrete, are suspended two one hundred and eighty thousand pound stranded steel messenger cables. It is these which support, at intervals of 167½ feet, thirteen fixtures each made up of three standard crossarms. On them are strung the telephone wires. The lowest wire clears the river bed by thirty feet—ample allowance for variations in level in the Gila. Ordinary open wire construction for a section of line as long as this would call for thirteen or more poles.

Some idea of the massiveness of this unusual piece of work may be gained by consideration of a few statistics. Each of the stranded steel supporting cables weighs 3.7 pounds per foot. The two reels, including the steel cable, weighed 12,000 pounds each. The job called for the excavation of 680 yards of earth, the fabrication of 75,000 pounds of steel-work, 750 sacks of cement, 185 tons of gravel, and 130 tons of sand. Altogether, a sizable undertaking.

One would have to search far to encounter a more interesting piece of construction, in which cable was involved, than the conduit leaving Manhattan Island to cross the Harlem River.

Housed in it are the main toll circuits from New York City to New England, as well as trunk circuits connecting various exchanges in the vicinity of the metropolis. It was important, consequently, that provision be made for rapid replacement of any cable that might develop conductor trouble. Briefly, hazards were obviated by the following means:

A pipe tunnel, 614 feet long, with walls 1¾″ thick and an inside diameter of seven feet, was buried in a trench so deep that the top of the structure was 27 feet below mean water level. This insured protection against injury by future dredging operations in this navigable channel. Twelve foot lengths of the pipe were assembled near shore into 72 foot lengths and these units, each weighing some 720 tons, were lowered into position by floating derricks. The sections rested upon cast iron saddles, spiked to a cap built upon timber piles. The pipe tunnel at each end consisted of approximately 75 feet of curved section. After divers had sealed its joints with lead, and a coating of from 18 to 24 inches of concrete had been applied, the iron tube was pumped out, dried and tested. It was then ready to hold the cable ducts, and was completely filled with conduit, a total of 206 ducts.

Another novel solution to a problem in cable construction was reached when the Miami River was crossed by means of conduit, buried 22½ feet below mean water level.

The river flows through the town of Miami. A number of submarine cables crossed it. Growth necessitated additional cable crossings and 3½-inch black steel pipe ducts were decided upon as being more practical than further increase in the number of submarine cables.

The site selected was near Flagler Street, where the river is approximately 240 feet wide and the channel (the Miami River is navigable) some 15 feet deep. Pipe for the project was delivered in short lengths. These lengths, placed upon a temporary dock to facilitate handling, were welded together to form 18 pipes, each about 270 feet long. The 114 welds were pressure tested and the pipes then shaped so that they were straight for 170 feet in the center and sloped upward at each end to fit manholes located on each river bank. The finished pipes were then clamped together in a stack three ducts wide and six ducts high.

In the meantime, a bucket dredge had dug a ditch across the river bed and was ready to receive the conduit. By means of a steel beam "strong back" with outriggers, one floating derrick was able to lift the assembled pipes from the temporary dock and to lower them into position in the ditch. The ditch was back-filled with the soft rock that had been removed from it; the completed job was checked by divers; and the conduit was ready for lead-covered cable to be placed in it, in a manner similar to the laying of underground cable.

Problems are often solved on the draughting-board before material is delivered to construction forces in the field. The fourth submarine telephone cable link between Key West and Havana is a good case in point.

This cable, an improvement over earlier ones, is non-loaded and employs a thicker paragutta insulation than formerly specified. Six thin copper tapes are wound spirally on a central copper wire. The continuity of the circuit is therefore assured. Melted rubber, following passage through a vacuum chamber, fills the interstices between tapes and central conductor. In case of a rupture, water would not be likely to travel far along the conductor. Paragutta goes on next, followed by cotton tape. Copper tape is next wound on with a slight overlap and this is a protection against the teredo or other submarine borers. Over this copper tape six heavier copper tapes are wound spirally without overlap to provide the return conductor.

Three different types of armoring were used: one for depths not exceeding 1,000 feet; another for a depth of 1,000 to 2,000 feet; and a third for depths greater than 2,000 feet. The first of these consists of 12 heavy iron wires, .3-inch in diameter. The second is made up of sixteen smaller iron wires—about .2-inch in diameter. The deep water section is armored with 22 wires of high tensile-strength steel, each little more than .1-inch in diameter and each covered with a fabric tape as a protection against corrosion. Over all three types of armoring were applied finally two layers of jute.

The cable was made with as few joints as possible. Most of the splicing was performed on a special jointing machine before delivery to the cable-laying crews. Shore type cable, six miles of it, was laid first. This was paid out from a barge until the cable ship, which could not anchor closer to shore because of shoal water, was reached. A splice was then made to the main cable and, early the following morning, the cable ship started on a course which it had previously sailed over and marked with buoys.

One of the most original construction projects undertaken in recent years was in connection with a change in address of an office building. The eight-story, 11,000 ton structure, housing the general offices of the Indiana Bell Telephone Company at Indianapolis, was pushed 52 feet farther back on its lot and then turned 90 degrees. Six hundred employees inside the building carried on as usual during the move.

Elevators ran up and down; gas, steam heat, water, electric power—all such facilities were maintained by flexible connections; and long distance telephones, spliced to lengths of armored submarine cable to allow slack, operated without interruption. Visitors came and went, entering and leaving by means of a " drawbridge " at the entrance, which pivoted as the building changed position.

The 59 steel columns supporting the building were reinforced with 500 tons of structural steel so that they could not shift in their relationship to each other. A concrete mat, overlaid with 6 x 8 fir timbers and surmounted by steel rails, formed the surface upon which the building was rolled. The rollers were placed under steel shoes on each side of the supporting columns and I-beams were affixed to help distribute the load from column to roller. A total of 4,000 rollers was employed.

Eighteen 100-ton and 75-ton jacks of the ratchet screw type, placed strategically and operated by 18 men, moved the building with ease. Jacks were reset after every foot of the journey.

This relocation, which allowed space for a new building and at the same time saved the cost of moving the Indianapolis repeater station and offices, was so intriguing to the public that a viewing stand was provided for the benefit of the curious. It was filled with interested spectators daily.

On the Albany-Catskill conduit route for underground telephone cables, there are a number of unusual construction devices. This conduit line is, for the most part, on private property, which in itself is somewhat out of the ordinary. Swampy spots were traversed by above ground fills, with the material for filling frequently brought from a distance. Special culverts carried the conduit line over streams and extra precautions had sometimes to be taken to insure good drainage. This story, with technical thoroughness, was covered in the Bell Telephone Quarterly for January, 1931.

However, few conduit construction jobs have been more novel that that accomplished when Flatbush Avenue, Brooklyn, from Avenue U to Barren Island was lowered three feet and repaved. The customary procedure in the past when a duct line had to be set at a deeper level, called for blocks, screwjacks or chain hoists. Rather extensive repairs followed, for concrete top and bottom slabs, tile conduit and mortar joints are all brittle. But this duct line was laid delicately in place in its new home without any of these tools. Ice was the miracle-worker. Two tons of it, regular family-refrigerator grade.

This is what happened. First, the duct line was uncovered. Then, at intervals of six feet, pits were dug to the new depth required. These were filled with ice. As the earth between the ice slabs was removed, the duct-line was supported as it were on jacks of ice. The pressure of the cable structure itself and the warmth of the air did the rest. In 48 hours the ice was melted, lowering the line so evenly and gently that breakage was negligible.

Pole lines, as everyone realizes, represent a substantial part of outside plant investment. Methods by which the cost of such lines may be reduced, therefore, constitute significant contributions to telephone efficiency.

With the advent of toll cable lines, with strong supporting strand, low wind resistance and long stretches through open country, it was apparent that the length of spans could be increased above the usually accepted limits of "forty poles to the mile." Within the past several years a number of cable lines have been strung on poles set from 250 to 360 feet apart. The "normal" pole interval is about 130 feet. The saving in first cost is obvious. A thriftier maintenance record is to be expected as well, for long span construction tends to lessen the degree by which cable is subjected to the effects of tension and compression arising from changes in temperature.

The setting of poles frequently taxes the inventiveness of construction forces. Ordinarily, holes may be made rapidly by machine. But when mountain regions are being traversed and rock is encountered, blasting must be resorted to; while poles set in boggy land must, sometimes, be erected upon foundations especially created, such as pilings capped with concrete slabs.

All telephone construction and, indeed, every phase of telephony, is guided by a common belief. It is this: no matter what hindrances have been created by man, no matter what obstacles nature has placed in the way, they can be overcome. This guiding principle does not admit of defeat. It accepts only the limitations of the state of the art and, as the boundaries of fundamental knowledge are constantly being pushed back, it accepts those limitations only tentatively.

Such an attitude inspires, in telephone-worker and telephone-user alike, a vast measure of confidence in the ability of the art of communication to grapple with the inevitable problems of the future.

STERLING PATTERSON

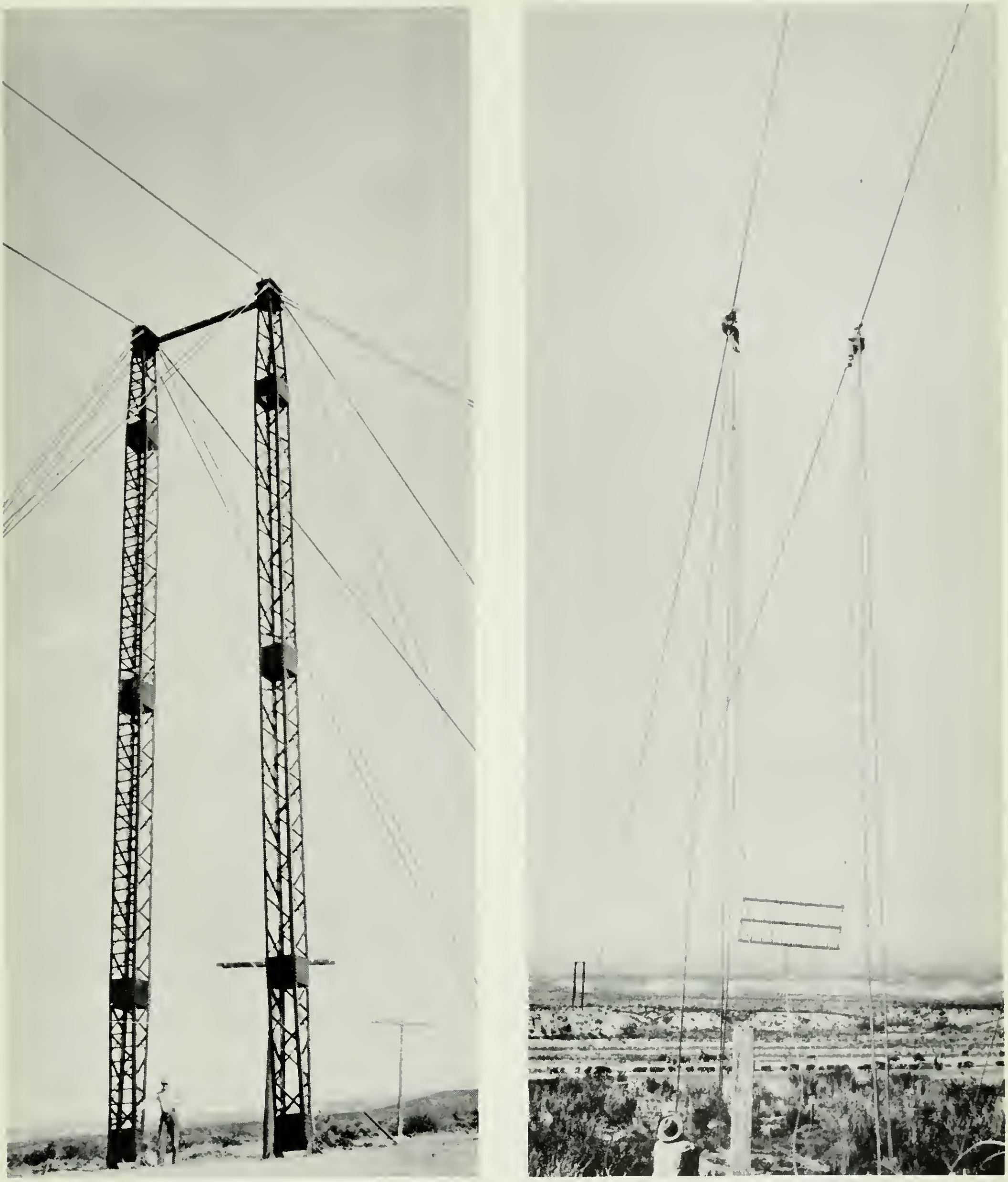


Fig. 1. The Gila River Crossing Is the Longest Open-Wire Catenary Span in the World. The Left View Is Looking Up the Steel Columns on the North Side of the Wash During Construction. At the Right the Size of the Workmen, and the Procession of Cattle, Suggest the Great Length of the Span.

Fig. 2. Plowing in Buried Cable Armored Against Natural and Man-Made Hazards.

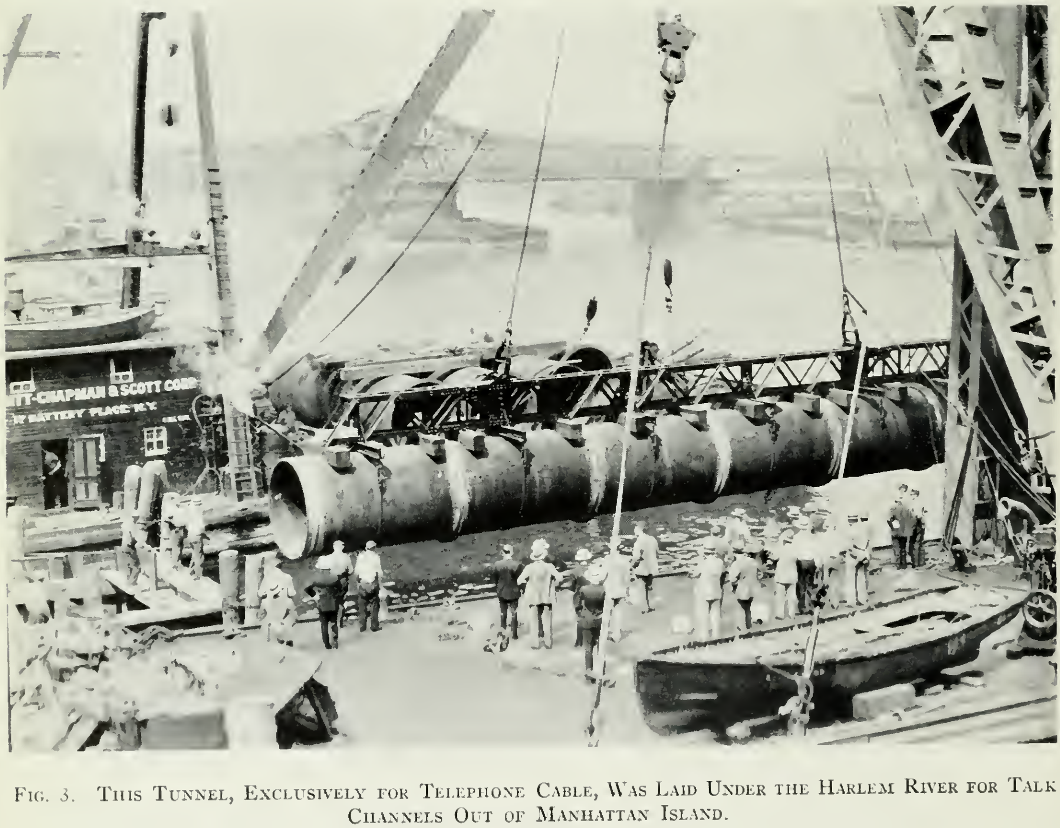


Fig. 3. This Tunnel, Exclusively for Telephone Cable, Was Laid Under the Harlem River for Talk Channels Out of Manhattan Island.

Fig. 4. The Cable-Laying Barge at Key West Showing the Huge Loops of Telephone Submarine Cable and the Balloon Buoys. The Insert Shows One of the Three Different Types of Submarine Cable with Varying Protective Coatings that Are Necessary Between Key West and Havana.

Fig. 5. Eighteen Men with Jacks Push 8-Story, 11,000 Ton Building. This Picture Shows the Start of the Straight Move South.

Fig. 6. Three Construction Views of the Protected Underground Route for Telephone Cables Between Albany and Catskill. In Places It Resembles a Roman Aqueduct as It Cuts Through Swamps and Forests and Bridges Streams.

Fig. 7. Part of the Mechanicsburg-Shepherdstown, Pa., Toll Cable, with Three-Hundred-Foot Spans, Showing How It Is Possible to Utilize High Spots in the Cable Route for Placing Short Poles.

Fig. 8. Using Blocks of Ice to Gently Lower Occupied Telephone Conduit in order to Permit Changes in Highway Grade near Floyd Bennett Airport, New York.

The Collected Papers of George Ashley Campbell

(Editor's Note: A volume containing the technical papers of Dr. George A. Campbell has just been issued by the American Telephone and Telegraph Company. The publication is commemorative of Dr. Campbell's long and distinguished service as Research Engineer of the Company and of his fundamental contributions to the development of telephone transmission.

While the volume as a whole will appeal primarily to the specialist in transmission theory, it carries two introductory chapters which, because they are historical in their point of view, will be of interest to a much wider circle of Bell System readers. The QUARTERLY *welcomes the opportunity, therefore, of reprinting these chapters. The first is by Professor Vannevar Bush, Dean of Engineering of Massachusetts Institute of Technology, while the second is by Dr. Edwin H. Colpitts, for some years Executive Vice President of Bell Telephone Laboratories and himself, like Dr. Campbell, but recently retired.)*

FOREWORD

GEORGE A. CAMPBELL has lived and worked in a period during which there has been unprecedented progress in the application of the products of scientific effort to the needs of mankind. Of these products none has led to a more brilliant and serviceable accomplishment than that which brought about the telephone, or more generally, electrical means of communication as we know them today.

The telephone could never have reached its present state of serviceability if it had not been for the vision of those who early guided the epochal invention of Bell into a healthful relationship with its underlying scientific principles. The realization of new materials, and the invention of new combinations, has influenced its development enormously. The telephone has grown vigorously however, largely because in a great country it has been nurtured in accordance with the best scientific tenets. Those whose vision is responsible for our telephone system of today evolved these tenets at a time when in this country at least science had little respect from the multitude.

As a matter of history, it seems clear that as the results of scientific progress come to be of direct utility in everyday affairs there are two stages. One of these, the first, has little popular appeal. It includes the processes of interpretation and adaptation of the broad disclosures growing out of profound creative study—a study that is classical and painstaking. There follows this first stage a second, which includes the introduction into commerce of new mechanisms based on foundations laid by classical study. The earlier work, although often of equal brilliance in comparison with the later applications, is appreciated by only a few, and understood in but a superficial manner, if at all, by the vast group that may be termed the public. On the other hand, the introduction into the practical world of an idea culminating from a long developed scientific background is often received with acclaim. Curiously enough this lauding is usually greater the less the principles underlying the idea are understood.

Industry often scratches about the roots of advancing science, finding serviceable devices here and there, or merely attempts to break off the useful buds of a growing tree, thus retarding future growth. This, it seems, has been the traditional American way of doing things, to which fortunately there have been outstanding exceptions. As the country grows older and more mature in its approach, and as it becomes more and more difficult to carry on by superficial contact with the guiding logic of creative thought, there will be a sounder type of activity in this intermediate region between basic science and the ultimate industrial application really depending on science.

In our economic history there are a few cases where a group of industrialists has grasped a body of science as its own, advanced it into new fields, and reaped the results in a thoroughly intelligent fashion; yet when this has been done the fruits have been great. After all, this exploitation of the vast contributions of science by those who through preferment serve the practical needs of mankind is in the sound way of progress. The day of the industrialist who is a dilettante in science is nearly done. Even in its formative period the telephone company had fully grasped these principles.

It is felt that it is necessary to have this background before us if the position of George A. Campbell in the scientific and engineering fields is to be understood and appreciated. He has been a pioneer and a representative in industry of a rare group of whom there must be many if we are to proceed in the future as rapidly as in the past.

When Heaviside wrote his electrical papers they were read by only a few, and of these still fewer understood or were willing to recognize the scintillating bits of thought because these thoughts were mounted in a matrix which was faulty in its rigor. Of those who understood, only two or three grasped the meaning of Heaviside's work to such an extent that they could interpret it, reduce it to a sound basis, and make it truly serviceable.

In order that there may be great commercial advances, it is always necessary that there be an individual with new thoughts and a setting in which they become commercially feasible. In Heaviside's day the time was not ripe for great communication systems, nor were men of his time receptive to what appeared to be radical departures from convention. Unless there had been prophets to see the light and to carry it over into the new day, the great work of Heaviside would have been lost. These men who carried the torch can be numbered on the fingers of one hand, and of them Campbell stands out as the predominant figure, not alone because his grasp was sound and persistent, but also because he was associated with those who by transportation and communication developments were beginning the great work of joining America into a single nation.

Into this early advance, to meet a commercial exigency, came the loading of telephone lines. The vision was Heaviside's The design formulæ were Campbell's. Out of a mathematical argument came coils of the right size and in the proper places to enable wires to go underground and to carry speech to long distance.

It is difficult in retrospect to appraise and appreciate the intricacies of this accomplishment. Today we think in terms that have acquired meaning and visual power by long use. At that time the problem was very largely abstract. It is true that electrical configurations are more adaptable to mathematical treatment than are mechanical, for in the former, measurements are more readily and precisely made. Hence the application of mathematics to electrical engineering problems may and does proceed to complex things, for its premises may be checked and its predictions verified. Yet it was a long road from the bare idea of continuous loading, or even the suggestion that the loads might be discrete, to a working cable or open wire line with the proper loads at the correct spacings.

Empiricism here would have been utterly hopeless and unjustifiably expensive. One cannot temporize with a long transmission line running across actual country by trying this and replacing that. Haphazard work of that nature could have but resulted in discouragement and failure. Procedure by thoroughly rigorous mathematical treatment to the condition where operation is understood, is the necessary step if the result is to be practically accomplished. For this, Campbell, and Campbell almost alone, deserves the credit. He gave us the loaded line.

Directly out of this development followed the filter. The mathematics of the loaded line and of the filter are of the same genus. He who thoroughly understands one will know the other. If coils can assist they can also impede, and a change of sign or a shift of variable is no great effort to the mathematician. But in order that the filter might emerge, the grasp needed to be complete. It was because Campbell was a pioneer in understanding of the phenomenon of propagation of guided electrical waves that the filter was to him a natural next step.

The separation of electrical components of differing frequencies is so commonplace today that it is hard to realize that it was not an immediate extension from the ideas of optics. Yet optics had not dealt with two-dimensional wave systems and interlaced networks. Also new definitions, new concepts, new interpretations became essential before the partition of electrical frequencies could become as productive in results as the separation of colors in the spectrum. Campbell's physical theory of the electric wave filter which culminated in his publication in 1922 marked the advent of a new understanding of the subject.

Just as Campbell's "Loaded Lines" in the *Philosophical Magazine* in 1903 had marked the appearance of a new school of thought in transmission, so his "Cisoidal Oscillations" in the *Transactions of the American Institute of Electrical Engineers* in 1911 opened up a new and powerful manner of considering circuits generally.

Heaviside had initiated the algebra of transients. He had created a new way of bringing within the range of analysis the oscillations in electric circuits. Had it not been, however, for those who interpreted, applied, and strengthened his scheme of thought, it would never have become utilized. Heaviside was the pioneer, and then came a few such men as Campbell to place the matter on a sound footing and make it useful. True, mathematicians had long manipulated Fourier series and integrals, and there had been generalizations based on the use of the Fourier transform. To render a far-reaching tool of this sort truly useful requires, however, much more than merely formulæ of pure mathematics. Oftentimes he who interprets and amplifies deserves as much credit as he who first grasps a mathematical generalization for having overcome obstacles equally great.

One estimate of a creative thinker is based on the extent to which he influences the thoughts of those who follow and who also think profoundly. The entire telephone technical personnel, when dealing with oscillations, now think in terms brought into their midst by Campbell. That some of these thoughts might be useful as well as clear led to the publication with Foster of "Fourier Integrals for Practical Applications."

It is not necessary to deal with each of Campbell's contributions, for the group of papers of which this is the foreword tells its own story. He has lately worked in that baffling field of endeavor aimed at sorting out and precisely defining the units with which we deal, and in many other aspects of our present procedure. Most clearly, however, he stands out as the one to whom the telephone art owes the realization of the loaded line, the electrical filter, and the facile treatment of the transients which pulsate in its networks, and as a modest, generous character who by his very nature has inspired others to broaden into a highway the trail which he brilliantly blazed into the vast reaches of Science and Engineering.

Vannevar Bush

Introduction

In all its more important elements, the present plan of organization of the Bell System had evolved within a relatively few years after the invention of the telephone by Bell. Then, as now, adaptation to the unusual requirements of the telephone business was accomplished by an organization having licensee operating telephone units and a manufacturing unit grouped around a parent company. From the beginning the parent company assumed certain obligations and service functions, among which was the active prosecution of technical research and development to improve the telephone art.

Passing over the initial stages of research and development, by 1897 the American Bell Company, whose functions as the parent company were later taken over by the American Telephone and Telegraph Company, had, by gradual steps, built up a research organization of physicists, chemists and engineers. This organization in 1897 was located in Boston and was under the direction of Dr. Hammond V. Hayes. To us in 1937, Dr. Hayes' department possibly appears as a small group, but as late as 1897 organized industrial research was scarcely known outside of the Bell System, and in those days the Bell System had 325,000 stations as contrasted with over 14,000,000 stations today.

Forty years ago, two aspects of the transmission problem were recognized as particularly pressing. Long distance telephony had come to be a substantial business, but line costs were high, and a practical commercial range did not much exceed 1,000 miles. Hence the two major objectives were to secure better and more economical circuits with the possibilities of reaching greater distances. Of even greater importance, with the rapidly expanding telephone business in and about the larger cities and in the more densely populated sections of the country, it had become necessary to place telephone circuits in cables. To maintain reasonable transmission constants and to extend these cables to all points where their use was indicated meant a very large expenditure for many of the operating Bell companies. This second phase of the transmission problem has continuously received great emphasis with outstanding results in savings. Dr. Hayes, facing these problems and appreciating the need of adding to his staff one who had a working knowledge of the most advanced electrical theory recently developed by Maxwell, Kelvin, Weber, Heaviside and other mathematical physicists of the 19th century, employed a young man, a graduate of the Massachusetts Institute of Technology with five years of advanced study at Harvard, Paris, Vienna, and Göttingen. For the communication industry, the step taken and the choice of Dr. George A. Campbell were most fortunate and timely.

Soon after his employment by the Bell Company, Campbell found himself engaged on the problem of how to provide more economical and more efficient transmission circuits. Appreciating the part which series inductance plays, his thought naturally led him to study the suggestion that inductance be added in the form of coils properly designed and introduced at intervals in series in a telephone line. Campbell's study of this problem both by mathematical and experimental methods was carried out quite independently and in ignorance of work which Professor Michael I. Pupin had in hand. Both investigators finished their work and applied for patents at about the same time. Professor Pupin was able to establish a slightly earlier date of conception, the patent interference was decided in his favor, and the parent company, following its practice of making available all improvements in the art to its Associated Companies, immediately acquired exclusive rights under the Pupin patents. But it seems fair to say that Campbell's analysis of the problem was actually more detailed than Pupin's, and it led him to formulæ for the design and spacing of loading coils which were superior to his rival's, so that from the very beginning they alone were employed for the building of loaded lines in the United States. By this one piece of work performed within a relatively short time after his employment by the Bell Company, Campbell demonstrated his leadership among those applying mathematical analysis to the problems of electrical transmission, and his ability to state his conclusions in a form that the development engineer could use in practical applications.

Momentarily anticipating another important development, it may be pointed out here that it was Campbell's complete analysis of the loaded line problem that led him to a totally unexpected network—and one destined to become equally famous—the electric wave-filter. To the practical importance of the filter, I will return in a later paragraph.

The fundamental theoretical work covering the principles of loading telephone circuits was completed by Campbell in

1899. By September, 1899, the theory was confirmed by laboratory tests on reels of actual cable. Following these and many other laboratory tests, two cable circuits 24 miles in length, connecting Jamaica Plain and West Newton by a roundabout route through Boston, were equipped with loading coils. These circuits showed the expected gain in transmission efficiency and were put into commercial service beginning on May 18, 1900. Much remained to be done, however, before the large scale commercial application of the loading principle to open-wire and cable circuits was successfully carried out. To the practical development of the loading art, Campbell contributed largely at every step.[1]

The outstanding problem was the reduction of the basic principle to a practical form of coil. Many different coils were designed and tested but for one reason or another found wanting. It was recognized that an economical design for a loading coil would undoubtedly require the use of iron but there were many questions to be determined with respect to the form which the iron should take; whether it should constitute an unbroken magnetic circuit or be interrupted by one or more air-gaps, whether it should be in the form of wire, plates, or ribbon, and how finely subdivided, and what should be its characteristics—permeability, resistivity, etc. Also there were questions as to the size and shape of the coil and its core, and as to the copper windings, whether the wire should be solid or stranded and, if the latter, of how many strands and how insulated from one another.

The requirements in respect to energy losses were far more exacting than for any previous type of coil and means had to be developed for measuring the efficiency of the coils at voice periodicities.

[1] The development of the first successful loading coils and their application to telephone lines is too long a story to recount here but because none of Dr. Campbell's very early records has ever got into print I am reproducing at the end of this introductory Chapter three brief memoranda of the year 1899.

It was found that practically all these questions relative to loading coil design depended upon the quality of iron employed in the core and that better coils could be designed if iron of normal permeability and extra high resistivity could be procured. Consequently a great deal of effort was expended to find such an iron, including an extensive investigation of iron oxide. All materials of this sort proved to have undesirable properties, because of either hysteresis losses or unsuitable permeability, or because of being incapable of being drawn or rolled into the proper size. However, the work of designing a loading coil, using such materials as were commercially available, was pushed ahead.

In the summer and fall of 1900, an extended experiment was conducted by loading with simple solenoidal coils a long distance commercial open-wire telephone circuit of No. 12 N.B.S. gauge conductors between Bedford, N. Y., and Brushton, Pa., a distance of approximately 670 miles. This experiment was successful in showing marked improvement in telephone transmission by reason of the loading but the coils used were not of satisfactory design and the improvement in transmission was not as great as it should have been. The result of this experiment therefore was to emphasize the importance of the problem of loading coil design.

As the coil finally adopted for commercial loading was of the toroidal type, this review will be confined to some of the mileposts in the development of that coil upon which work began as early as August, 1899.

The toroidal type of coil had long been known, but largely owing to the difficulty of obtaining suitable core material, it was not until March, 1901, that the first satisfactory coil of the toroidal type possessing a fine iron wire core, known as "T-300," was constructed. This coil had an inductance of .25 henry and a total effective resistance at 1000 cycles of slightly over 5 ohms, about half of which consisted of eddy current losses in the iron core.

After the design of the coil had been completed, there still remained many practical problems incident to its commercial manufacture and use, such as obtaining adequate supplies of material, providing means for testing the coils in the factory, assembling and boxing the coils for installation on pole lines, protecting them from leakage and lightning, controlling cross-talk, etc.

In April, 1901, an order was placed with the Western Electric Company in New York for several hundred T-300 coils, but because of difficulties encountered in commercial production it was not until October, 1901, that a sufficient number was produced to load one New York–Chicago circuit. Two other New York–Chicago circuits were loaded with an air-core solenoidal coil known as T-350. The principal difficulties in producing the T-300 coil commercially were:

(1) Insulation of the individual No. 38 B. & S. iron wires of the core.
(2) Insulation of the individual strands of the copper winding.
(3) Measurement of energy losses in the completed coils or cores.
(4) Limiting the losses to tolerable values.

The improved transmission over the loaded No. 8 B.W.G. circuits from New York to Chicago at first aroused great enthusiasm, but after a few months complaints began to come in that the transmission efficiency, particularly in wet weather, was not holding up. Gradually it was learned that three important problems remained to be solved:

(1) How adequately to protect the coil against injury by lightning.
(2) How to insulate the coils and line wires so as to reduce the leakage of the circuit.
(3) How to coordinate the transposition system of the pole line and the loading coil locations so as to reduce cross-talk.

The solution of these three problems was worked out during the next six years, coincidentally with an extensive application of commercial loading to open-wire circuits, particularly No. 12's.

Early in 1902, the design of a loading coil for cables was taken up aggressively and, by virtue of the experience gained in designing the open-wire loading coil, proved to be relatively simple. By September, 1902, a cable between Cortlandt Street, New York, and Newark, was loaded with the new toroidal coil known as T-420, and the transmission improvement was found by test to be closely in conformity with expectations.

The New York–Newark cable offered the first opportunity for an important application of loading to cables; the art of loading was sufficiently advanced to seize this opportunity without delay. The major field for loading and the bulk of the economies following its introduction have been in the loading of cables. More than a decade ago, due to the advent of the telephone repeater and carrier current systems, loading on open-wire circuits became obsolete.

In Campbell's first successful laboratory demonstration of loading (September 6, 1899), using T-14 coils on a 35-mile length of standard 19-gauge cable, the coil spacing was such as to give a theoretical cutoff frequency of 11,000 cycles. This high cutoff was chosen to make sure that all necessary voice overtones would be transmitted. Rearrangements of the coils on the laboratory cable made it possible to test lower cutoff arrangements, as a step toward determining the minimum cutoff standards for satisfactory transmission. As a result of these tests the Jamaica Plain–West Newton cable circuit was designed to have a theoretical cutoff of 3500 cycles. The Bedford–Brushton open-wire circuit had the same cutoff. Further tests resulted in planning for a cutoff of about 2200 cycles on the New York–Newark cable. Subsequent cable loading installations were designed to have a cutoff of about 2300 cycles, a standard which was later adopted for open-wire loading in

1904. During the past twenty years, the cutoff frequency standards for loaded voice frequency cable circuits have been substantially raised. It is an interesting coincidence that the theoretical cutoff frequency of our present repeatered loaded cable circuits for broadcast program transmission is almost identical with that used in Campbell's first experiment with T-14 coils on his laboratory cable.

As noted above, with the introduction of loading, inductive effects resulting in the phenomenon of crosstalk between neighboring telephone circuits became more of a problem to the telephone engineer. While it had been shown by earlier workers that crosstalk was a complex effect of both electromagnetic and electrostatic induction in which the latter was frequently the more important, I believe Campbell first reduced the various factors to such a computational basis as was both accurate and readily manageable. He pointed out the importance of Maxwell's capacity coefficients and coined the term "direct capacity" now modernized to "direct capacitance." He showed in these early memoranda that crosstalk between two circuits depends to a considerable extent and particularly in the case of loaded lines on a function of the various direct capacities between the wires of the two circuits. He termed this function the "direct capacity unbalance." Campbell's studies led not only to mathematical formulæ but to the development of measuring apparatus which was destined to play a great part in the future telephone developments. In this period he produced his well-known shielded balance for the accurate measurement of electrical constants at telephonic frequencies. Out of this grew a simple method for measuring direct capacities, and also the well-known capacity unbalance test sets which have played a fundamental role in the manufacture and installation of toll cables.

With the Campbell shielded balance, the present writer early made an extensive set of measurements of the direct capacities of a short section of 40-wire open-wire line which permitted a simple calculation of capacity unbalances. This served foı many years as a basis of transposition design.

The telephone repeater art which plays such an important part in the modern telephone plant owes to Campbell that masterly analysis of repeater circuits which laid a sure foundation for its future development. The type of line balance involved in repeater operation early attracted Campbell's attention. Before the advent of the vacuum tube, various mechanical devices, notably the receiver-microphone repeater, were intensively studied with the idea of adapting them to use as repeaters. The early repeater development involved two problems: first, to secure as nearly as possible a perfect amplifying element; and second, to adapt this element to the telephone line. What is involved in this second problem can only be appreciated by the telephone engineer who has had long experience in the transmission art. As to the adaptation of repeaters to telephone lines, various experimenters and inventors had proposed circuits to accomplish two-way telephony, and out of this prior work had come two fundamental repeater circuits, namely, that in which a single repeating element amplifies messages reaching it from both directions, and the one which includes two amplifier elements, one assigned to each direction of transmission. These repeater circuits came to be known as the 21-type and the 22-type, respectively. In the 21-type repeater, two sections of line as nearly identical as possible are balanced against each other as opposite arms of a bridge. In the 22-type repeater, each incoming section of line is balanced against an artificial line or network, thus permitting, as Campbell's analysis showed, a greater inherent flexibility as well as a greater stability. The inherent stability limits of these circuits, however, were not clearly formulated until Campbell made a study of the circuits. A memorandum written in 1912 called attention to the 22-type circuits in the following words:

"... In addition to this, singing will not be introduced by any possible unbalance, however large, in either of the lines, provided the unbalance of the other line does not exceed a certain critical magnitude. Furthermore, the two lines connected together may differ radically in character since each is balanced separately against its own artificial line. . . . Theoretically, a given total amplification can be secured with a larger singing margin if it is distributed among a number of properly spaced points along the line rather than concentrated at a single point. For example, four equally spaced repeaters each giving an amplification of five miles might be substituted for a single repeater giving twenty miles. . . . If it became necessary merely to eliminate certain frequencies lying outside of the range required for telephony, the use of an artificial selecting circuit would seem to present no difficulty."

In the same memorandum which discussed the 22-type repeater, Campbell suggested the use of the "four-wire circuit" as a logical extension of the one-way paths in the 22-type, each extended path containing as many one-way amplifiers and line sections as desired. This was in 1912, and the four-wire circuit, although now so widely used both at voice frequencies and in the carrier art, appeared at that time to have little practical application. It was proposed as a structure possessing, relative to the other types of repeaters and lines, very great stability, and as such was recognized as of technical interest if not of immediate practical value.

Turning to the subscriber's set, we find again the indelible impress of Campbell's mind. He was the originator of the single-transformer anti-sidetone circuit which is now achieving almost universal acceptance. But more than this, he did a masterful piece of work in revealing all of the possible circuit arrangements having doubly conjugate branches, and in setting down the impedance relations of the line, network, transmitter and receiver for these various branches. This systematic analysis of the problem greatly facilitated a comprehensive survey, giving assurance that all types of circuits were being considered and that those best fitting the available transmitters and receivers were being selected. A summary of this work is to be found in the paper entitled "Maximum Output Networks for Telephone Substation and Repeater Circuits," in the writing of which Mr. Ronald M. Foster collaborated.

Undoubtedly, one of Campbell's most important contributions is the network to which he appropriately gave the name "electric wave-filter." In 1917, a patent on this device was issued to him. As intimated above, he discovered the filter properties of an iterative network consisting of lumped reactances through his analysis of the problem of the loaded line, and to one reading his famous paper "On Loaded Lines in Telephonic Transmission," published in the *Philosophical Magazine* in 1903, it is evident that even at that early date he had begun to envisage the low-pass and high-pass wave-filters.

Today there is hardly a phase of telephone transmission in which filters do not play a part,—in most cases, a very essential part, either in the transmission apparatus or as tools employed in research. In the future art, they seem destined to play an even larger part. The property of sharply separating currents of different continuous bands of frequencies is, of course, the basis of all carrier telephone and telegraph systems. While it is possible to conceive of such systems based upon tuned circuits and other simple devices of the older art, they would at best be crude and inefficient arrangements. Other important uses for wave-filters arise in telephone repeaters, radio systems, telephotography, composite sets, laboratory and testing apparatus, reduction of battery supply noise in telephone exchanges, control of noise from electrical power and railway systems, etc.

In this brief review of Campbell's work, mention should also be made that he was one of the early investigators of antenna arrays to secure directional transmission, and that certain fundamental patents in this field were issued to him.

In recognition of the far-reaching and fundamental character of Campbell's contributions to the telephone art, his associates welcome the opportunity of showing their appreciation by arranging for this collected edition of his published technical papers. Unfortunately, his publications by no means cover the range of his researches. He published relatively little. Many of his important memoranda were never put in that polished form which in his opinion would render them suitable for publication, and still reside only in the Company's files. It is a pleasure to be able to announce, however, that Campbell is now giving consideration to ways and means of partially filling in this gap.

In writing an Introduction for this commemorative volume, I welcome particularly the opportunity of expressing a word of appreciation regarding the man himself. And here my words convey not my thoughts alone but mirror the feelings of the many colleagues who have been associated with Campbell in the prosecution of his studies, and the much larger group who have been concerned with putting into practice the discoveries and inventions he has made. In common with many other truly great minds, it has been his choice to avoid publicity and public appearance, so that outside the circle of his immediate associates and a few of the more mathematically gifted students of his chosen branch of electrical science, his fame is far from commensurate with his achievements.

In Campbell's case, lack of participation in public activities must not be interpreted as indifference or lack of interest in the common welfare. He has shown himself in the highest sense to be an idealist, and having once aligned himself with a cause, he has served it devotedly without regard to the toll of effort it might exact from him personally. In recent years, he has enlisted in the struggle centered about the adoption of a rational system of physical units. He early became convinced of the fundamental soundness and simplicity of the set first advanced by Giorgi, and some of his latest papers (four are included in the present volume) deal with the merits of Giorgi's proposal.

We who have grown up under Campbell's inspiration and tutelage most deeply regret his retirement from active participation in the work of the organization to which he has rendered such conspicuous service. He has been more than a pioneer and inventor. His mode of life and work has been as much an inspiration as his technical contributions are foundation stones of the telephone art. His self-sacrifice and devotion will long linger in our memories, and his serenity sets a high goal toward which we, in our individual efforts, will aspire but seldom reach. Viewing his long and successful career, we realize anew the profundity of Emerson's declaration, "the great man is he who, in the midst of the crowd, keeps with perfect sweetness the independence of solitude."

E. H. Colpitts

Notes on Recent Occurrences

DR. C. J. DAVISSON OF BELL LABORATORIES SHARES NOBEL AWARD IN PHYSICS

ANNOUNCEMENT on November 11 that Dr. Clinton J. Davisson of the Bell Telephone Laboratories shares with Prof. George P. Thomson of London the 1937 Nobel Prize in Physics brings world-wide recognition to the researches of a scientist who has been a member of these Laboratories since their organization. The award to Dr. Davisson is for his demonstration that electrons, one of the fundamental building blocks of all forms of matter, and which familiarly display themselves as tiny particles of negative electricity, behave under certain conditions as trains of waves. An earlier discovery by A. H. Compton—also a Nobel prize recipient—showed that beams of light which usually display themselves as trains of waves, will under suitable circumstances act also as particles. The electron and the light quantum behave as though they had dual personalities.

The discoveries of Compton and of Davisson each furnish independent proof of a basis theory of modern physics: That matter (mass) and energy are again but dual aspects of a single entity. In experiments continuing over a number of years, Dr. Davisson, in association with Dr. L. H. Germer, also of the research staff of the Laboratories, directed beams of electrons against a target of a crystal of nickel, from which the electrons were diffracted in the form of trains of waves—a characteristic of energy.

In 1928 the National Academy of Sciences awarded the Comstock Prize to Dr. Davisson " for the most important discovery of or investigation in electricity or magnetism or radiant energy " made in this country during the past five years, for his work in this field. In 1931 he and Dr. Germer received the Elliott Cresson medals from the Franklin Institute, Philadelphia, and in 1935 he received the Hughes Medal of the Royal Society of London.

The Nobel Prizes were instituted under the terms of the will of Alfred B. Nobel, Swedish chemist and engineer and the inventor of dynamite and other high explosives, who died in 1896. The income from a fund so established is divided annually among those persons who have contributed most to the advancement of Physics, Chemistry, Physiology or Medicine, Literature, and the Cause of Peace. The prize in physics is awarded by the Swedish Academy of Science in Stockholm. Distinguished Americans who have received the Nobel Prize in physics are A. A. Michelson, R. A. Millikan, and Arthur Compton.

MOTION PICTURES TRANSMITTED OVER COAXIAL SYSTEM SHOW CABLE'S POSSIBILITIES FOR TELEVISION

THE transmission of sound motion pictures over the coaxial cable between New York City and Philadelphia was demonstrated in the latter city before Bell System executives and newspaper men on November 9. The principal feature of the demonstration was the presentation of a sound motion picture, sent through the cable from the Bell Telephone Laboratories in New York, which, as it went along, described by voice and animated diagram how it was being transmitted and received. Several news-reel "shots," with sound, were also transmitted.

The motion pictures were reproduced in Philadelphia on a glass screen large enough for a group of ten people to see easily. The accompanying sound came from a loud speaker.

The experimental coaxial cable system between the two eastern cities has at present a million-cycle range. The Bell System, in anticipation of the time when it may be called on to transmit television programs to broadcasting points, just as it now carries radio broadcasting programs on its wire and cable networks, wished to test the performance of the coaxial system in handling a single message whose frequency components occupy a range as broad as a million cycles; that is, a current of the kind required in television programs.

Sound motion pictures represent a convenient laboratory method of simulating the type of television program which may at some time in the future be offered for transmission. The Laboratories therefore constructed a transmitter to originate that wide range of frequencies, and a suitable television receiver. It was these which were employed in the transmission and reception of the program on November 9.

TELEPHONE SERVICE OPENED BETWEEN NEW YORK AND BAGDAD

TELEPHONE service direct from New York to Bagdad, the capital of 'Iraq, was inaugurated on December 15 with a conversation between Said Righed Rashid and Mr. Lowell Thomas, who was associated in Arabia during the World War with Emir Feisal, later the first King in Bagdad and the father of the present ruler. The telephone call went through the American Telephone and Telegraph Company's overseas switchboard, over a short-wave circuit to London, England, thence by short-wave to Cairo, Egypt; and on the banks of the Nile it changed from a short-wave circuit to a land line across the Suez Canal over the Sinai Desert, north through Palestine and on across the North Arabian Desert to old Bagdad.

RADIO TELEPHONE SERVICE TO S.S. WASHINGTON

RADIO telephone service between the S.S. Washington and shore stations of the American Telephone & Telegraph Company was opened December 15, 1937. The service, operated on board the liner by the Mackay Radio and Telegraph Company, will be available throughout the vessel's voyages across the Atlantic, for connection to all Bell and Bell-connecting phones.

D. A. CRAWFORD AND ELIHU ROOT ELECTED DIRECTORS OF AMERICAN TELEPHONE AND TELEGRAPH COMPANY

AT a meeting of the Board of Directors of the American Telephone and Telegraph Company held on December 15, Elihu Root, Jr. of New York and David A. Crawford of Chicago, were elected to fill the vacancies caused by the deaths of E. E. Loomis and Thomas Nelson Perkins.

Mr. Root is a member of the legal firm of Root, Clark, Buckner and Ballantine, and Mr. Crawford is President of The Pullman Company.

VICE PRESIDENT JEWETT TO RECEIVE "WASHINGTON AWARD"

DR. FRANK B. JEWETT, Vice President of the American Telephone and Telegraph Company, has been named to receive the "Washington Award" for 1938.

This honor is granted annually by a committee representing the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the Western Society of Engineers.

The award was instituted in 1916 by Dr. John Watson Alvord, a Past-President of the Western Society of Engineers and a distinguished consulting engineer of Chicago, whose letter to the governing body of that Society included the following: "Being desirous of promoting a better appreciation by the public of able work accomplished by engineers for the public welfare . . . I desire to see established an honor award,—by medal or other tribute—to be annually presented to that engineer whose particular work in some special instance or whose services in general have been noteworthy for their merit in promoting the public good." The award is made by a Committee composed of nine representatives of the Western Society of Engineers and two each from the four other engineering bodies mentioned above.

Former recipients of the Washington Award have been: Herbert Hoover, 1919; Captain Robert W. Hunt, 1922; Prof. Arthur Newell Talbot, 1923; Jonas Waldo Smith, 1925; John Watson Alvord, 1926; Orville Wright, 1927; Dr. Michael I. Pupin, 1928; Bion J. Arnold, 1929; Dr. Mortimer E. Cooley, 1930; Ralph Modjeski, 1931; William D. Coolidge, 1932; Ambrose Swasey, 1935; Charles Franklin Kettering, 1936; and Frederick G. Cottrell, 1937.

RECORD-BREAKING HOLIDAY LONG DISTANCE AND OVERSEAS TRAFFIC

THE volume of long distance and overseas telephone traffic reached a new high on Christmas Day, even breaking through levels of 1929 and before. Long distance calls put through at fourteen representative points rose almost six per cent over the high figures of last year while there were 755 Yuletide overseas messages, or eleven per cent more than in 1936.

The longest Christmas greeting traveled through telephone lines and the ether some 11,000 miles, as it sped from Johannesburg, South Africa, to Chicago. Paris and New York were involved in the conversation of longest duration—a Christmas Day message lasting thirty-one minutes. Among the calls which linked distant places was one set up between Greenwich, Conn., and Calcutta, India.

Transpacific overseas telephone calls established from the operating center of the American Telephone and Telegraph Company at San Francisco increased by about thirty-four per cent over last year. Japan was among the countries where traffic volume showed a marked rise, the number of seasonal calls placed being almost three times that tallied in 1936. Similarly, large increases were registered in several European countries—holiday calls established with Italy rising some 300 per cent and those to France and Germany increasing by one-quarter and one-seventh, respectively. In addition, a number of holiday greetings were telephoned from ships in mid-Atlantic.

Thousands of telephone employees worked on Christmas to rush the flow of long distance traffic over land lines in the United States. Thanks to carefully worked out preliminary arrangements, and to the use of such new facilities as the fourth transcontinental route to the Pacific coast, delays on long haul long distance service incident to heavy demand were of shorter duration than in previous years. Memphis, Tenn., and Minneapolis, Minn., showed the highest increase in the use of long distance service.

The program transmission facilities of the American Telephone and Telegraph Company assisted in bringing four Christmas radio programs from abroad. Late on Christmas Eve carols, sung by a choir in Bethlehem in Palestine and then routed to London via Cairo, Egypt, were dispatched across the Atlantic on American Telephone and Telegraph Company channels, for use on a network of the National Broadcasting Company.

BELL TELEPHONE QUARTERLY

VOL. XVII APRIL, 1938 NO. 2

"FLYING LABORATORIES"

"OVERSEAS OPERATOR"

DEALER IDENTIFICATION THROUGH CLASSIFIED TELEPHONE DIRECTORIES

TRAINING OF PLANT DEPARTMENT PERSONNEL

THE ART OF THE MAKER

AMERICAN TELEPHONE & TELEGRAPH CO. • NEW YORK

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A Medium of Suggestion and a Record of Progress

CONTENTS FOR APRIL 1938

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Communication History in the Making: Telephone Engineers in a Two-way Radio Telephone Conversation with an Airplane in 1917. See "Flying Laboratories," Which Begins on the Opposite Page.

"Flying Laboratories"

(*Editor's Note: It will interest readers of the* Bell Telephone Quarterly *to know that Captain A. R. Brooks, whose article appears below, has served for ten years as chief pilot and Supervisor of the Air Operations Group of the Bell Telephone Laboratories. From 1917 to 1922 he was in the U. S. Army Air Service, and the single-seater pursuit plane which he used in France is now in the Smithsonian Institution in Washington, D. C.*)

THE Bell System's contributions to the development of the art of radio telephony are principally suggested to the public mind in the present scope of the System's overseas service which, inaugurated in 1927, now connects American telephones with those in some 70 foreign countries.

That these contributions have also been of vital importance to the development of the aviation industry is not so generally appreciated. The object of this article is to describe briefly some of the System's research and development activities that are to-day reflected in the radio telephone instrumentalities so widely used to afford two-way communication between airplane pilots and ground terminals.

Aviation men, of course, are familiar with the facilities established in 1928 by the Bell Telephone Laboratories at Hadley Airport, New Brunswick, New Jersey, for the purpose of making field tests of apparatus and equipment designed by the System's radio experts. These facilities comprise shops, an office, hangar space, and first one and then two airplanes. Known in aviation circles as the Bell System's "Flying Laboratories," the two airplanes have already made nearly 2500 separate flights, totaling more than 270,000 miles of air travel.

But the story of this laboratory investigation really begins more than a decade before the advent of these "Flying Laboratories." It was in 1916, following the System's early demonstrations of transatlantic radio telephony, that the United

States Government first called upon the Bell System for coöperation in investigating problems relating to aircraft communication. The first request resulted in experimental radio telephone equipment for the Navy Department. The Chief Signal Officer of the Army asked Laboratories' officials in May, 1917, to undertake the emergency development of equipment for military aircraft. The demonstration a few weeks later of radio telephone communication between an airplane in flight and a ground station using apparatus both designed and built by the Laboratories' engineers is one of the most interesting and historic episodes in the story of the Bell System's wartime activities.

During the post-war period, aviation in America made rapid progress. By 1920, the Post Office Department was experimenting with a transcontinental mail service involving the use of planes and railroad trains in coöperation. By 1923, many routes were beacon lighted, enabling extended airplane performance through the inclusion of night flying. Two years later, the first privately organized corporations undertook contracts to fly United States mail routes. The Air Commerce Act, passed in 1926, intensified the growing interest in air transportation and the epochal flight of Charles Lindbergh in 1927 focussed public attention on the potentialities of air travel. Public interest was high. But to those who were studying all aspects of the situation, it was apparent that if the airplane was to become an efficient common carrier, its pilot must have trustworthy radio facilities for air navigation and for two-way radio telephone communication with ground sources of information essential for successful flying.

With the development of air transport obviously hampered by the unsatisfactory state of the radio telephone art, it was decided that the Bell Laboratories should enlarge the scope of their participation in the general attack on the specific problems involved. The Bureau of Air Commerce was already sponsoring hourly broadcasts of weather information, which meant that airplane radio telephone receivers were an immediate requirement. Promoters of transcontinental air transport were discussing the need for two-way communication sets. It was because of such circumstances that the Laboratories in 1927 undertook a fundamental investigation of radio frequency bands suitable for aircraft use and the development of improved apparatus and circuits suitable for two-way telephone communication systems between aircraft and ground.

Although airplanes could have been borrowed for field experiments, it was considered impractical to use any that were not owned and therefore under complete control. One reason for this decision was that for every hour to be spent aloft, many days before and after flights might often be required for installations, removals, or ground tests of equipment. Furthermore, the items of equipment complementary to radio requirements of the infant industry were not yet accurately specified. Instrumentalities to eliminate noise and other troubles in aviation radio telephone sets, as well as power units, regulators, and similar accessories, needed coördinated study. The rapid change taking place from water-cooled to air-cooled engines also created new questions. Before the year was ended, therefore, a single-engined four-passenger Fairchild cabin monoplane was being assembled at Farmingdale, N. Y., to furnish the Laboratories a medium for uninterrupted research in this field.

In the next eighteen months this ship made possible many contributions to airplane communication through initial studies made under field-test flying conditions. Then an all-metal, trimotored Ford of 14-passenger capacity (13,500 pounds gross weight) was acquired in October of 1929, and during the following year the original Fairchild was exchanged for a new one of six-passenger capacity. Both the Ford and the second Fairchild are still in service.

A licensed transport pilot has supervised the air operations of the Bell Laboratories at Hadley Field. The station personnel has included a second experienced pilot as well as a licensed mechanic and an expert technician. Added personnel has naturally been available from the Laboratories' staff in New York whenever peaks occurred in the development program. At any given time there have usually been from one to six engineers or assistants using the facilities of this particular field laboratory in arranging for or carrying out the ground or air tests.

Safety Precautions

From the very inception of the activity, the prime consideration was the factor of safety. Bell System employees were present during construction of each airplane by responsible manufacturers. All metal parts of each plane were carefully "bonded" to make one electrical unit. Additional structural members were added wherever there were requirements for special installations, such as provision for extra antenna supports, for cabin work-bench interchangeable with customary passenger seats, or for pedestals to mount the heavier laboratory measuring instruments. All wiring circuits were fused and, for those carrying high voltage, automatic cover switches were included, as in general laboratory practice.

The log books show that operation of the planes has largely been confined to the area over northern New Jersey. There were, however, special day or night flights to Washington, D. C., Pittsburgh and Bellefonte, Pa., Cleveland, Ohio, Albany, N. Y., Hartford, Conn., and to points over Long Island, N. Y.; and the record also shows flights to a few more distant cities such as Richmond, Va., Knoxville, Tenn., Dayton, Ohio, Chicago, Ill., Detroit, Mich., and Boston, Mass. There were also many flights to unnamed locations—regions in the sky nearly 20,000 feet high. These were in connection with tests for observation and correction of possible flash-over or sluggish relay action which might occur in some varieties of equipment operating under reduced pressures and lower temperatures. In such upper altitudes, oxygen was made available for the occupants of the plane if the flight were a prolonged one.

All flights except the very first few have been made with scheduled two-way radio telephone contacts maintained with a Laboratories' ground station, as well as with commercial airports or government radio stations.

Range of Investigations

The first flying tests involved studies of transmission to aircraft and were carried out simultaneously by a group of Laboratories' engineers in planes flying mountainous routes in western territory, and another group in the Laboratories' plane in the level eastern country. For this purpose a large field strength measuring-set, originally designed for use in automobiles, was cushioned in the cabin and carried through a wide range of altitudes and distances while recording signal strengths from ground radio stations which used different antenna systems or degrees of power. With data thus obtained, requirements of sensitivity and range for the first in a series of beacon and weather radio receivers were available. Aircraft radio transmitters were similarly developed and then, in sequence, several systems for two-way radio telephone communication between airplanes and ground stations.

A pilot's typical report during the early investigations was as follows: "In afternoon 8A Radio Transmitter was readjusted to 5690 kcs. from 4108 kcs. and tested with Whippany in preparation for next trip. Took off at 9:00 P.M. Lightning caused bad static both at Whippany ground station W3XN and in Fairchild W2XBX. Flew direct to Washington, D. C., at 2500 feet altitude, giving standard word lists for two-way conversation tests throughout. Station W3XN received clear signals from plane to position: beacon light No. 55 below Alexandria, Va. Noise level in plane receiver too high to understand station W3XN farther than light No. 60 (146 miles effective). Station W3XT received signals intermittently and transmitted when plane approached Washington. Bad fading on this frequency. Indication: not practical for night use. Returned at 5000 feet to Wilmington, Del., where clouds forced drop to 4000. Landed 2:00 A.M. 3452 kcs. next trip."

Since accessories vital to the evolution of satisfactory radio systems on aircraft were unavailable, the "Flying Laboratories" became testing media for certain items of equipment other than radio. For example, dependable "shielded" spark plugs and ignition "harnesses," not completely reliable in 1928, were, within two years thereafter, commonplace and satisfactory in service; at one time, after a great deal of early trouble had been experienced, there were four different types of "shielded" plugs firing in the Ford engines for comparative study.

Likewise, in power units for the requirements of radio, the wind-driven generators hanging out on the struts of the Laboratories' planes soon gave way to engine-driven generators which, in their turn, were replaced by increasingly dependable dynamotor units.

Hundreds of flights were made for accumulation of data regarding limits and qualities, varying according to times of day, season, distance or altitude, of transmissions to or from the planes. First studied was obviously the beacon broadcast band (220–390 kcs.), used at once in practical ground-to-plane one-way application. Next came attention to the medium frequency band (2600–6500 kcs.) allocated for two-way communication, and then portions of the ultra-high radio frequency spectrum for pure research in the earlier period and latterly for diverse aircraft purposes as assigned by the Federal Communications Commission.

In every investigation, models of newly designed electrical and mechanical equipment were assembled, installed, tested, changed, rechecked, and then given reasonable airplane life-test by the pilot alone or with the coöperation of an observer.

Literally a Laboratory in the Air: the Interior of the Ford Plane During Early Tests (in 1929), Showing the Laboratories' First Modern Receiver and Transmitter in Operation in the Foreground, While Measurements of Field Strength of the Associated Ground Station Are in Progress Beyond. The Pilot and Co-Pilot Are Just Visible at the Controls.

The Bell Laboratories' Tri-motored "Flying Laboratory" Making Aviation Radio Telephone Studies Over New York City.

The Laboratories' "Fleet": the Ford (Left) and the (Second) Fairchild Planes. The Laboratories' Planes Have Been Familiar to Hadley Field Attendants since 1928.

Scores of voice transmitters, with changes both large and small, were thoroughly tested in the planes to assure final perfection of the comparatively few types best suited to pass high quality voice frequencies while excluding all other sound classified as noise. New antennas were mounted on the planes and given adequate study. New filters, chokes, or relays were inserted in various system circuits; new materials were tested for improved insulation qualities or for better shock-proof mounting; improved power units were evolved.

The field of investigation also included such matters as radio aids for instrument or "blind" flying. This received first attention in the test and furnishing of special two-way radio equipment for investigations sponsored by the Guggenheim Fund. Later the Laboratories' Fairchild was equipped with tandem control, the rear pilot being enclosed in a cabin section which could be entirely darkened. Approaches and simulated "blind" landings, testing radio aids in the form of suitable indicating instruments (in coöperation with the Bureau of Air Commerce), were made at Newark, N. J., where a "bent beam" was available to mark the path for a plane to glide to earth much as if coasting down an invisible toboggan slide.

Other radio receivers were assembled from quite different specifications, such as one to enable a fog-bound pilot to identify his position positively over a known but unseen point on the earth. Known as the "cone-marker," this type advises the pilot (who has brought his plane "blind" to the vicinity of the airport by utilizing the now well established radio range stations) the moment he enters the area influenced by localized special high frequency transmission from the point on the ground; once definitely fixed as to location, the pilot proceeds with his "blind" or instrument approach which lands him safely at the airport.

Tests of facsimile and teletypewriter transmission and reception apparatus have likewise been made in the Laboratories' planes. And various developments such as anti-static direction finding and homing loops have received consideration.

With passage of several years, then, a later report of the pilot reads like this (with certain data deleted): "Coaxial antenna mounted in Ford and transmission line completed to radio receiver on cabin bench. Quarter-wave, shunt-connected rod antenna flown at 2500 feet out from ground station W2XID and at —— mile point courses checked to —— degrees. Two-way, during two flights, 4797.5 kcs. with W2XMZ and —— mcs. with W2XID." Another example: "With Ford motors running on ground at various speeds, voltage measurements taken with cathode-ray oscillograph on primary ignition circuits for interference-filter design data. UHF transmission from Fairchild to Deal; route —— degrees from Deal —— Miles. Altitude 3500 feet both directions. Two-way, station W2XMZ (Hadley) 4797.5 kcs. and 3415 kcs.; and WREE (Newark) 3105 kcs."

Practical Application

The aviation industry found the need of the newly designed apparatus so great that there was an immediate demand for the perfected two-way radio telephone system. In fact, the type of radio telephone equipment designed by the Bell Laboratories and manufactured by the Western Electric Company has been used since 1929 on scheduled air lines in the United States and elsewhere both for navigation and for dispatching.

In the ordinary course of procedure for test flights from Hadley Field, informal conferences are usually held, at which project engineers and the air operations supervisor discuss plans pertaining to the immediate objective of the flight, the equipment to be used, the scope of the ground or flying test, the routes to be flown, the altitudes to be maintained, and the data to be obtained.

As an example: there is to be a flight to test a modified direction-finder anti-static loop antenna on the Ford. When all is in readiness and while motors are warming up, the pilot calls a Laboratories' ground station at Hadley Field, Whippany, or elsewhere. After leaving the airport he again checks with the ground station. Since there is now government control of air traffic, it is necessary for him to give a flight plan to the ground station at Newark in order to obtain approval for this particular flight as to time, direction, and altitude, as well as to learn of other possible traffic along the proposed route. While the approval may have been obtained previously over the land telephone, if more convenient, it is usually done at the beginning of every flight as another part of the test of the apparatus involved.

In calling a station on the planes' licensed channels, the pilot is "on the air" when he turns on the filament switch and presses the microphone button to talk, releasing the button when he wants to listen. Since all Bell System radio transmitters and some of the radio receivers are held on their assigned frequencies by quartz crystal controls, there is no adjusting whatsoever. To shift from one of these frequencies, the pilot merely rotates a small crank which in a few seconds, through remote control, selects any one of the three frequencies in the present air transport equipment.

The radio receivers ordinarily aboard the "Flying Laboratories" are two in number: one mechanically and electrically locked to the transmitter for two-way conversation and hence automatically tuned to a new channel with the transmitter; the other a variably tuned receiver using the band for government beacon or weather broadcast. The latter receiver is manually operated (by a separate control, dubbed "the coffee grinder," or by selective "push-button" if desired) and tunes to any of the radio range beacon stations giving continual guidance over the present 22,400 miles of Federal airways.

In the typical flight we are considering, the pilot flies to a predetermined location in space. By a remote control and indicator wired temporarily into his cockpit he may take several bearings on land radio stations in order to check the accuracy of direction indicated with known direction. Or, he may check such details as the sharpness of beam in degrees of width while using the aural feature; or the degree of steadiness in received signal strength. During flight, engineers may make adjustments to parts of the equipment mounted on a cabin bench and connected to the rotatable loops hanging outside under the cockpit. Throughout the flight, the pilot reports to his ground station, and upon his return to Hadley Feld, the ship is turned over to the mechanic for usual maintenance, while pilot and observers assemble results and impressions of the test and decide on future operations.

So it is that years of research and experimentation with the "Flying Laboratories" and associated ground stations have brought about equipment that is of the utmost importance to commercial aviation. It is equipment that is extremely rugged, yet light in weight and of minimum size. To insure dependability, every possible detail had to be considered, from provision against failure due to continuous vibration, to insulation that withstands high voltages and moisture. The radio telephone apparatus that has resulted from the last decade of investigation, prefaced by the accomplishments of the war period, reflects the scientific attainments of the Laboratories' engineers and the high standards of the manufacturer, the Western Electric Company.

A. R. Brooks

"Overseas Operator"

MR. SMITH was lonely. While he has remained in Omaha, Mrs. Smith has been traveling in Europe. Her latest letter bore a date of two weeks earlier and was something less than satisfactory. Various questions are in Mr. Smith's mind: has she recovered from the cold she had mentioned; has she changed her mind about visiting Devonshire; when is she returning; shall he meet her in New York or Chicago? Mr. Smith has a happy thought: the telephone. Call her up! That's the way to get a quick answer! Hastily scanning her letter to see where she might be at this moment, Mr. Smith moves the dial: 2–1–1.

"Hello, Long Distance. I want a call to Brussels . . . Yes, Brussels, Belgium . . . Mrs. Smith . . . Wait, I'll give you the address. It's the Hotel Brabant . . . B-R-A-B-A-N-T . . . That's right. The address is 19 roo dee—I guess I'd better spell that too. R-U-E D-E R-O-G-I-E-R . . . What time is it in Brussels now? . . . All right, let me know if it's too late at night. I don't want to wake her up . . . If it's too late, I'll talk in the morning . . . about 8 o'clock . . . 8 o'clock *here* in Omaha." Giving his name and number, Mr. Smith hangs up his telephone.

But, fortunately, the six-hour difference between Omaha and Brussels hasn't made it too late, and before Mr. Smith has much more than re-read his wife's letter and speculated on what she may think when told he is calling, the telephone bell rings. "On your call to Brussels. We are ready." Then, "Hello, darling! How are you? . . . Yes, I hear you as clearly as though you were in the next room." And so, from the same telephone that he uses to call across the street or across the state, Mr. Smith chats with his wife across 1,500 miles of land

and 3,000 miles of ocean. Overseas service has added to the importance of his telephone.

In the United States, there are approximately 19,000 telephone central offices, to which are connected more than 19,000,000 telephones. At any one of these telephones there may be a Mr. Smith who wishes to call some one at any one of the 14,000,000 telephones located in seventy-odd overseas countries or territories. The manner in which this need is met and the various conditions which arise in the sequence of operating steps may best be described by considering the general process and incidents in handling overseas calls. The service, and the provisions and arrangements for handling the traffic, really start at the moment that the caller translates his wish into concrete form by lifting the receiver of his telephone to dial or call "Long Distance."

A Call Starts on Its Way

To the Long Distance operator our caller usually names the place he is calling. In the early days of the transatlantic service, many a Long Distance operator thrilled to hear a subscriber say he wanted Paris or Berlin, only to find that it was the namesake in Kentucky or New Jersey that was wanted. At the Long Distance offices in the cities where overseas radio circuits terminate—New York, Miami, and San Francisco—the answering operator, upon learning that an overseas point is wanted, usually transfers the caller directly to the overseas group, where the particulars of his call are taken by one of these specialized operators. In the case of other cities, the details are recorded by the answering Long Distance operator. Because in such a case the call must be passed to the overseas operator and as a rule more than the usual wait for a toll call would be involved, the caller does not wait at the telephone for completion of his call. Routing information is available at all offices showing that a call to Italy, for example, should be passed to the overseas operator at New York, one to Panama to the corresponding operator at Miami, and a call to Japan via San Francisco. So directed, the Long Distance operator reaches the appropriate overseas operator and relays the particulars of the call. An overseas operator thus receives calls either directly from callers in her own city or from Long Distance operators in other cities.

The work at a group of overseas positions is generally divided functionally. Certain operators are assigned to work with the distant terminals and are spoken of as "circuit" operators. Others, who attend to the preliminary and preparatory work over the wire system, are called "report" operators. Individual operators during the course of the day may be assigned to work either as report operators or as circuit operators.

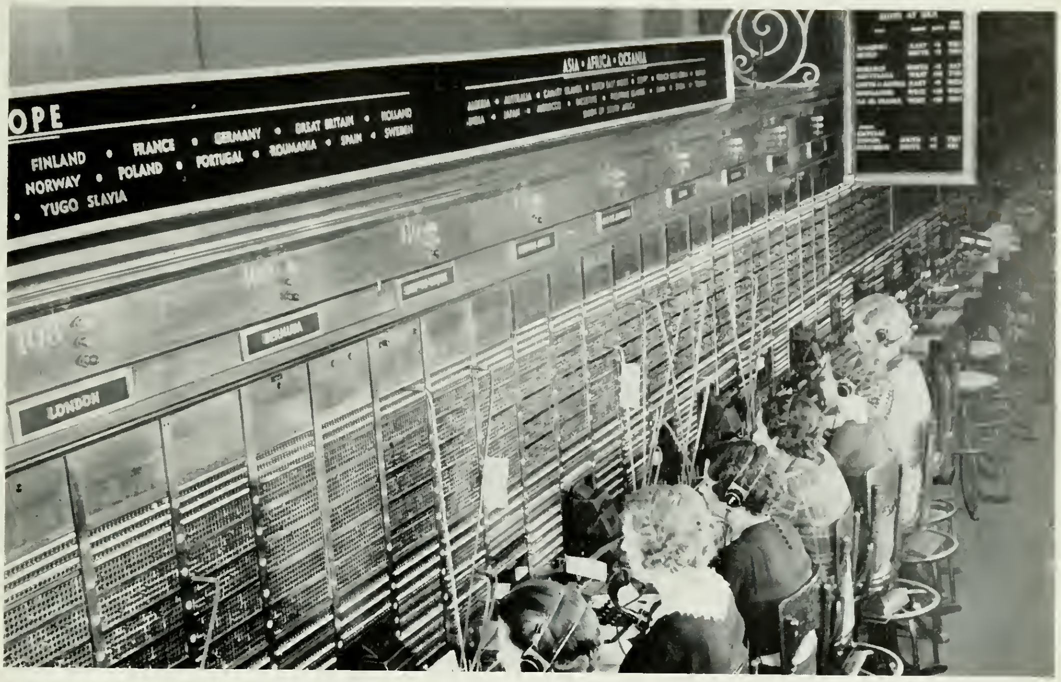
Accordingly, it is a report operator who receives the call. She records the particulars on a special ticket form which is generous in the space provided for the more extensive directions than are generally required on land line calls, as well as providing for many special notations for aid in completing and billing overseas calls. If we were to look over the shoulder of a New York overseas operator recording calls to Europe, we would note certain characteristics of the traffic. In the first place, while a call may be to any of twenty-six countries in Europe, the odds favor its being to Great Britain or France. It will be for a particular person, since in this service a call for a connection simply with anyone who may happen to answer the telephone in a foreign country is so rare as to be negligible. In sixty-five per cent of the cases, the call will be for an American, traveling or residing abroad. On six out of ten calls, the telephone number of the person desired will have been furnished by the caller—the percentage running slightly higher if the call is to London or Paris. On the remainder there will be a street address, or the name of a firm, corporation, institution or establishment. Twenty calls out of a hundred will be for persons staying at hotels, generally those patronized by visitors from these shores. Seventy-five per cent of the calls will be wanted as soon as it is possible to complete them, but the remaining twenty-five per cent have been filed for completion at a later time or even a later day. The large proportion of calls filed in advance of the time wanted is without doubt due in part to differences in time of day between the calling and called places which put the daily routine of the calling and called persons out of phase; there is also an advantage in that the person desired, being notified of the call in advance, has an opportunity to arrange his affairs so as to be available and prepared to speak at the specified time.

After the call has been recorded, if the called number has not been furnished, reference is made to the telephone directory of the foreign city on file at the overseas section. In so doing, correctness of names of persons and places can be verified. If the called number cannot be found, however, the call will be passed onward without it, for tracing at the distant terminal or at the office of destination.

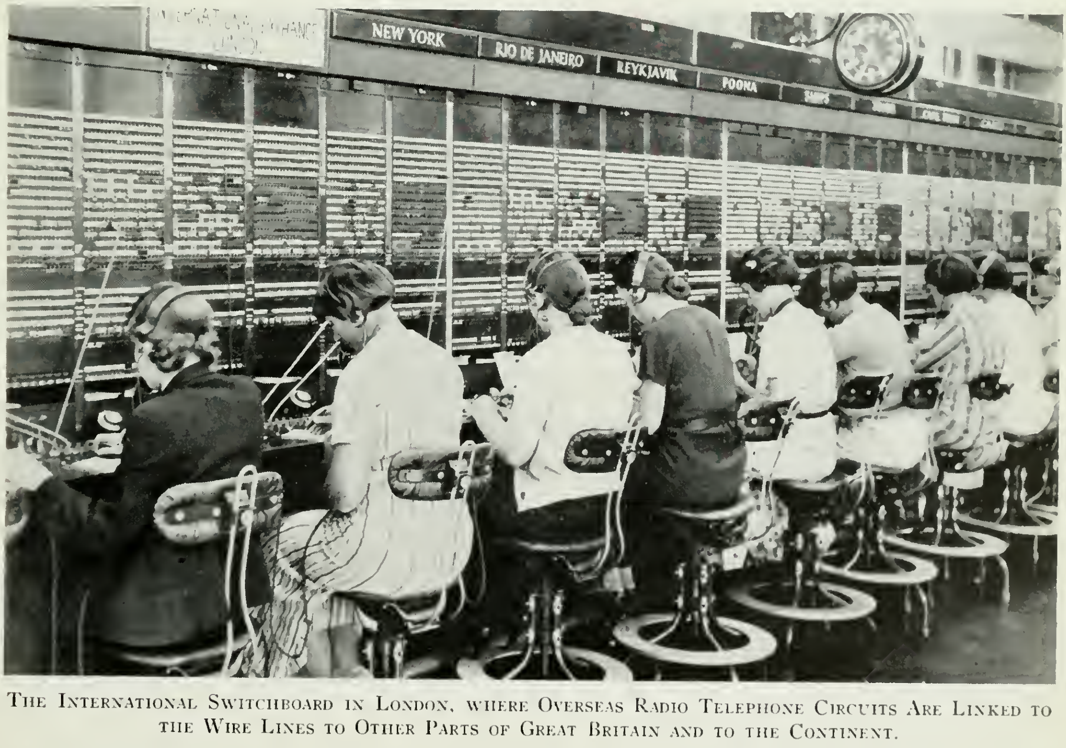
The ticket is then handed to a circuit operator who is handling traffic over the radio circuit required for this call. Her first step is to familiarize herself with the particulars, so that she may deal with it intelligently.

It Reaches a Foreign Shore

As she casts a practiced eye over the ticket, the circuit operator draws on no small fund of geographic and telephonic detail concerning that part of the world with which she works. It is necessary for her to recognize, for example, cities which are generally known in the United States by other than their native names—Vienna for Wien, Leghorn for Livorno, Munich for München. Calls may be filed by either name. The principal central office prefixes in the large cities, the particular way in which street addresses are given in foreign lands, the importance of certain identifications such as the postal district letters in London and the arrondissement numbers in Paris, the various ways in which " Incorporated " in company names is expressed,



A Section of the American Telephone and Telegraph Company's Overseas Switchboard in New York at which Are Handled Calls to Europe, to Bermuda, to the More Distant Countries of South America, and to Ships at Sea.

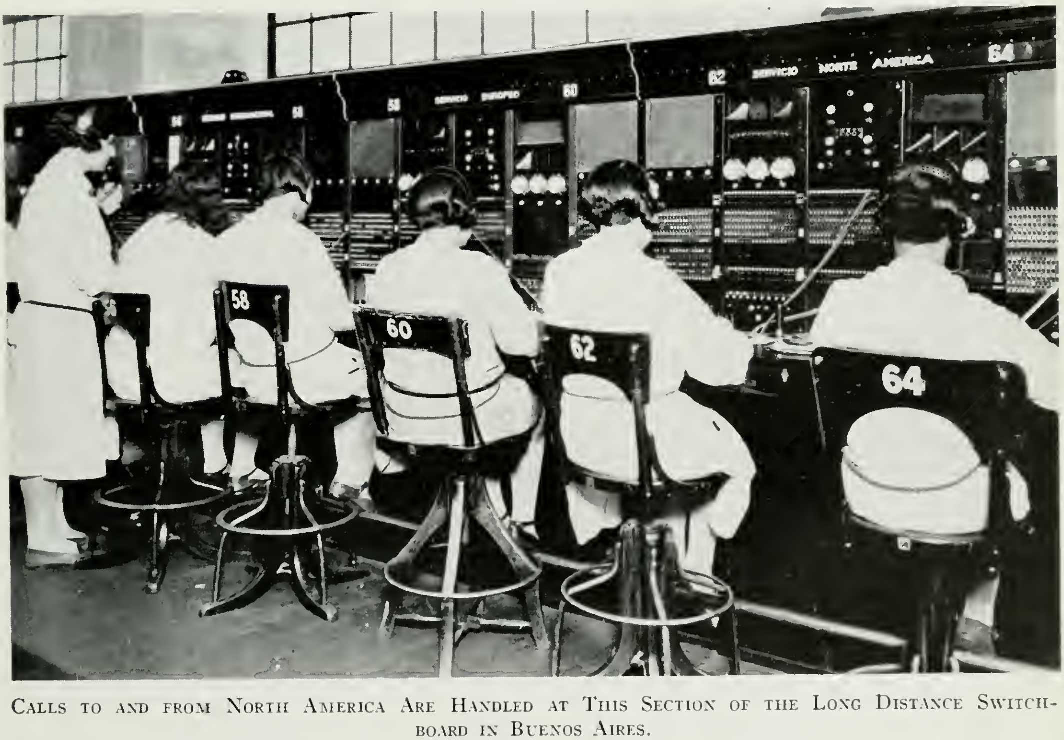


The International Switchboard in London, where Overseas Radio Telephone Circuits Are Linked to the Wire Lines to Other Parts of Great Britain and to the Continent.

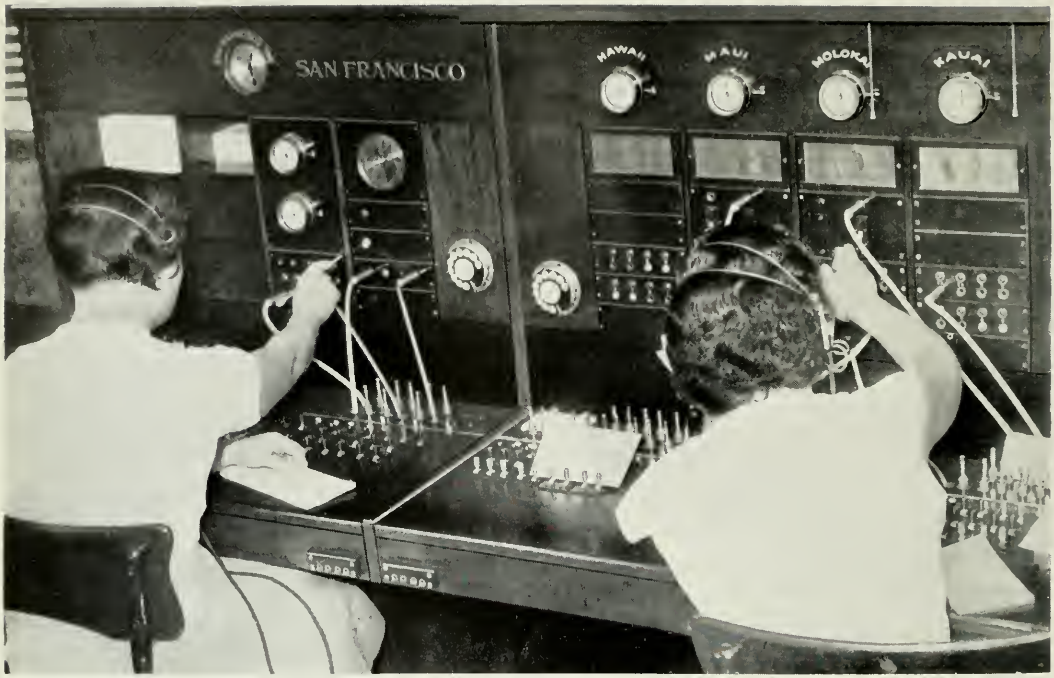
Bell System Overseas Service Reaches Places Small as Well as Large. This Switchboard in Ciudad Trujillo, Dominican Republic, Connects with the A. T. & T. Station at Miami, Fla.

Overseas Positions at the "Interurbain" or Long Distance Office in Paris. There Is Now a Direct Radio Telephone Channel between New York and Paris, in Addition to the Circuits via London.

A Section of the Long Distance Switchboard at Amsterdam, The Netherlands.



Calls to and from North America Are Handled at This Section of the Long Distance Switchboard in Buenos Aires.



Honolulu Connects with the A. T. & T. Company's Trans-Pacific Station at San Francisco as Readily as with Other Islands of the Hawaiian Group.

International Telephone Calls Both by Wire and by Radio Circuits Are Handled in This Long Distance Office in Berlin.

from the British "Limited" to the Japanese "Kabushiki"—knowledge of these and a thousand other details contributes to the intelligent handling of the call and to the avoidance of mistakes and delays.

The next step in the process of handling the call is to pass the call to the distant side. In the case of all of the overseas services operated by the Bell System, this is done simply by dictating the particulars as they appear on the ticket. Since our overseas calls are dealt with by speech, the question of language comes to the fore. Naturally, if operators in two countries with different languages are to speak with each other, one at least must be bi-lingual. In Europe the general rule among the various telephone administrations is that any international service may be operated in the language agreed upon between the interested administrations. In the radiotelephone services throughout the world, the language to be used is likewise a matter of agreement. As a practical matter, English is used in a number of cases where it is not the native tongue at either terminal. The Tokyo-Shanghai radiotelephone circuit, for example, was operated in English, and certain circuits between South America and Europe are operated in this tongue. Of the twenty-four distant countries or territories in which the Bell System overseas circuits terminate, the native language is English in the case of five, French in two, Spanish in thirteen, Portuguese in one, Dutch one, Japanese one, and Chinese one. All of these circuits, however, are operated in English.

In passing the particulars of the call, our circuit operator resorts to spelling words, letter by letter, when necessary to insure accuracy. As she dictates the call, the operator on the distant side records it on a ticket; at the conclusion, coming as an indication that all of the items have been given, the circuit operator on the outgoing side assigns a serial number to the call which serves thereafter as its identification.

Advancement of the call toward its completion now takes place on the distant side. The objective, of course, is to reach the telephone at which the person desired may be found, to ascertain if he is available and, if so, to proceed with the establishment of the connection. The exact process of doing this does not constitute a specific operating method, because it is governed by conditions in the country concerned. In most of the countries of the world, the telephone service has developed according to the habits and customs of the people as well as the broad social, economic, and political factors. Differences in organization, the kind and quantity of plant provided, methods of operation, and the philosophy as to objectives naturally produce differences in methods and in service results. The speed with which our overseas call is handled on the distant side will depend largely on the pace or tempo of telephone operations as a whole in the particular country. The various steps may be simple and quick if there are ample trunks and wire circuits directly accessible to the overseas operator, efficient operating methods, well-organized auxiliary services, such as "Information," a maximum of control by the operator actually handling the overseas call, and a general precision in operations by other operators whose work is of a semi-mechanized character. The reverse may be the case if the fundamentals for rapid handling of the traffic are lacking.

The Distant Operator Reports

In due course, the distant circuit operator will have a report on our call. Again using the European services as an example, we may anticipate that the person desired has been reached on about fifty per cent of the calls, and that he will be unavailable on about thirty per cent. On more than ten per cent of the calls, in spite of the care exercised before passing the call, further information is required by the distant side in order to trace the person desired. The first report on the remainder will be of great variety, of which "no reply from the called telephone" will predominate. On the fifty per cent which cannot be completed because of these delaying conditions, further attempts will have to be made from time to time. The extent of this is reflected in the fact that on all European calls, the New York and distant operators deal with each other an average of nearly five times per call.

Relative time of day is of importance in giving reports to the caller. On a call to Manila, for example, the report obtained from the called telephone may be that the called party is not available but is expected about 11 P.M. This report is to be given to the caller, who is perhaps in Boston and who may not know the exact difference in time. The general practice on such a report is for the Manila operator to quote the report in terms of her own time; the San Francisco overseas operator notes it on her ticket in terms of Pacific Standard Time and in giving the report to the caller makes such changes as may be required. To facilitate this, small tables showing relative time of day in the various countries at which our overseas circuits terminate are issued to the overseas operators from time to time. Due to the Daylight Saving Time changes and cases where countries change their legal time, this table requires corrections from ten to thirteen times a year.

When both of the persons involved are available, the circuit operators at the two terminals proceed with the establishment of the connection on their respective sides. Certain technical features enter into this apparently simple step and influence the detailed routine. During the time that the two circuit operators were dealing with each other, the technical operators, watching the meters which indicate the outgoing and incoming volume levels, were able to set the amplification and other factors at a fairly constant value, since the operators were close to the terminals and spoke constantly in the same tone of voice. The preparatory work on the land-line side was done independently by report operators, so that until the land line is connected to the radio circuit there is no indication to the technical operator as to what changes in adjustments will be required for the over-all connection. Hence it is the practice, when all is ready, for the circuit operator on the incoming side to connect the land line to the radio circuit upon order of the operator on the outgoing side, whereupon the latter addresses the person at the far end of the connection. From his response to the operator the technical operator on the incoming side makes the changes in adjustments necessary to compensate not only for the land-line conditions but the voice of the particular speaker. Upon obtaining this response, the circuit operator on the outward side has a practical speaking test and, if the results are satisfactory, she connects the caller to the radio circuit, thus completing the connection. The technical operator on the outward side is then able to adjust his end of the circuit with the assurance that the proper adjustments on the distant side are already made.

The Circuit Is Made-to-Order

During the course of conversation, both the technical and traffic operators are on the alert to take action should any difficulty develop. If, as often happens, a second person at one of the telephones talks on the connection, and if his or her voice in point of volume is substantially different from that of the previous speaker, the technical operator's meters indicate this and he raises or lowers the amplification to the proper level. At the conclusion of conversation, the two circuit operators meet on the circuit, confirm that the connection may be released, and proceed with other calls. The technical operator alters the circuit adjustments once more to meet the speech conditions of the two operators.

Although marked advances have been made in improving radio communication, disturbances from atmospheric conditions and from invisible magnetic storms—believed to be the result of active spots in the sun—make these circuits less stable than wire circuits. These disturbances may make the radio circuit temporarily unsuitable for traffic, in which case it is taken over by the technical operator for such adjustments as can be made or, if natural forces are too strong, until the ether storm subsides so that standard qualifications are again met.

The overseas services have shown marked and continuous improvement since their inauguration. When the service with Europe was opened eleven years ago, the average interval to complete a New York-London call was in the order of forty-five minutes; the speed on similar calls now averages between ten and twelve minutes. Many calls between terminal cities are completed in one or two minutes, the caller being at the telephone while attempt is made to complete the call. Refinements of methods and the development of special skill and experience as well as technical improvements in facilities have contributed to better service.

The "Christmas Rush" Starts Early

No story of the handling of the overseas traffic would be complete without mention of the exceptional conditions that prevail during the Christmas holidays. It is at that time of year that thoughts turn to families and friends separated by distances and the telephone offers the means to exchange greetings and to hear the actual voice of loved ones. The booking of overseas calls for completion on December 24 and December 25 starts early; usually the first call may be expected by the end of September. As the season draws near the number of such calls increases. On one occasion a call was booked by letter from a man in a foreign country who had not yet left home but who wished to speak with his family on Christmas from New York.

The really heavy filing begins about December 22. Last year in the transatlantic service nearly sixty-five per cent of the calls wanted on Christmas Eve and about eighty per cent of the calls wanted on Christmas Day were filed in advance. The total demand for overseas services was about four and one-half times that on a normal day, with one of the services running nineteen times normal. Plans for handling this traffic were made many months in advance and general international consultations were held by telephone in perfecting a common understanding of these plans. All available radio facilities were scheduled for continuous operation until the traffic should be cleared. Operating staffs were trained in the special procedures devised for dealing with a heavy overload of traffic. But one fundamental factor could not be anticipated—whether radio conditions would be favorable.

On the transatlantic route, due to the experience in previous months it had seemed likely that one of the periodic magnetic storms would disturb radio conditions about December 20. But that date came and passed without sign of difficulty. The question then was whether it would hold off until after Christmas. It didn't! About noon of the 24th, intermittent trouble began to disturb the London and Paris circuits; by mid-afternoon there was no longer any doubt. Just as the Christmas Eve peak of traffic arrived, between 5:00 and 7:00 P.M., the overseas operators were struggling with only half the normal facilities and several times the normal number of calls. Late in the evening, conditions improved rapidly and the traffic started to move more nearly in accordance with its usual speed. Christmas Day was relatively free of radio disturbances and the heavy traffic not only at New York but at Miami and San Francisco was kept moving by augmented overseas staffs.

In the course of operations which involve such direct and personal relations between overseas operators in different countries, there are inevitably causes for misunderstandings; occasions when it seems as though a call is not proceeding just right on the distant side. Both operators are working against time and under pressure from the users of the service and neither is in a position to comprehend fully the conditions which each is meeting on her own side. In some cases the language problem is involved and it is difficult to understand and to be understood.

To the great credit of these young women, both here and abroad, it may be said that in the entire history of these services only the most harmonious relations have been maintained. The patience, tolerance, and philosophy with which difficulties are met and overcome speak well for the self-discipline and earnestness of these operators.

With them, the call's the thing. This point of view arouses a strong sense of mutual responsibility and stimulates a high degree of coöperation. Without such a spirit, the service would descend to the level of routine; with it—well, one of the daily stories will illustrate the difference. Naturally, the identifying names and places as here related are fictitious, but the situations are factual.

The Operators "Get Their Man"

It is three o'clock in the afternoon, a recording signal appears at the overseas switchboard at New York. The overseas operator answers and receives from Mr. Blank, a mid-town subscriber, what looks like a very simple call; he asks to speak with a Mr. Dash at a certain hotel in London, adding that if Mr. Dash is not at the hotel he might be reached through the North German Lloyd office in Southampton. These particulars are passed to London, and nine minutes later the report is received that Mr. Dash has left the hotel and it is believed that he has gone to Yorkshire. The Southampton telephone, which London found listed as Norddeutscher Lloyd Bremen, does not answer, the time being shortly after eight in the evening in England. From a strictly routine view, this report might finish the call, but telephone operators don't quit so easily. Besides, the directions and the report suggested that the call might be of especial importance. When the overseas operator gives the report to the caller, however, he shows no undue concern but merely asks that she try to reach Mr. Dash at Southampton about four o'clock the following morning—which would be 9 A.M. in Southampton—and, since he would not be in his office until 9 A.M. in New York, she should wait until then to complete the call.

At four in the morning, London reports that Mr. Dash is unknown to Norddeutscher Lloyd in Southampton and they can be of no assistance, therefore, in tracing him. When the caller is informed of this upon his arrival in his office shortly after nine o'clock, he tells the overseas operator the whole story. Mr. Dash intends sailing to New York on the Bremen, leaving Southampton tomorrow. It is vital to speak with him before he embarks, as events have made it unnecessary for him to come to America. The overseas operator thinks quickly: there was the Yorkshire angle. Why Yorkshire? She asks a question; the caller says perhaps Mr. Dash is at his brother's place, but he doesn't know where in that county of a hundred or so towns the brother may live. "We will try to locate him," says the overseas operator and a moment later she is relating the circumstances to her colleague abroad. London calls the hotel and talks to the hall porter. Does he remember Mr. Dash? Has he any idea as to where in Yorkshire he might visit? This alert functionary who handles the hotel mail thinks a moment. Yes, he noticed a letter from Coddingdame-Ribblesdale—"the wife 'as relatives there, miss, and it took my fancy to see the nime." That's a clue, but it seems to vanish as the directory for that district discloses no listing under the surname of the elusive Mr. Dash. The post office might know, and within a few minutes the London overseas operator is inquiring of the Coddingdame-Ribblesdale postmistress if she knows anyone by the name of Dash. "Down in the country," she says, "but the postman will pass the place in his late delivery and can mention the telephone call from America . . . No, miss, there's no other way . . . Yes, miss, we'll make a point of it."

At four the following morning London tells New York that Mr. Dash has been located at the Southern Hotel in Southampton but is not available at present. She adds that the tender taking passengers to the Bremen, which will anchor off the Isle of Wight, will leave the dock about 12 Noon. That will be 7:00 A.M. in New York, but Mr. Blank has given no telephone number other than that at his office, which may not open until two hours too late. The overseas operator, with the help of others, searches for the caller's possible home telephone: nothing listed in Manhattan by his name. He may live in an apartment house or hotel, but that would be hopeless to find. Hundreds of thousands of persons working in New York live in suburban towns, and with this possibility as a last resort the overseas operator, assisted by others, starts a search through the various directories of Westchester County, Connecticut, and Northern New Jersey. At last! A listing is found in a New Jersey town which corresponds with the name and initials of the caller. The supervisor considers a moment, for it would be serious to arouse a wrong person at that hour of the morning. "Try it," she says. A sleepy voice answers the ring. "Are you the Mr. Blank who is calling Southampton?" "Yes," he replies. He is tremendously relieved that Mr. Dash has been located. "Keep after it, operator, will you? It is most important that I catch him before he leaves."

Within an hour London reports again. Mr. Dash did not return to the hotel but he has been reached at the dock. The completion of the call is now a matter of routine. In a few minutes Mr. Dash's plans are completely changed and Mr. Blank retires for a final nap, thinking of the chase around England. "Well, those girls certainly get their man!—but now, how did they find *me?*"

Another recording signal at Long Distance: "Overseas operator."

EDWARD J. PADMORE

Dealer Identification Through Classified Telephone Directories

MAGAZINE readers and radio listeners without number have noted in advertisements and have heard over the air the statement, "For the name and address of the nearest dealer, look in your classified telephone directory." That reference phrase is the keynote of a specialized Bell System directory service which has demonstrated an increasing usefulness during the decade of its existence. First developed on a national scale by a centralized organization in 1928, Dealer Identification Service has proved its value not alone as a convenience to telephone subscribers and the public at large, but no less as a factor in promoting efficiency in the retail distribution of goods and services. It provides the vital link in the chain of information connecting manufacturers and consumers by answering the important "Where To Buy It" question.

Classified telephone directories have always served as "buying guides," since in them the local merchants and purveyors of services are listed under classifications generally descriptive of types of business or commodities or services. As the nation expanded industrially, the distribution and advertising of branded or trade-marked goods and services on a nation-wide scale greatly increased. Until recent years, there was no sure and ready means whereby a prospective purchaser could find the local dealer, agent, or representative of a *particular* product or service *by its advertised or brand name or trade mark.* In most cases, a person who wanted to buy something of this description had either to "write for booklet and name of nearest dealer," or to "shop around" locally until he found what he sought.

There were two serious disadvantages in this situation. In the first place, it was a real inconvenience to individuals who, having made up their minds that they needed or wanted certain specifically identified things, had difficulty in finding where to get them. Second, it was a weak spot in the nation's economic life, since dollars spent for national advertising, having created a desire for the purchase of the advertised product or service, could not in most cases "follow through" by directing purchasers to the place where that desire might be gratified.

The Bell System's classified telephone directories, long familiar and useful to millions of people, were the obvious and logical medium for filling in this gap—by providing, a wholly new kind of directory service, whereby local dealers could identify themselves *under the brand or trade-mark name* in every community in which the product or service was represented and in which classified books were distributed.

It was apparent that benefits would accrue, from such a directory service, to three groups: first, of course, to consumers —the public—through the ease with which they could locate the local outlets of the brand-named or trade-marked articles or services they wanted; and to advertisers and to their local dealers or representatives through the increased effectiveness of national advertising when localized by inclusion of some such directional reference as that quoted at the beginning of this article.

These three groups mutually would benefit from a service designed primarily to increase the usefulness of the classified directories to telephone subscribers and the public. But investigation soon revealed that this increased usefulness could be brought about only with the participation and active cooperation of national advertisers—manufacturers of branded or trade-marked products and their advertising agencies—and of their retail dealers and local representatives. The public would be passive beneficiaries of the introduction of the additional buying service in the "yellow pages" of their telephone books.

Prior to 1927, as the result of analysis of the then existing situation and of the opportunities for remedying it through the System's directory organization, a merchandising plan was developed by one of the Bell Companies, in coöperation with the American Telephone and Telegraph Company, to be presented to manufacturers and other advertisers, which would make

Refrigerators—Electric

FRIGIDAIRE REFRIGERATORS

Save more on current, food, ice, upkeep! Only Frigidaire has the New Silent Meter - Miser, new "Double-Easy" Quickube Tray, and many other *exclusive* advantages.

"WHERE TO BUY IT"

DISTRIBUTOR

FRIGIDAIRE DIV
General Motors Sales Corp
2446 Univ av (StPaul) .... NE stor-7301
For Service Call .... NE stor-7304

SALES & SERVICE DEALERS

CLINTON E G CO
740 Wash av N. MA in-3068
Hagen M B Realty Co
1014 Excelsior blvd Hopkins. WA lnut-0266
MEINECKE SALES CO
1937 Univ av (StPaul) . MI dway-9988

SALES DEALERS

Berry-Chase Co 1206 Harmon pl. GE neva-4643
Boutell Bros 5th & Marq av...... MA in-5421
Central Applnc & Supply Co Inc
223 E Henn. AT lantic-6559
Central Auto Sales Co
4007 Central av. GR anville-7275
Egler & Anderson Inc
1903 Central av. GR anville-4782
Electric Repr & Const Co
1021 Marq av. BR idgeport-5183
JOHNSTON BROS 3029 Nic av. CO lfax-3147
Knaeble Co 513 Plym av ...... HY land-9636
Richfield Hdwe Co 5425 Nic av.. LO cust-8813
Schuller Auto & Implmt Co
4117 W Bdway Robbinsdale. HY land-2765
VOLKENANT APPLNC STORE
1619 Plym av N HY land-9261

An Example of Dealer Identification Service as Millions of Telephone Subscribers Find It in Their Classified Directories: Brand Name, Trade Mark, Descriptive Text, and List of Local Representatives.

possible local dealer identification with brand-named and trade-marked goods and services in every community served by a classified telephone directory.

This merchandising plan was called Trade Mark Service, because it provided for an illustration of the trade-mark or distinctive insignia of the brand, with a few words of text under the directory classification descriptive of the product or service, and for the listing immediately below that of local dealers or representatives, with their addresses and telephone numbers.

In 1934, a simpler form of dealer indentification was introduced, eliminating the illustration and text but retaining the brand name under its appropriate heading. While less prominent, this junior form of the service gives the same buying information to the public and permits the local dealer handling several brands to identify himself with all of them at very moderate cost.

It is usual for manufacturers and other national advertisers to bear the expense of Dealer Identification Service under a coöperative plan with their dealers or local representatives. One of the very practical advantages of the service is that it need be purchased only in classified directories serving the communities where the product or service is obtainable. Being thus directly keyed to local distribution, dealer identification carries with it none of what advertisers know as "waste circulation."

Recording Instruments

BROWN RECORDING INSTRUMENTS—
MPLS-HONEYWELL REGULATOR
CO 2753-4th av S..........RE gent-8221

An Example of the "Junior" Form of Dealer Identification Introduced in 1934.

As originally developed, the plan did not make provision for manufacturers to purchase the service to match their distribution either nationally or sectionally, since each of the Bell Companies undertook to offer the service only in its own classified directories and to manufacturers and dealers located in its own territory. The need for some nation-wide arrangement became obvious almost immediately, and each Company then undertook to act as sales agent for any or all of the Bell Companies, so that manufacturers could sign one contract for the service in any number of classified directories serving communities where they had distribution.

As experience demonstrated the great possibilities and the wide potential scope of the service, it also disclosed the need for one central organization to carry it to its fullest development: to analyze directory "coverage" (distribution), to undertake sales plans, to carry on advertising programs, to work closely with manufacturers and their advertising agencies. Ten years ago, in 1928, the present Trade Mark Service Division of the American Telephone and Telegraph Company was organized to do these things on behalf of the Bell Companies and to arrange with manufacturers and others for the inclusion of dealer identification in the classified directories of all companies.

Experience gained through the ten years since the organization of this centralized group has proved very beneficial to advertisers, particularly those who include a definite phrase in their adverstising copy or in their radio programs referring readers or listeners to the classified telephone directories. Today such well-known advertisers as Westinghouse, Stromberg-Carlson, General Electric, DeVoe and Raynolds, Packard, Goodyear, Remington-Rand, Hewitt Rubber, Zenith Radio and dozens of others refer prospective customers to these brand names, as listed in the classified directories, for the names, addresses and telephone numbers of their nearest local outlets. Some of the insurance companies help to insure their advertising by including a "classified" reference telling prospects how and where to find the nearest agent. Such "Where To Buy It" references as the four illustrated add strength to good creative advertising copy.

This directional feature in advertising is bringing customers into the stores of local merchants and increasing the service value of the classified directories, which today are used by more than 90 per cent of all telephone subscribers to help them

PROTECT WHAT YOU HAVE

North America policyholders throughout the world, the policies of this oldest American fire and marine insurance company mean dependable protection, tried and proved for 143 years.

North America Agents may be found in the Classified Telephone Directories under the name and identifying "Eagle" emblem of this company.

not investigate this modern method of duplication? Write A. B. Dick Company, Chicago, or see classified telephone directory for the local address.

EDISON-DICK MIMEOGRAPH REG. U.S. PAT. OFF.

SEIBERLING TWO TREAD

Look for this symbol in your phone book when you want first-quality tires — sold and serviced by Seiberling independent dealers only.

NOW IS THE TIME

We invite you to use York as a yardstick of the latest and best in air conditioning and refrigeration for your business. Write for the book below. There are York Headquarters Branches and Distributors throughout the world. For one convenient to you look in the Classified Section of your phone book.

York refrigeration air conditioning

Examples of References to Dealer Identification in Classified Telephone Directories, Clipped from Advertisements in Magazines of National Circulation.

with their buying problems. Surveys from all parts of the country prove this general average usage.

One of the most difficult things to prove in the promotion and sale of any product or service is the actual results of advertising. Every advertiser, large or small, is always interested in how his printed advertising or radio program is "going to pull." Yet it is difficult to get any "yardstick" which will accurately measure advertising results. Surveys made for and by many clients have proved the results flowing from the use of Dealer Identification Service. Likewise, unsolicited testimonials of its usefulness indicate benefits to dealers, manufacturers, and the public.

The advertising manager of a well-known insurance company wanted to know the value of this service to its local agents, and asked for proof of results. A survey made among 828 agents in the forty-eight states showed that twenty-three per cent received inquiries, thirteen per cent settled claims, and twenty-one per cent secured orders from their listings under the four kinds of insurance they sell. These results were far beyond the advertiser's expectations.

A large coal company marketing a trade-marked brand of coal asked, "What results are we getting from this form of advertising?" The dealers in fourteen representative cities were personally interviewed, and again "dealer identification" proved its case. Forty per cent of the dealers reported orders, all traceable to their listings under that brand of coal in local classified directories.

A survey made by a tire manufacturer among 229 dealers (114 by personal interview and 115 by questionnaire) indicated that sixty per cent considered the service valuable, and thirty-six per cent reported sales traceable directly to their brand name listings. Yet of the 114 dealers personally interviewed, only thirty-nine per cent were primarily tire stores.

A firm of haberdashers in a southern city which believes in classified telephone directory advertising and which listed its store under a well-known brand of shirts under the classification of "Haberdashers," reports: "In one instance we know of a woman that spent $17.50 for merchandise with us." She looked in the "yellow pages" for the particular brand of shirts her husband wore, went to the store listed, and got them. Many similar statements from local dealers and from manufacturers only add to the fact that this directional service in classified directories has proved a convenience to the public, has aided merchandising, and has helped advertising to do a better job.

During this ten year period a consistent national advertising campaign has been conducted by the central organization in more than a dozen executive, sales, advertising and dealer magazines to aid in the promotion of dealer identification through classified directories. A special phase of this program has been directed to the public through four widely circulated general magazines to promote greater use of classified directories.

This national advertising program is further enhanced by a coördinated merchandising campaign whereby reprints of every "classified" advertisement are furnished to all Bell Companies for the use of their local directory advertising salesmen. They are also used as direct mailing pieces to prospective clients, and by the manufacturers themselves, who send them to their dealers and distributors to stimulate greater representation under their own trade marks in local classified directories. To supplement the national advertising campaign, the Bell Companies also carry on local classified directory advertising campaigns to increase further the usefulness and service value of every classified telephone directory.

A special feature of the national advertising campaign is the arranging of "tie-in" advertisements with clients—placing the classified directory advertisement which illustrates the client's use of dealer identification on the same page or "spread" of the magazine where the client's own advertisement appears and in which the client includes a phrase referring readers to the "classified" for the name, address, and telephone number of the nearest dealer. This definitely focusses attention on both advertisements and has proved to be a buying aid in selling.

As a result of the ten years of progress with dealer identification through classified telephone directories, the service value of "The Nation's Buying Guide" has been greatly improved. Today the number of well-known brand-name listings, together with their local outlets, is steadily increasing. Manufacturers have found that the "yellow pages" of telephone books have a definite place in advertising budgets and that dealer identification helps to direct customers to their dealers' stores. Proof of this is the fact that many concerns making several products under the same brand name are now identifying each separate product in the classified directories to match its distribution. Among those who have such multiple dealer identification in classified telephone directories are: Kelvinator with 12, Frigidaire with 6, Westinghouse with 9, General Electric with 7, Johns-Manville with 5, Remington-Rand with 12, International Business with 13, every one of which is helping people with their buying problems and at the same time making the classified telephone directory a better medium to serve the public. All of the Bell Companies have contributed to the success of this plan for bringing together buyers and sellers of branded merchandise locally, sectionally and nationally.

C. B. Smythe

Training of Plant Department Personnel

THE telephone job in the industry's pioneer years, as compared with the complexity of the job today, was a relatively simple thing, requiring little specialized knowledge and only limited skills. Equipment was simple and few special services existed. There were fewer classifications of work, men were more readily interchangeable between assignments, and —most pertinent to this discussion—men could master their work without planned training; could, in fact, learn by sheer exposure. In the early days every man started from scratch, and made his own way, often floundering, but—due to the comparative simplicity of the problem—usually succeeding in becoming a "good telephone man."

Today our national life is complex, and we are surrounded by the highly technical and complicated devices which make that civilization possible. The Bell System covers the nation with a wide variety of services "hand-tailored" to the needs of present-day living. The instrumentalities for these services are many and complicated—cable, radio, teletype, carrier, dial equipment, etc.—and the skill and technical proficiency of the men who operate and maintain this apparatus must be of a very high order.

Starting from scratch is no longer possible, and the System has grown too far to permit "growing up with the business." Floundering must be avoided, not only from the standpoint of efficiency, but because final success is virtually impossible without careful advance planning, coaching, and training. The System must therefore *make* its "good telephone man."

The handling of complex apparatus and equipment manifestly requires adequate knowledge and understanding. Installation, operation, and maintenance necessitate a high degree of specialized skills. Because the services offered by the Bell System are many and varied, and because fine precision apparatus is necessary for these services, employees with a high level of knowledge and skill are required.

This specialized knowledge and these particular skills are not available elsewhere, and it is the responsibility of the Bell System to impart them to its people within the confines of its own business. And they must be so imparted—accurately and rapidly—if the plant is to be operated with the efficiency necessary to give telephone service as it is today.

The Training Program

The formulation of training programs requires a careful analysis of the men to be trained, and of the scope of knowledge and type of skill necessary to proper performance of each job. This means a thorough study of the job itself, and a decision as to the minimum standard of accomplishment that can be accepted at any stage of the learner's progress.

Broadly considered, training may be divided into craft training and supervisory training. In the crafts, a knowledge of proper methods of performing manual manipulative work is a primary concern, together with a skill which will result in correct and reasonably rapid performance. Most of the knowledge necessary is factual and not subject to opinion, so that the educational method to be employed is naturally informational. That is, any instructional method which can present facts in such a manner that they can be properly understood and assimilated, can be used. Which of the available techniques is actually chosen is a matter of efficiency—measuring the effectiveness of the method against its cost. For example, a more rapid and effective training job can be done where an expert instructor is available and where suitable demonstration apparatus and school facilities can be used, as may be seen in the accompanying illustration of station installation training. However, if the geographical distribution of the men to be trained is such that a considerable travel expense would be involved in bringing men to a school, it may be more economical to train on the job if the longer time (which is, of course, an expense item) is more than offset by a saving in travel expense.

Craft Training

There are several types of material which must be presented, dependent on the status of the individual. The new man, and often the recently transferred one, naturally requires orientation on his new job. He must get a general picture of the nature of the telephone business and its policy, and must understand wherein his job fits with respect to the main objectives of the business. He must also be given enough technical knowledge to understand the operations he is to perform, and must acquire sufficient skill to be able to perform these operations with safety to himself and to the service, after which he may proceed on actual productive work, acquiring more skill and the additional knowledge that comes from experience.

Those men who have passed the first stage, or initiation period, will require additional training as they progress to more and more difficult parts of the work, and as they are given more complete responsibility for planning and deciding questions which involve some judgment.

Even the older men who have attained top rank in their crafts may need occasional retraining on specific points where, either because their assignments may include a given point but seldom (as in the case of installation of special equipment, such as amplifying devices for persons with impaired hearing) or because (as may be true in such common operations as soldering) their former knowledge may have been forgotten or their skill become rusty.

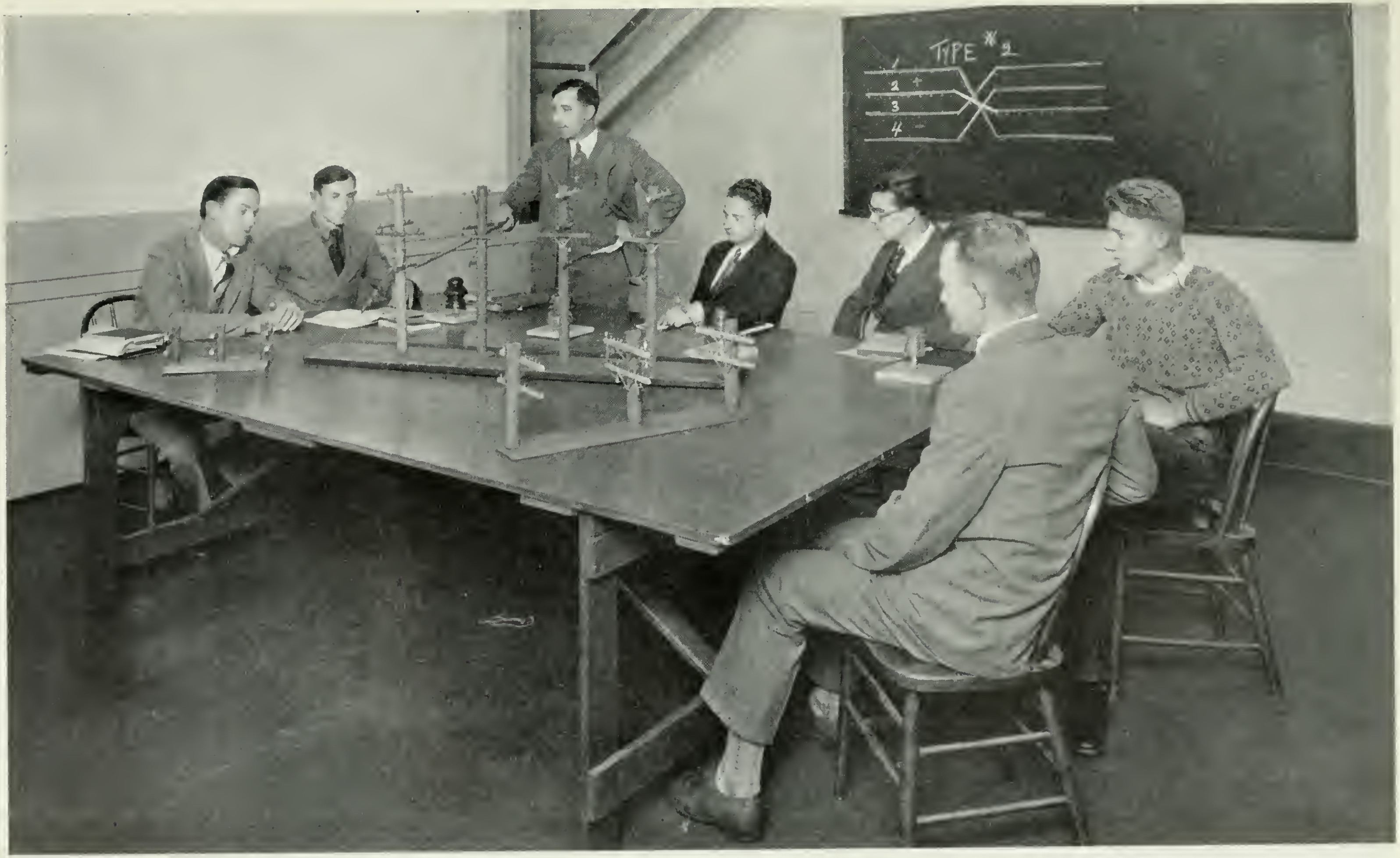
All of the men must be kept abreast of advances in the telephone art. As new equipment and improved methods are introduced, it is essential that the men who are to use this equipment and follow these methods be properly instructed. In the Bell System this is a very considerable part of the training work, applying in times of expansion and depression alike.

Supervisory Training

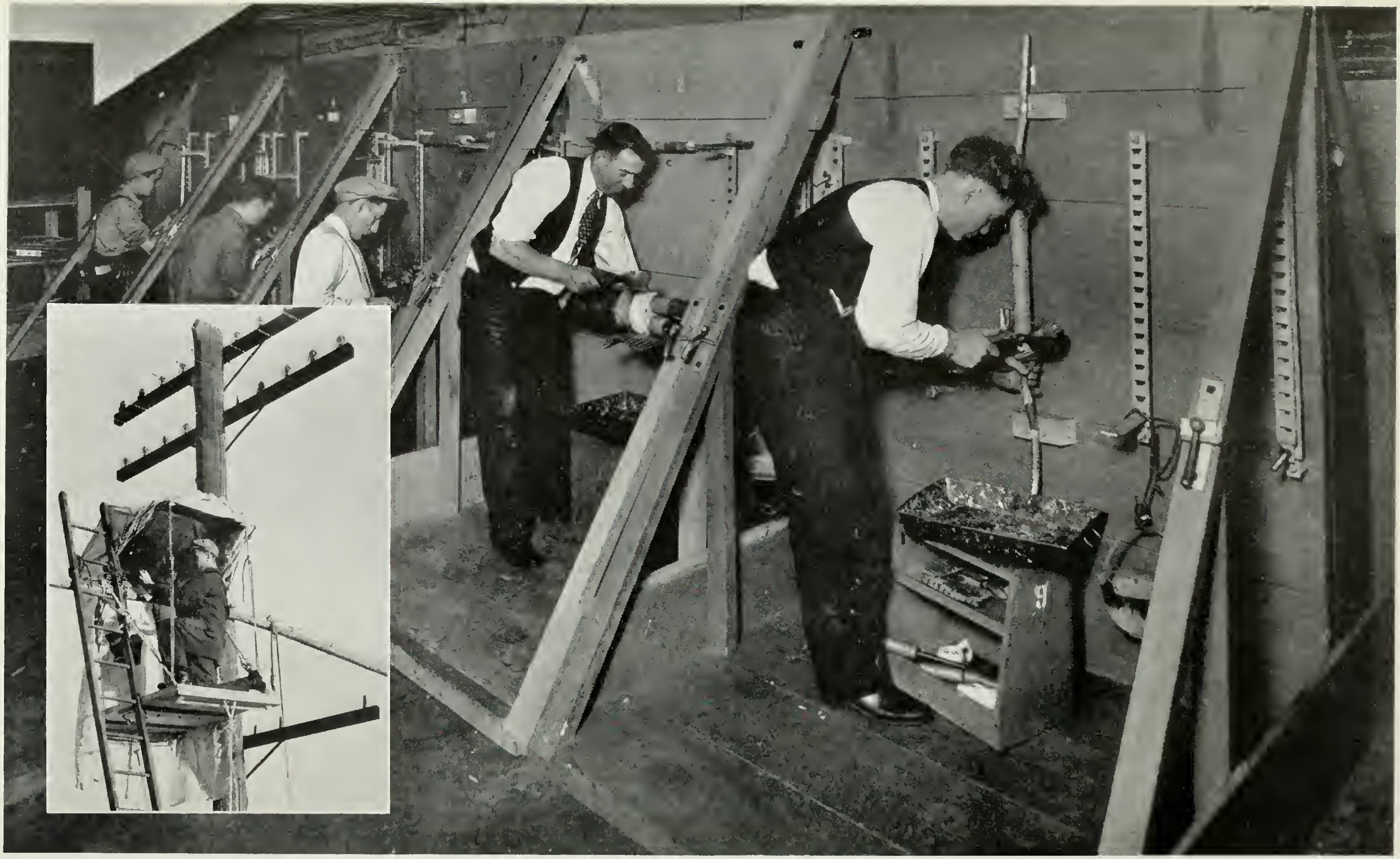
With the foremen and other supervisory people, training must be designed to inculcate judgment and reasoning ability, since these men have the responsibility for making independent decisions, and cannot function by rule and rote. The training procedure must therefore be developmental rather than informational. That is, the training approach is not to present conclusions as to the proper functioning of a supervisor, but to present cases and data for consideration, and then to assist him through a process of reasoning which will bring him, step by step, to the logical conclusion based on the data, so that in fact he makes his own decision.

At different levels the scope of this training and its manner of application may be different, though the principle remains the same. The men under a foreman ordinarily are of the same craft, which is almost always the craft in which the foreman made his mark as a workman. He must, of course, be kept up to date in the work of this craft, through a process of training virtually identical with that used with the workmen themselves. In addition, he has certain chores of his own—the preparation of reports, making of inspections, etc.—where the informational approach can best be used. But his chief responsibility is as a leader of men: planning their work, maintaining their morale, safeguarding them, and insuring that the quantity and quality of their work is up to standard.

As consideration is given to the higher levels in the organization, a broadening of the variety of work supervised is found and a lesser requirement for an intimate meticulous knowledge of the craft operations. At the same time, the responsibilities for good leadership become heavier, and the importance of each decision greater as more men are affected by these judgments.

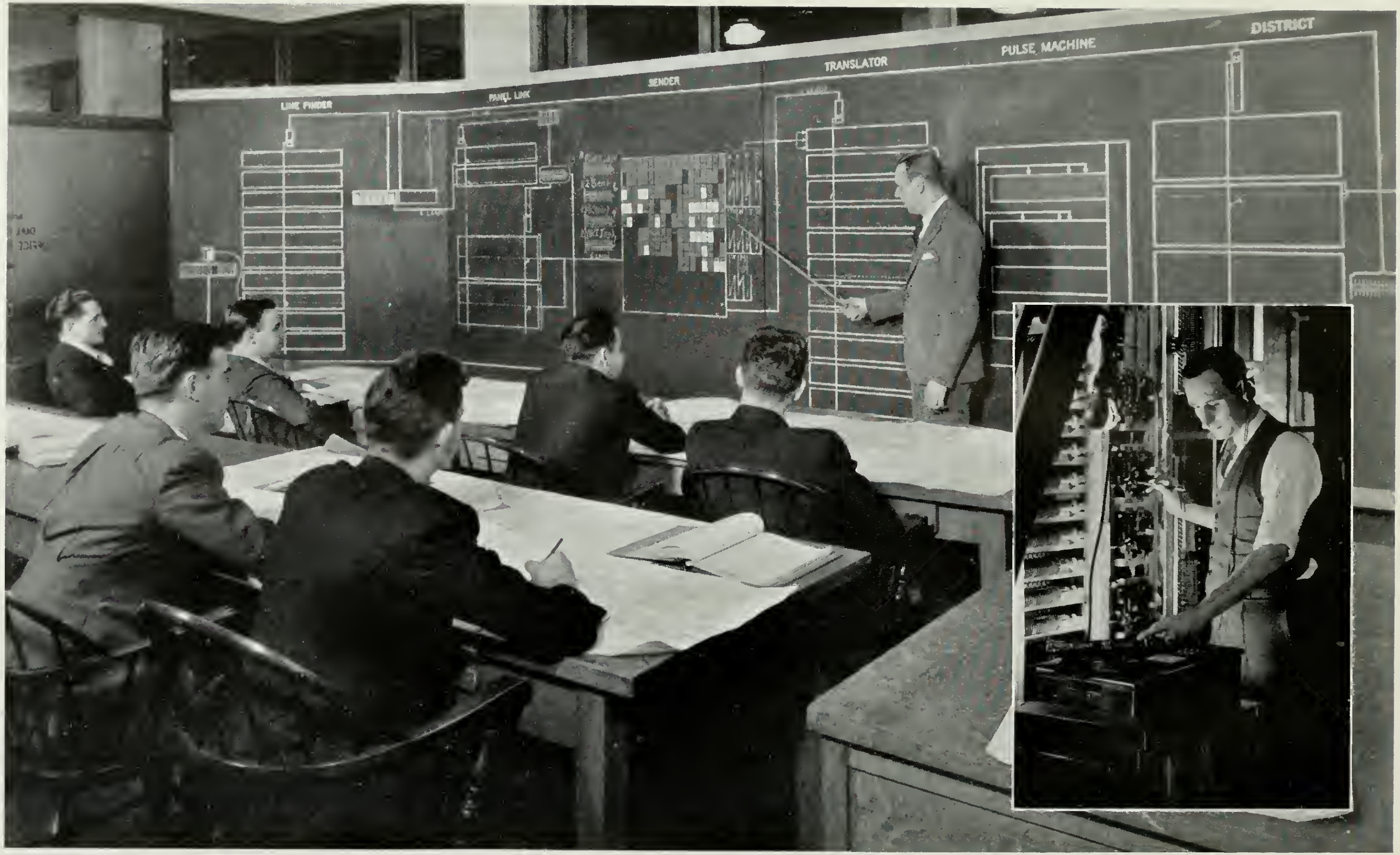


Some of the 10,000 Men in the Construction Force Are Learning from Working Models Which Illustrate How "Transpositions" Are Made.



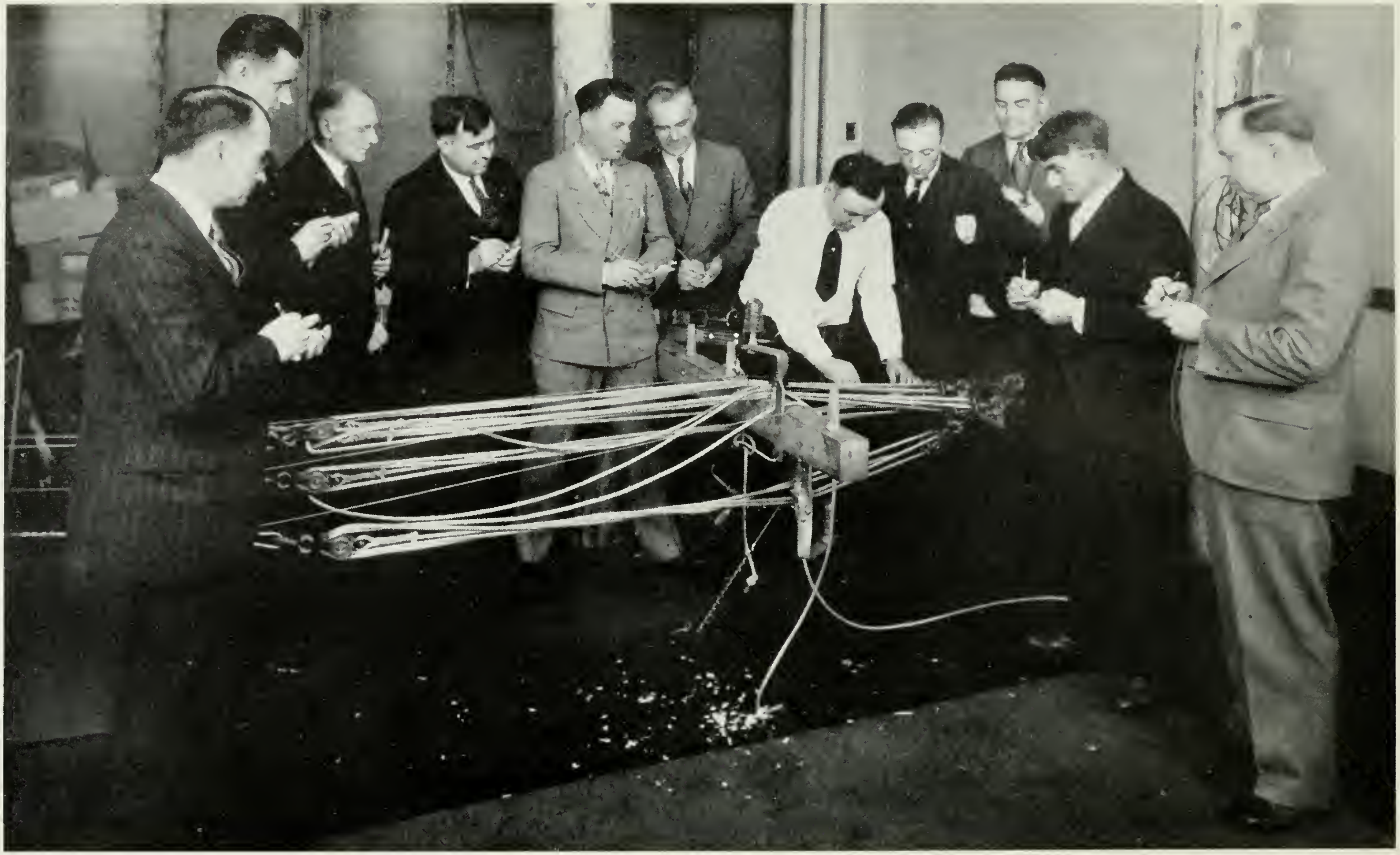
A School for Cable Splicers. There Are About 6,500 Men in the System's Splicing Force Who Need This Knowledge and Skill.
Insert: Splicer at Work on Aerial Cable.

It Takes a Force of 23,000 to Install and Maintain Bell System Telephones. The Men Shown Here Are Studying the Recently Introduced "Anti-side-tone" Equipment. Insert: The Installer Puts in Another Telephone and Meets the Newest Customer.



THERE ARE 15,000 MEN WHO CARE FOR THE EQUIPMENT IN TELEPHONE CENTRAL OFFICES. SHOWN HERE IS A SCHOOL WHERE SOME OF THESE MEN ARE TRAINED ON PANEL DIAL APPARATUS. INSERT: APPLYING THIS KNOWLEDGE ON THE JOB.

Some of the 6,000 Test-desk Men Learning Their Work by Seeing and Hearing. The Instructor Is Acting as the Customer in a Simulated Case of Trouble. Insert: Working at a Test Desk.



About 7,500 Supervisors Are Required in the Plant Department. This Group Is Receiving Training as Instructors, One Man Acting as Teacher and Another as Student, While the Others Make Notes on the Teaching Method Used.

Therefore, training efforts are almost entirely developmental in the higher supervisory levels.

The Informational Method

The problem, then, is to consider craftsmen at various stages of development, and supervisors at various levels in the organization. And there is available a choice of informational and developmental training methods.

As previously mentioned, the two major means of giving informational training are the plant school and so-called on-the-job instruction. The plant school permits of certain efficiencies, in that special apparatus need not be duplicated, that outstanding instructor talent can be concentrated, and that attention can be given wholly to the needs of the student. The training material can be presented easily in a sequence based on the difficulty of learning rather than in the sequence in which the job must be performed. As a general example, in actual practice one cannot fly an airplane until it has been taken off the ground, yet intelligent teaching would cover straight and level flying before "take-offs."

On-the-job training saves travel time and time off the job, but is restricted by the limitations of the job then in progress, by the necessity for guarding against harmful effects on the service, and by the fact that the local foreman must serve as instructor. With the latter point in mind, a program of instructor-training for foremen has been carried out.

In practice, both of these methods are used, the choice being dependent upon the economics of the situation; often, in fact, a student alternates between school and job, getting from each that which it is best fitted to give.

The Developmental Method

Perhaps the most important part of the training of a supervisor lies in a carefully conceived series of experience assignments which will give him the proper background for his job.

Given this background, it is still necessary for the supervisor to learn to evaluate his experience properly. Lacking complete experience, the experience of others must be made available to him, usually in the form of typical cases; and again he must learn to evaluate.

Developmental training is fundamentally a means of teaching how to evaluate experience. It pre-supposes an adequate background of actual experience or provides something in the nature of synthetic experience.

The ability to analyze and weigh either his own experience or that of others is acquired by the supervisor through a recognition of the factors involved and by practice in logical reasoning. It is the function of developmental training to give—or rather to improve—the individual supervisor's performance along these lines. The usual technique is that which has been variously known as the conference method, the discussion process, or simply as the developmental approach.

Conferences, in this sense, are discussions conducted in such a way that the supervisors who are members of the group contribute virtually all of the data and ideas, and reach unanimous conclusions which are definitely their own considered beliefs. The function of the leader is to confine the discussion to the subject in hand, and to see that all of the data are brought out in the discussion so that the logical conclusion will be reached. To do this, a rather extraordinary degree of skill is needed by the leader. For this reason, conference leaders have been given rigorous and extended training in the understanding and use of the necessary technique.

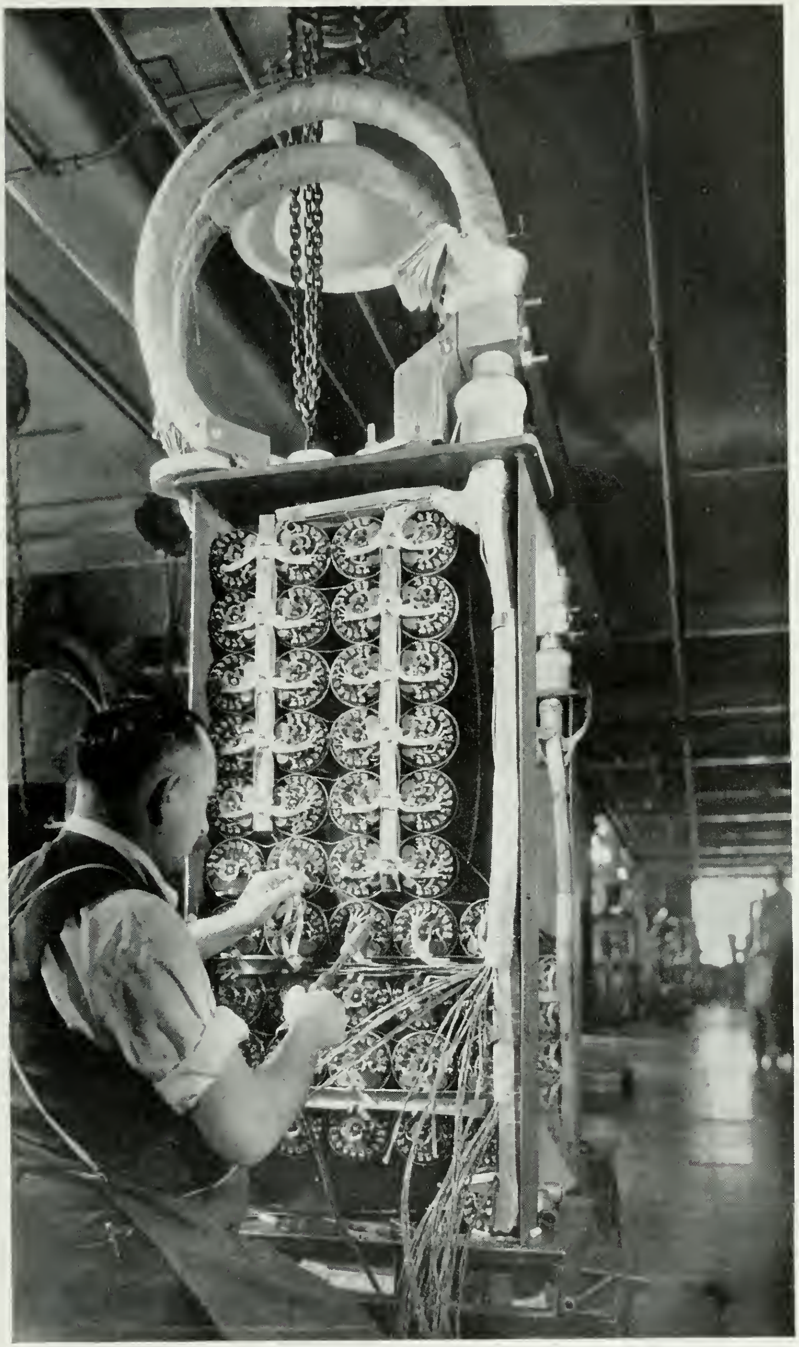
In addition to these more formal conferences, many meetings are held between adjacent levels of supervision in connection with the routine conduct of the business. Recently some progress has been made in training higher supervision in the use of the conference technique, so that these men may use this as a teaching vehicle, both in group discussions and in individual dealings with their immediate subordinates. This might be likened to the on-the-job phase of craft instruction, whereas the formal conferences are similar to plant school teaching.

The Objective

Thus the gamut of training is run: men at various stages of progress, with jobs of differing degrees of difficulty, and with great or small responsibilities. Training at centralized schools or widely distributed as the telephone work itself must be distributed. Training informative only, and training designed to stimulate the inner growth of the individual. But throughout this variegated pattern runs one common thread: the determination so to select training material, so to time training courses, and so to select and apply training methods that the Bell System may serve the nation successfully in these days of complexity and change as it did in the simpler days gone by —by virtue of the "good telephone man."

C. T. Schrage

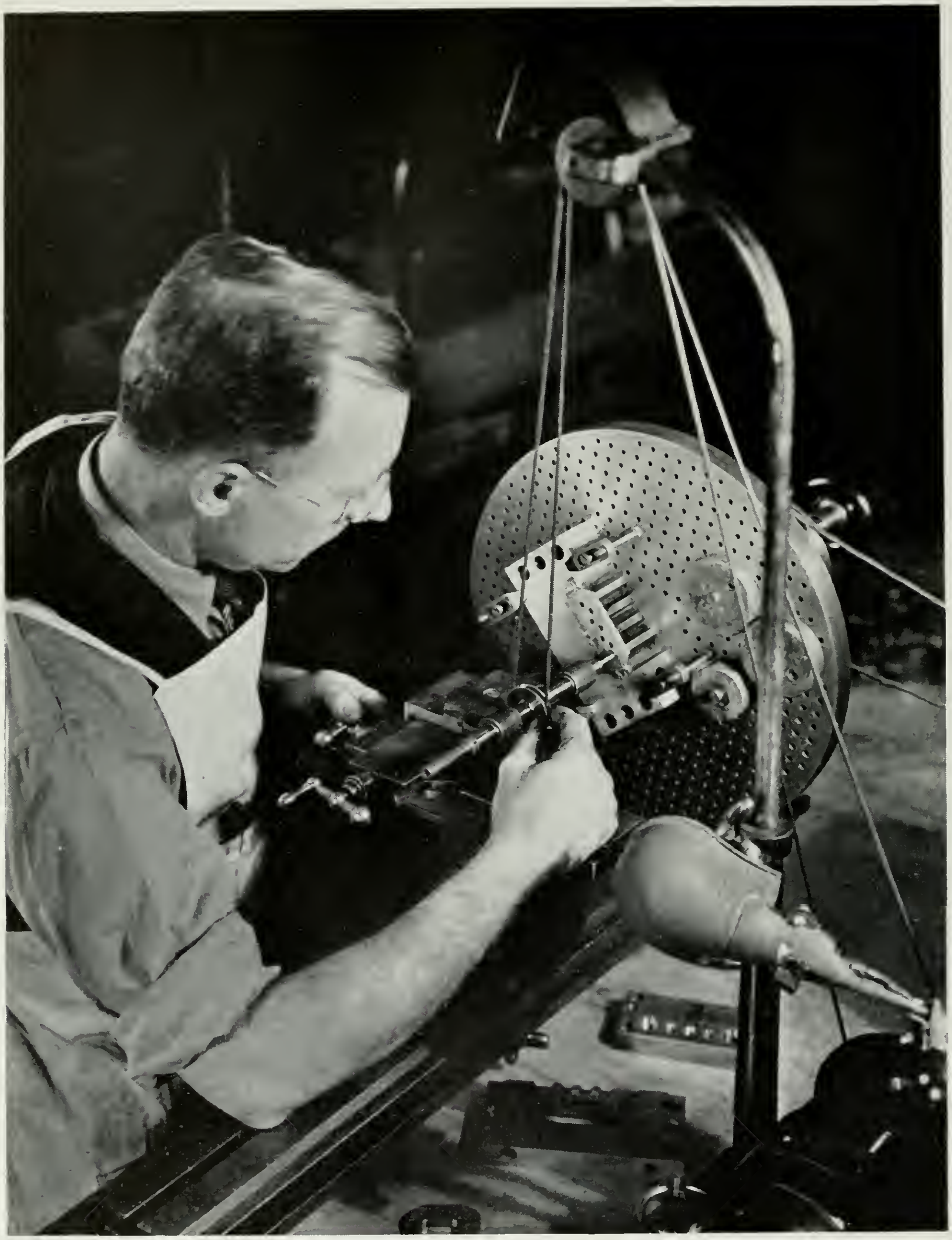
This set tests 204 connections on a cable terminal. Placed upon the elevator in the set, the cable terminal is lowered until it makes the proper contacts within the set. By throwing a switch on the panel, the operator starts a sequence of electrical tests which show up defects in insulation or wiring.



Assembling loading coils in the case. Before the loading coil was invented, the longest satisfactory telephone circuit was about 35 miles. Today, using loading coils to tune out distortion and repeaters to boost the current, your trans-continental telephone call is as perfect as a call to your next door neighbor.

This gleaming, molten billet is lifted red hot from its mould by the electric chain hoist. This is one of the processes in reclaiming used metals and returning them to the telephone plant again, in this particular case as bronze drop wire which will be made from the billet.

Flame from the bunsen burner plays upon the glass envelope of a vacuum tube, preventing too rapid cooling after the glass has been sealed. Under the watchful eye of the expert, the tube is gently nursed to keep it from cracking.



Grinding holes in hardened dies to correct distortion caused by heat treating is a delicate job. After the grinding operation, the holes will be in correct relationship to each other within .0002 inch, or one fifteenth of the diameter of a human hair.

Telephone cords get their finishing touches. The punch press operator is putting terminals and metal supporting bands on the cords.

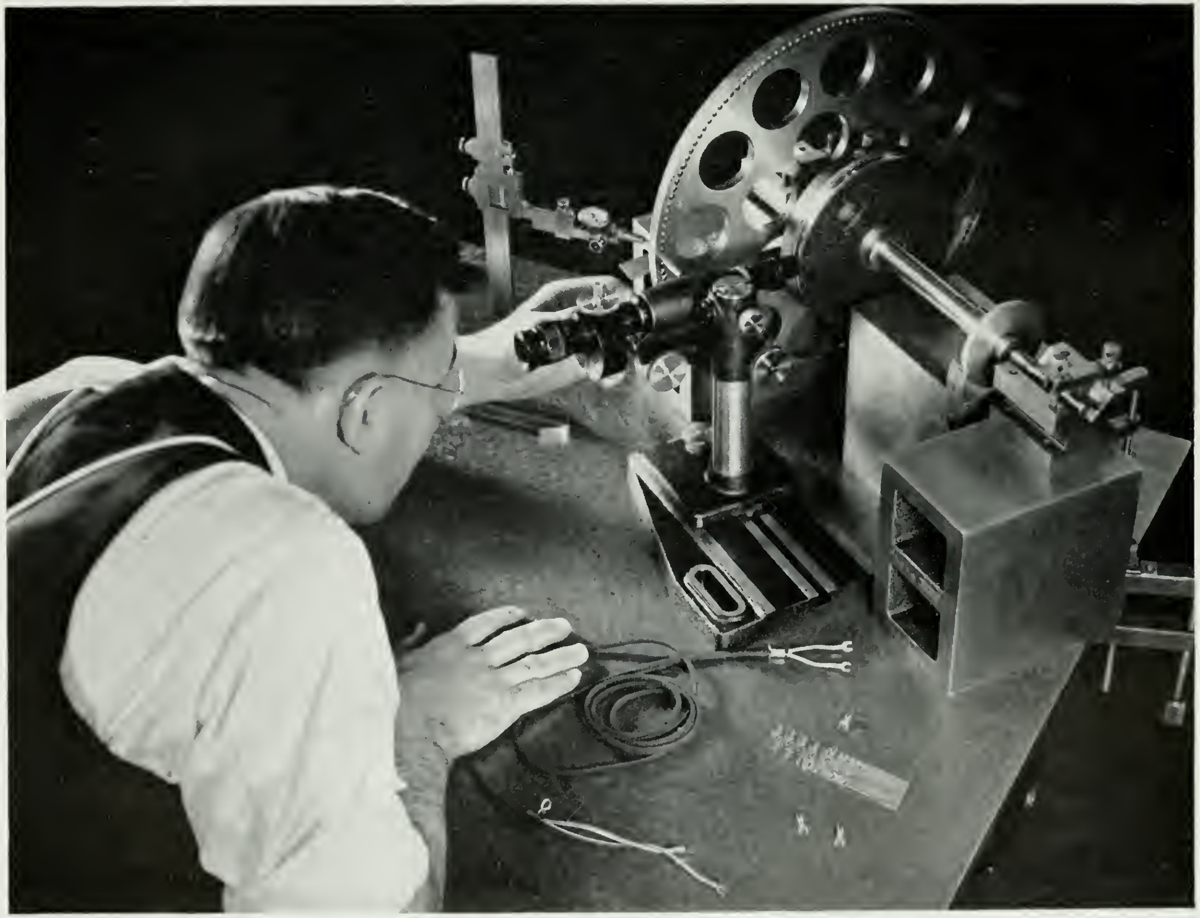
Under the sure touch of the craftsman, this bewildering maze of wire will shortly be converted into a neat and orderly bay of relay rack in a central office, with every last wire soldered to its correct terminal.

Adjusting clutches on friction roll drives on panel dial exchange equipment. These drives move the selector rods which make the desired connections.

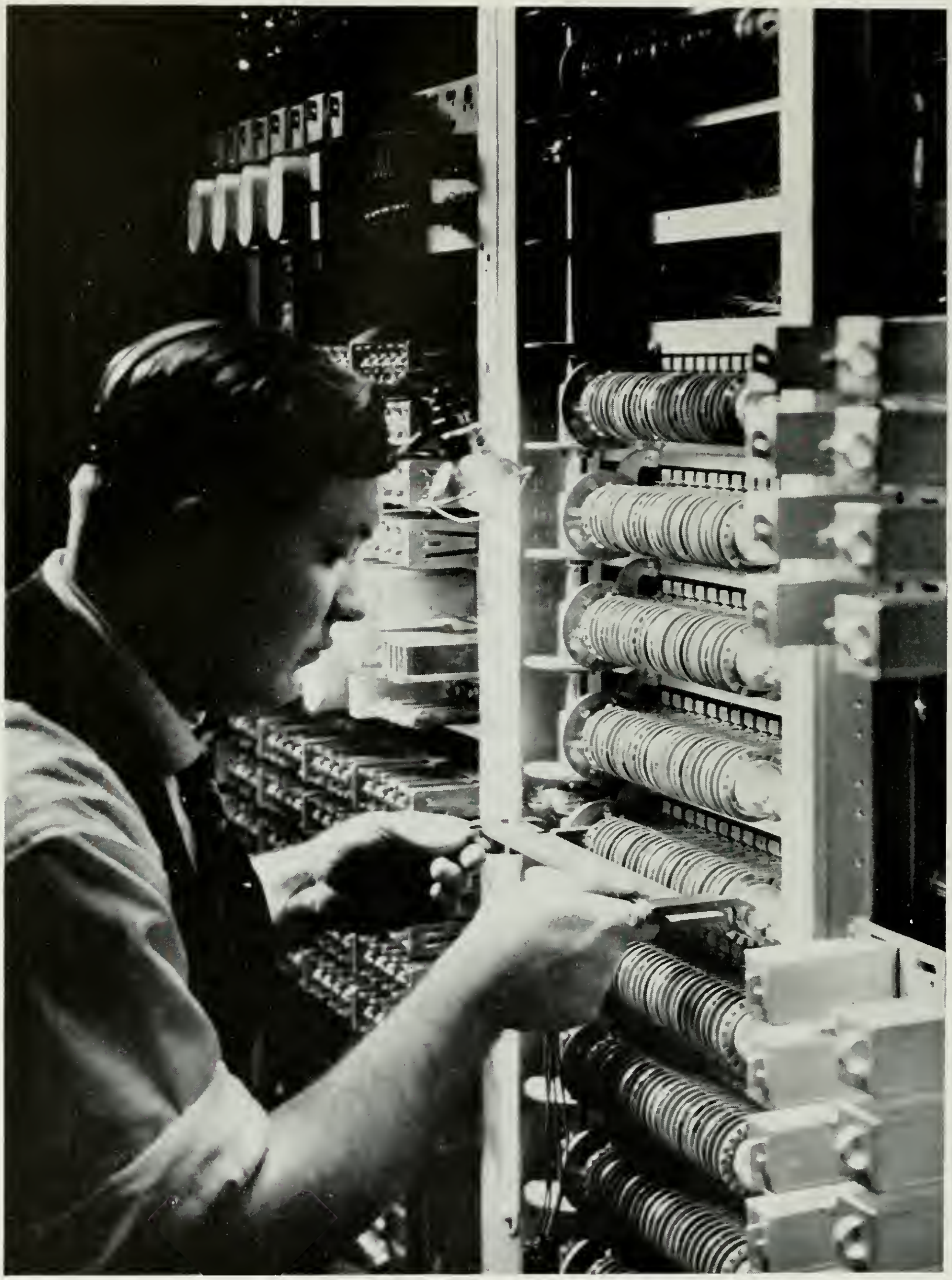
Mounted on a device similar to a lathe, the glass tube and the copper band spin swiftly before the gas flame and finally form a perfectly sealed joint. Thus a water-cooled type of transmitting tube gets its copper collar.

As wire used in telephone circuits must be of uniform diameter, certain sizes are drawn through holes pierced in a series of diamonds until the exact dimension is obtained. The machine shown here drills and shapes the holes in the diamonds. The diamond dies are produced with an exactness of one fortieth of the thickness of a human hair.

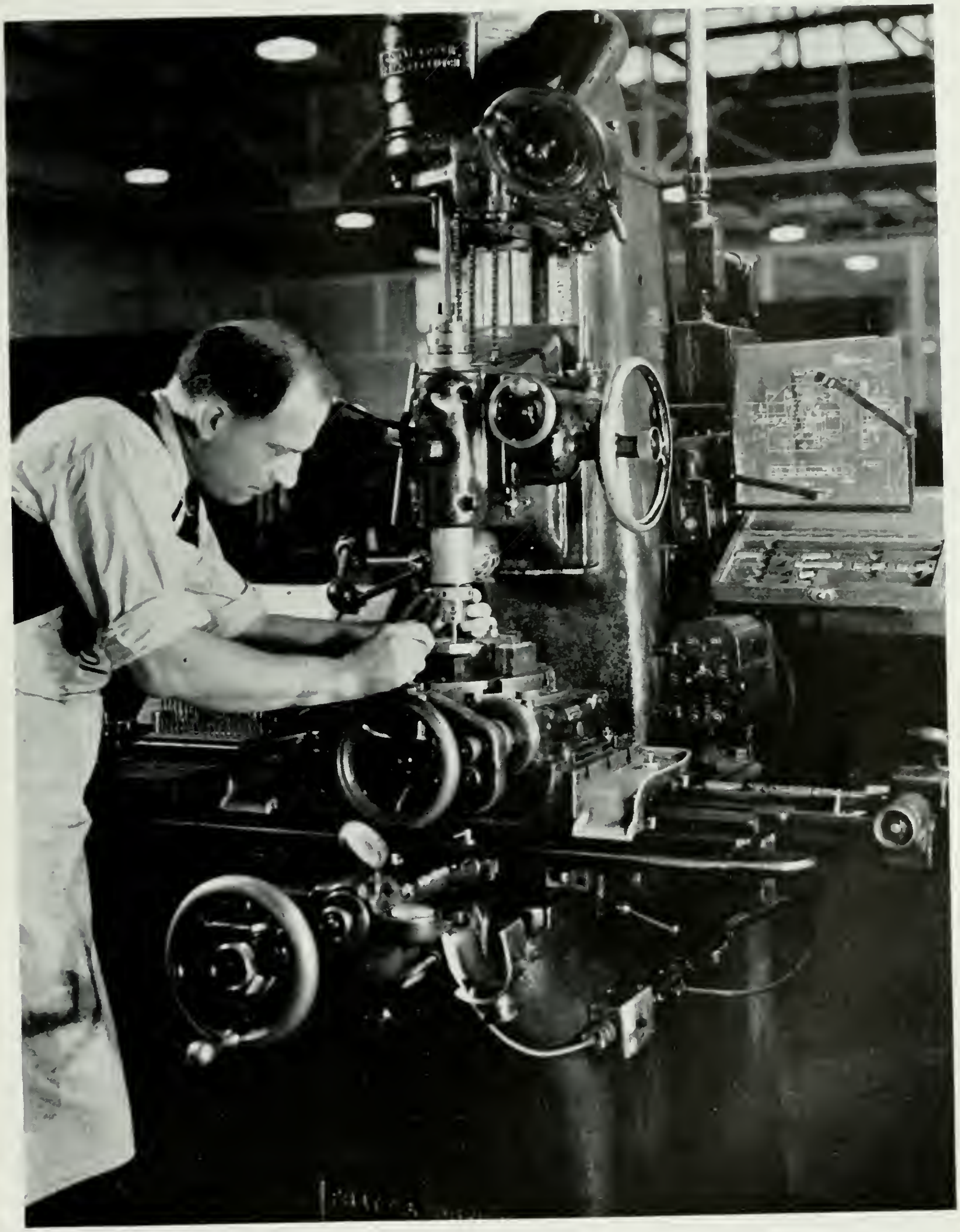
After this skilled worker determines the exact axis of the glistening Brazilian quartz crystals on the table before him, diamond-studded saws will slice the crystals into slabs to be ground to the proper size. Used in filters, making it possible to hold a number of telephone conversations over the same wire at the same time, the crystals in many cases must be accurate to within one fifty-thousandth of an inch in thickness and one one-hundred-thousandth of an inch in length.



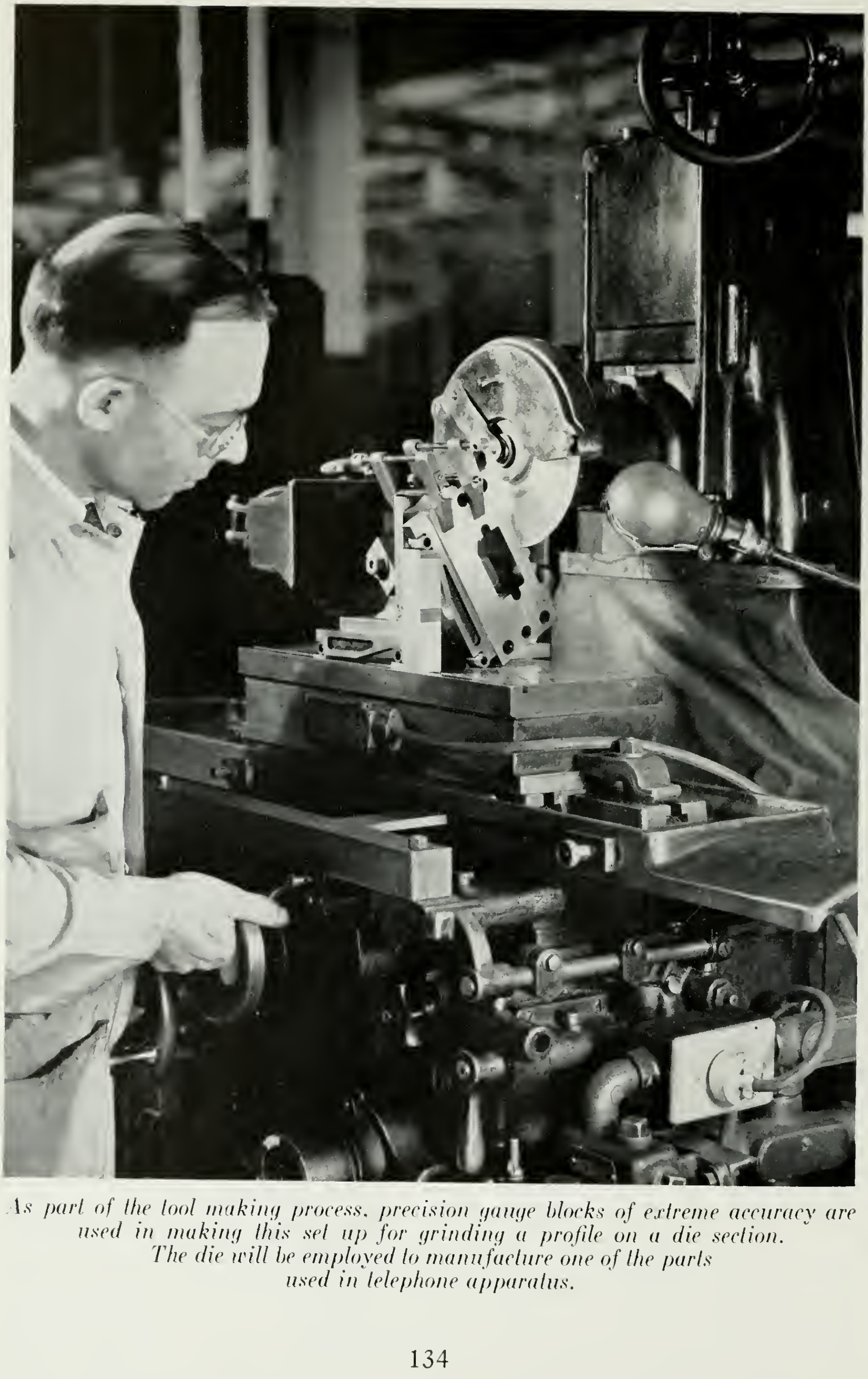
By peering through a Zeiss optical tester at the master plate having accurately located holes, this inspector is able to determine the accuracy of the ratchet wheel shown mounted near the right end of the shaft. The ratchet will be used as part of a device for stamping out solderless cord terminals.



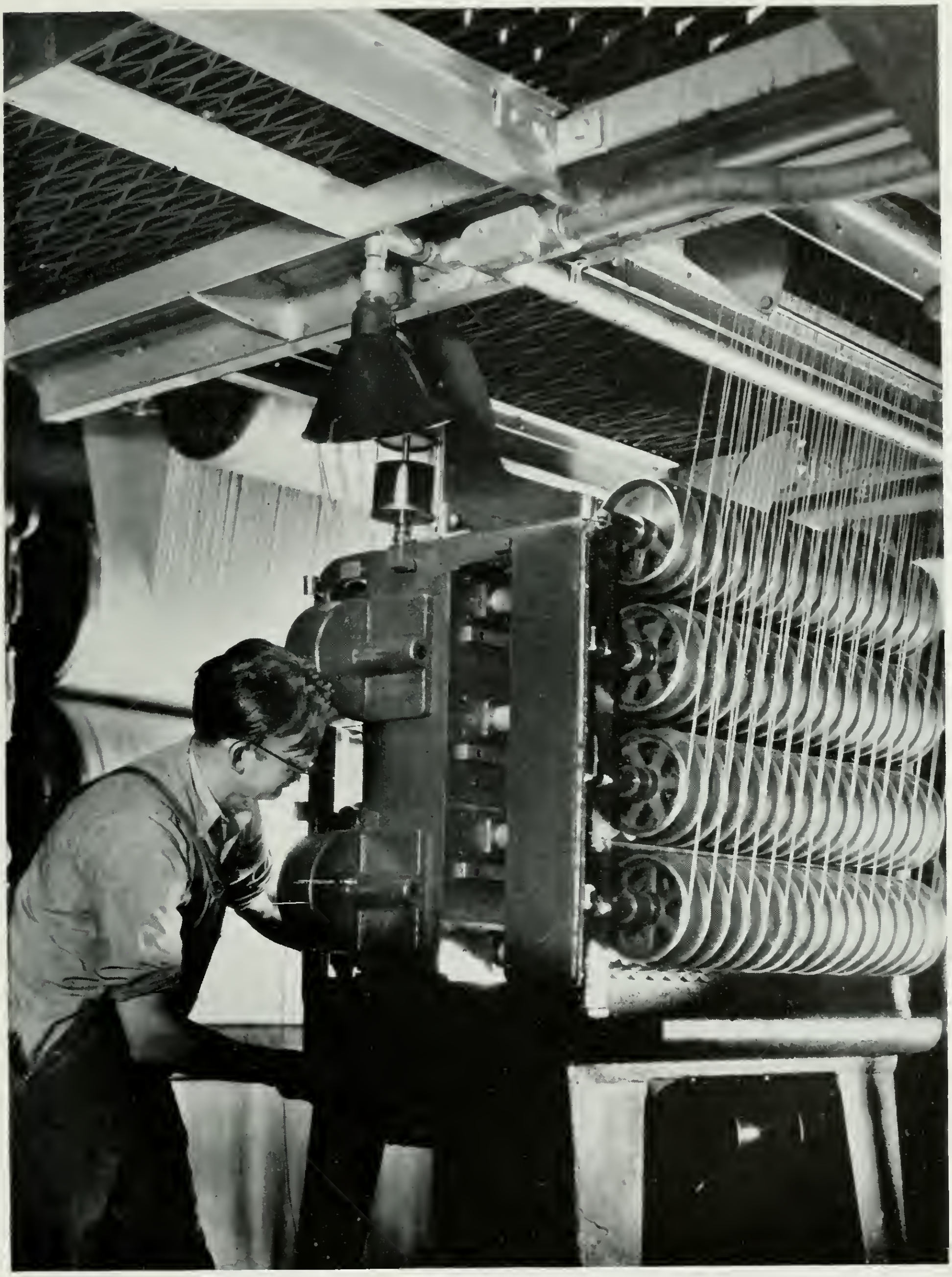
Checking up on the versatile sequence switch. This interesting device, which plays a prominent role in the panel dial exchange equipment, can accommodate as many as 24 cams with four brushes to each cam, so there may be 96 separate wire connections to a switch.



As the facilities with which Western Electric manufactures equipment must be of the highest accuracy, the machines required to build these facilities must be, if anything, even more precise. This jig borer, used in the tool and machine construction departments, works with an accuracy of one ten-thousandth of an inch.



As part of the tool making process, precision gauge blocks of extreme accuracy are used in making this set up for grinding a profile on a die section. The die will be employed to manufacture one of the parts used in telephone apparatus.



This is the polishing unit of a paper-pulp insulating machine, a machine which makes it possible to form a coating of wood pulp right on the copper wire as its insulation. The machine applies pulp on sixty wires at once and replaces the old process of wrapping individual wires with paper ribbon.

Detecting what the human eye cannot observe—the electrical values of telephone cable. This testing equipment determines whether the resistance and capacitance of representative pairs of conductors meet their specified requirements.

Before being sealed and shipped from the factory, this large toll cable is inspected for electrical properties, which are important for proper transmission of telephone messages. The inspector here connects one pair of conductors at a time to leads from the testing apparatus, enabling another inspector located a short distance away to make the necessary measurements.

Notes on Recent Occurrences

BANCROFT GHERARDI RETIRES AS A. T. & T. VICE PRESIDENT AND CHIEF ENGINEER AFTER A DISTINGUISHED CAREER OF 43 YEARS OF BELL SYSTEM SERVICE

NEARLY 600 men and women of the Department of Operation and Engineering of the American Telephone and Telegraph Company gathered on April 21 to do honor to Bancroft Gherardi, Vice President and Chief Engineer, retiring at the end of the month after 43 years of notable service to the telephone industry and a career which brought wide recognition of his achievements both within and outside the Bell System. He was presented with a Washington desk and chair, and with a choicely bound volume which bears a message of tribute and the signatures of all present and many former members of his Department.

Prefacing the book of signatures of all the members of his Department, which was presented to Mr. Gherardi on their behalf by Miss Louise Barbour, of the Traffic Division, is this inscription:

> "Bancroft Gherardi:
>
> "On the occasion of your retirement as Vice President and Chief Engineer of the American Telephone and Telegraph Company, the members of the Department of Operation and Engineering have gathered to express regard and esteem for your inspiring leadership and your distinguished career.
>
> "You have been a vital force in the remarkable development and growth of the communications indus-

try during 43 years of Bell System service and we honor you for your outstanding achievements.

"We individually wish you health and happiness in the years to come."

In presenting the desk and chair to Mr. Gherardi, B. S. Stevens, Engineer in the Plant Engineering Division, took occasion to review some of the outstanding features of Mr. Gherardi's distinguished career. He said:

"Under the continuous leadership of Bancroft Gherardi, the Department of Operation and Engineering has become a vital force in the forward progress of the Bell System. In this progress of the largest private business enterprise in the world we, in this department, have felt the inspiration of orderly accomplishment of our individual parts. We know that this has been greatly due to the guidance of a man with unsurpassed background of sheer telephone ability fired by honest zeal and tempered by broad human sympathies which have won him our esteem. It is this feeling of esteem which prompts our congratulations to him on his well earned right to whatever leisure he may choose.

"Whatever his choice, it is safe to predict that anything he may say or do about the art of electrical communication will further its advancement. His record of 43 years of active participation and leadership in this advancement spans the period of development in this country from about 300,000 to more than 19,000,000 telephones. It reaches back to the time when telephone subscribers cranked their hand generators and a 1000-mile connection from New York to Chicago was truly long distance. It has come down to this day when metropolitan dial systems are commonplace and when a telephone conversation around the world via wire and radio has actually taken place.

"Throughout this period of rapid evolution in the communication art, nothing has stood out more than the successful organization of the technical forces in all the branches of business activity involved. In the direction of this organization work the record of Bancroft Gherardi has been outstanding and can be visualized only in part by a brief recital of some of the events in his career.

"In 1895, with the Degrees of B.S. from the Brooklyn Polytechnic Institute, M.E. from Cornell, and a Post Graduate M.M.E. also from Cornell, at the age of 22 Bancroft Gherardi started his telephone career testing some of the relatively few telephone cables in the area now operated by the New York Telephone Company. Telephone authorities in New York and New Jersey thought well of this young man's work in traffic as well as plant engineering, and in 11 years, five of them spent as Traffic Engineer of the New York Company, he became Assistant Chief Engineer of both Companies.

"About a year later, when Mr. Vail, just after becoming President of the American Telephone and Telegraph Company for the second time, set about developing a strong headquarters staff in New York, he moved promptly to bring about the selection of the right man for the important job of Engineer of Building and Central Office Equipment. The right man was Bancroft Gherardi, who has completely justified the foresight of his selection.

"Three years later it became clear that Plant Engineering in the Bell System should benefit if guided by one man. Bancroft Gherardi was the man, and he served nine years as Engineer of Plant in charge of Plant Development and Standardization for the Bell System. His record on that job, during which he directed such accomplishments as the Boston-Washington underground cable and the first trans-continental telephone line, made him the logical choice for Chief Engineer.

"Two years later, with the development and research activities of the System separately organized, it was recognized that advantages should result from focusing responsibility for those activities of the A. T. and T. general staff relating to the engineering and operating technique of the Bell System. The logical focus for this responsibility was Bancroft Gherardi, and he became Vice President and Chief Engineer in charge of the Department of Operation and Engineering of this Company.

"We know Mr. Gherardi's record as the head of this department. We know of his great personal influence in his relationships with all of the field and staff leaders in the Bell System. We know that he has played a great part in establishing good relations with the power companies whose network of lines parallel the telephone lines so extensively in this country.

"Perhaps some of us are not so familiar with his other related activities which have caused engineers and scientists in other walks to enlist his aid and to do him honor; for instance, we have just referred to his relations with the power companies. In this he led in the formation of the Joint General Committee of the Edison Electric Institute and the Bell System, and is Bell System Chairman of that Committee. He is also Bell System Chairman of the Joint General Committee of the Association of American Railroads and the Bell System, which is concerned with similar problems.

"In the A. I. E. E. Mr. Gherardi has been a manager, Vice President, and was President during 1927 and 1928. He has served on such Committees as the Executive, the Edison Medal, the Finance, the Headquarters, the Public Policy, the Research, and the Constitution Revision. He has represented the Institute upon the Board of Trustees of the United Engineering Trustees, Incorporated, the Library Board, the National Research Council, the United States National Committee of the International Electrotechnical Commission, the John Fritz Medal Board of Award, and other bodies. He served as President of the United Engineering Trustees and as Chairman of the John Fritz Medal Board. During his association with the A. I. E. E. he has been the author of many important contributions included in their transactions.

"Let us just mention some other jobs which have occupied part of his leisure time:

> Trustee of Cornell University
> President of the American Standards Association
> Representative of the Bell System in charge of Relations with the International Advisory Committee on Telephony
> Chairman of the Engineering Section of the National Academy of Sciences.

"Some of his honors should be mentioned also, such as Honorary Degrees of Doctor of Engineering from the Brooklyn Polytechnic Institute and from the Worcester Polytechnic Institute, and the emblem of the Fourth Order of the Rising Sun, which was conferred upon him by the Emperor of Japan. In 1932 the American Institute of Electrical Engineers awarded the Edison Medal for that year to Bancroft Gherardi 'for his contributions to the art of telephone engineering and the development of electrical communication.' Quoting from the Institute's announcement of this award:

> 'His broad vision as to the place of communication not only in the affairs of the people of the United States but also in world affairs, and his initiative and skill in the development of engineering and operating organizations and in the development of the art generally, have contributed enormously to the growth and success of present day communication.'

"Mr. Gherardi, it seems to us that with this record behind you, you may wish as the spirit moves you in the future to express yourself in writing now and then. If this should be so, it would please this group of people to have you accept for such use a desk and chair of a type favored by the first President of this country, who was a great engineer and who exemplified many of the qualities which we have found in your leadership of our work."

WILLIAM H. HARRISON ELECTED VICE PRESIDENT AND CHIEF ENGINEER OF A. T. & T. CO.

WILLIAM H. HARRISON, who was elected on April 20 to succeed Bancroft Gherardi as Vice President and Chief Engineer of the A. T. & T. Co., was born on June 11, 1892, in Brooklyn, N. Y., and after graduating from high school in 1909, he obtained a position with the New York Telephone Company as a repairman. In 1911 he was transferred to the repair shop, where he was engaged in apparatus inspection, assembly, etc. On December 4, 1914, he became associated with the Engineering Department of the Western Electric Company and was assigned to circuit design work. During a portion of this time he was also a student at Pratt Institute, Brooklyn, where he was graduated in 1915 in Industrial Electrical Engineering.

In 1918 Mr. Harrison became associated with the American Telephone and Telegraph Company in the Engineering Department. This department was divided in 1919 into two groups, one concerned with problems of operation and engineering and the other concerned with problems of development and research. Mr. Harrison became identified with the first group, and in 1924 was appointed Equipment and Building Engineer. Four years later, on December 24, 1928, he became Acting Plant Engineer, and on October 1, 1929, he was appointed Plant Engineer. In 1933 he was elected Vice President in charge of Operations of The Bell Telephone Company of Pennsylvania and The Diamond State Telephone Company, assuming his new post on April 1 of that year. A few months later he was elected a Director of The Bell Telephone Company of Pennsylvania and appointed a member of the Executive

Committee of the Board of Directors. A similar election and appointment were made shortly thereafter with The Diamond State Telephone Company. On February 1, 1937, he was appointed Assistant Vice President in the Department of Operation and Engineering of the American Telephone and Telegraph Company, succeeding K. W. Waterson.

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and a Record of Progress

CONTENTS FOR JULY 1938

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Customers and Service

These remarks by W. H. Harrison, Vice President and Chief Engineer of the American Telephone and Telegraph Company, were made before the Sixth Annual Convention of the Edison Electric Institute, held at Atlantic City, N. J., June 6–9, 1938

IN these perplexing times it is satisfying to talk about service, because it is the one phase of the management job that pays returns substantially in proportion to the effort extended. The appreciation and rewards from service activities sustain enthusiasm, nourish idealism, provide stimulation.

It is this stimulation which makes me brash enough to be eager to present a discussion of service before you men who have demonstrated such high service ideals and have achieved such distinction toward service perfection. I say this with assurance, for it has been my good fortune in connection with the work of the American Institute of Electrical Engineers to see something of your activities—to observe the spirit of progress, of service, of enthusiasm for the job you have to do and the eagerness to find better ways of doing it.

I presume the day-to-day customer relationships—right-of-way, construction, installation, maintenance, repair, arrangement for new or changes in service, billing and collections, and so on—in the light and power field present many of the considerations with which we in the communications field must deal. With this similarity, it is not far afield to tell you something of our approach to the service situation. Forgive me if in this I seem much too much "Bell System"; for in a discussion like this, brevity transcends modesty.

Broadly speaking, service, good or bad, is the product of instrumentalities and of the organized effort and will of the personnel. One must complement the other. This is desirable in any business, but is essential in ours, where each transaction is a personal one.

Of course, good communication service would be impossible without adequate instrumentalities; and notwithstanding the really fantastic advances in ease of conversation, clarity of transmission, greater reliability, the conquest of distance—all the result of intensive and continuing search for new and improved instrumentalities—it is not my purpose to discuss the influence of these on present-day service.

I do want to say, however, that never has there been a period so productive as the present of better facilities directly involving the customer. With distance no longer a challenge, with world-wide telephony a reality, full emphasis is toward perfection in established fields. For example, present-day voice transmission systems reproduce the voice so faithfully that difficulty in understanding arises in only about two to three calls in a thousand. Similarly, present-day mechanical switching systems, with a myriad of separate connections, are capable of completing millions of calls per day with but a fraction of one per cent affected by faults in the equipment. New transmission systems permit many conversations to be held over a single pair of wires. The latest of these, employing two wires each surrounded by a tubular shield no larger than your little finger, holds promise of transmitting a frequency band of two or three million cycles, thus providing several hundred circuits, each of high quality, for the transmission of speech, or perhaps two circuits covering the entire range for television.

But all of this is an intriguing story by itself and is one that could well be related to the creation and perfection of instrumentalities in other industries, and especially so in the light and power field. For here technical and theoretical genius has been so effectively combined with genius for adaptation and application as to gain the admiration and respect of the scientific world.

I think the broad aspect of service which would be of most interest to you is that having to do with organizing the effort and will of the personnel. For in this age of scientific achievement, this art of management technique—of management's power to develop and assign responsibilities, to analyze and appraise results and causes, to interpret aims and policies, to inspire, to bring out the best in men and women—frequently is not recognized as having the force it does have in rendering adequate service.

The Power of Service Ideals and Traditions

In fact, the greatest asset in our present day service is the years of patient constructive effort that have made service ideals and traditions part of the habit of thinking of the entire organization. Manifestation of this tradition is found in every activity; it underlies every consideration of the business. You men need no reminder of the tremendous force of this.

This management technique and responsibility involve the coördination of a wide range of activities, reaching all the way from specific operating practices to the attitude of mind of the people doing the work. It takes form in methods and procedures, in knowledge of the essential facts as to performance, in the appraisal of results from the user's standpoint, in training and continuing development of the personnel in every level of the organization, in satisfactory and considerate conditions of employment, in sound employee relations.

Methods and procedures grow out of study and experience as to the most effective way of carrying on the business. They require continuous scrutiny and review. Customer habits and requirements and demands change constantly, and management must be alert to anticipate these ever-changing and increasingly exacting conditions under which service must be given.

Service betterments flow as frequently from advances in methods as they do from advances in instrumentalities. For example, one of the most impressive and attractive features from the customers' standpoint within the past decade grew out of the development of the operating method whereby a long distance call is handled while the customer remains at the telephone. Before the introduction of this method, the average time required to handle a call was six to seven minutes, whereas the average is now but a minute and a half.

With service the function of so many interrelated activities, it is hazardous to suggest that any aspect is most important; but in our business there is general agreement that without full and continuing knowledge of the essential facts regarding just what the customer receives—what he actually experiences in using the service—management would be without its most useful tool.

Management's Most Useful Tool: Facts

Over the years, step by step, there has been developed within the Bell System information which makes available to supervision on a current and programmed basis significant and dependable facts as to just what standards of service are maintained. This information takes form in periodic results data procured on a sampling basis, and for the most part by specially selected employees not engaged in the work under scrutiny. The sampling procedures cover all day-to-day operations. They are designed to include substantially every type of contact between the customer and the company.

The separate operations under constant review and the specific data recorded are far too numerous to outline here. I think, though, a few illustrations will give you some idea of the general plan. Here is one:

A customer makes a request for new service or for change in service. Such requests are made each working day. Management should know:

1. Is all the essential information—name, street address, etc.—correctly recorded?

2. Does the customer understand charges, initial and recurring?
3. Does customer understand full uses of service?
4. Does customer have adequate services?
5. When is completion of work desired?
6. Was work done when and as requested and in manner desired?

Another operation will further illustrate. A customer makes a call from a telephone served by either a manual switchboard or a dial office. Here are the things that should be known about this call:

1. What was the time interval in seconds required to establish the connection?
2. Was any difficulty experienced?
3. What were the transmission characteristics?
4. Was the manner of the employee involved satisfactory?
5. How many calls failed of completion because the called party's line was busy, or because of no answer or slow answer or faulty operation, or for other reasons?

Take another type of operation. A customer makes some inquiry as to his bill:

1. Was the information furnished correct in every detail?
2. Was the manner of the employee satisfactory?
3. Was the customer fully satisfied with the explanation?
4. If the inquiry could not be immediately answered, was the information given within the promised time?
5. Was there any unnecessary delay in the handling of the inquiry?

Information of this sort, in a form available for ready use and on a current basis, is furnished to the supervisory forces for such action as may be necessary or desirable. No supervisor is without pertinent facts as to the work under his or her supervision.

When it is considered that 85,000,000 telephone calls are made each day, that there are 400,000 contacts in the business offices each day and 90,000 visits to a customer's home or office for installations or repair work, faulty or imperfect handling of even a fraction of one per cent of these contacts holds potentialities of customer irritation or ill-will in hundreds of thousands of situations each day. The volume alone justifies most careful scrutiny of these service transactions.

The broad pattern of all of these results data is such as to make possible intensive and healthy competition between separate units of the System, thus providing one of the greatest of stimulants for progressive improvement—the spirit of competition. To make the comparisons equitable, and particularly to make trends significant, much of the data is reduced to a common denominator. This general procedure has the further value of bringing to bear the combined experience of all units of the System in the search for better results.

Of course, as you well understand, the value of this whole approach is not simply in setting up results data. It is in the ability of supervision to translate the indications into effective action. Management procedures—born of system-wide experience, training, leadership—accomplish this. It has been our experience that training in the fundamentals and technique of management is as essential as is the training of the craftsman. Instruction courses following the case method of procedure are a current part of the training in the various levels of supervision.

Going Beyond Technical Efficiency

In the discussion thus far and for the most part, I have been referring to operations or transactions readily susceptible of measurement—in short, to the technical phase of service. But good technical service is not enough. Service must be pleasing: the customer must be made to feel that there is personal attention for him. This is a difficult assignment to develop in a few sentences. Yet it so influences customer satisfaction that some generalization of it is necessary. The form this important requirement takes is hard to define. It is found in the tone of voice, in the expression of the eye, in the manner of speech, in cordiality of mind; in short, it is that something 'way down deep in people which moves them instinctively to do graciously those things they are called upon to do.

All of this is especially important when a customer experiences difficulty or in unusual circumstances. It manifests its presence in every conceivable fashion—and frequently, when a customer is in difficulty, it takes the form of running counter to established practices to care for an immediate situation. It is what we sometimes speak of as the tone of service, the frosting on the cake, the desire to please, service from the customer's viewpoint; finally, it is the "voice with the smile."

As you will appreciate, this kind of attitude toward the job is something that requires continuing stimulation. As a means of providing this, one of our companies recently ran a contest in which employees were urged to write about their personal experiences and ideas regarding their relations with customers. I am going to quote the article which was awarded first prize.

> "I work and live in a small community. My office serves seven small towns composed of people of varied nationality such as Polish, Slavish, Italian, Russian and Lithuanian—not to speak of the older stock like the German, Irish, Welsh and English. My work is never monotonous, but varied and interesting because I am in constant contact with so many kinds of people. Not all of them are pleasant, but it is all the more satisfying to please that kind, for it seems like a real accomplishment. Due to the limited knowledge of English which some of them possess, I often have very humorous contacts with them. It is necessary to sympathize with a mother whose children are quarantined with measles, encourage the woman whose husband or family is out of work, or rejoice with the persons whose circumstances have improved so that they can gladly pay their bills on time. When I speak to my subscribers of these things we speak a common language, one which everyone understands. We also reach the common meeting ground of human interest. This, I think, is important in the way of public relations. I try to leave with my subscribers the feeling that I, as a representative of the Bell Telephone Company of Pennsylvania, am personally interested in their lives as individuals—not just as telephone numbers. So many events in our lives to-day are treated impersonally that a little real interest

even from a stranger is inclined to create a pleasant impression. All this makes me a more alert person—a person who must never miss an opportunity to serve.

"When I can induce my subscribers to pay their bills gladly, and when I can make them understand that we are glad to serve them at any time, and that they, as individuals, are part of the great family of telephone users whose wants we try to anticipate, I think I will be helping to create good public relations between them and us."

(*By Miss Romayne Lally, Service Representative, Olyphant, Pa.*)

This typifies the service tradition, the service instinct.

Results in all this type of activity, good or mediocre, are about in proportion to the employee's interest in the job. This, in turn, reflects the ability of supervision to inspire, to enthuse, to create and sustain team play, to maintain idealism. Without satisfactory conditions of employment, without considerate treatment, and without continued sympathetic understanding and mutual respect between employees and management, there is little supervision can do.

I happen to think that in any business these days there is no more important management responsibility than this. Certainly, it is fundamental to good telephone service. As you plan for the service betterments of to-morrow and as you contemplate the conflicting aims, purposes, and objectives of the well (and other) intentioned people who seek to guide the destinies of employees, it is clear that a supreme test of employee balance and management vision lies ahead. We recognize this as a challenge to the continuance of progressively improving service. It is a challenge for every industry. But I am confident that enterprise, initiative, understanding and good sense will prevail in the future just as these characteristics have enabled men and management to care for the difficult and perplexing situations of the past.

W. H. Harrison

The Telephone Goes Down to the Sea in Ships

FOR a person on a ship at sea actually to hold a telephone conversation with a person on the shore was, no longer than nine years ago, an event. Today, from any one of the 19,500,000 Bell System and connecting telephones in the United States, one can make telephone calls in the usual way to some 600 different boats in the coastal and harbor waters of this country as well as on the Great Lakes; perhaps more important, a person on any one of these 600 vessels can make a call to anyone at a telephone on shore. More than half of these boats are yachts and other pleasure craft, with the balance made up of tug boats, barges, fishing boats, steamships, ferry boats, pilot boats, and other commercial vessels.

Every day, people aboard these boats discuss with other people ashore, by telephone, such commonplace but important matters as are illustrated by the following fragmentary quotations, fictitious but typical:

"Proceed to Pier 18 for immediate tow of barges A and B, which are loaded with cars of perishable fruit. Can you pick up these barges in an hour and have you enough coal aboard for a 15-mile trip?"

"Our engines have broken down one mile east of Execution Light. Can you send us a tow and also 20 feet of tube to repair fuel line?"

"Hello, Margaret. We had a pleasant trip and expect to land at the yacht club dock about 7 o'clock. Please have a car at the dock to meet us. Will it be convenient to wait dinner for us?"

"Mr. Jones, this is your secretary speaking. We have advance information that there will be considerable weakening today in the franc and Mr. Smith has asked me to ascertain what action you wish taken."

"This is the trawler *Mary*. We have run into a large school of mackerel 10 miles south-southeast of Montauk Point. Suggest you notify other company trawlers operating in this vicinity to proceed here."

Ship-to-shore radiotelephone service was first put into operation in 1929 between the SS. *Leviathan* and the transmitting and receiving stations of the American Telephone and Telegraph Company in New Jersey. Today, the American Company's stations on the Atlantic and Pacific coasts provide radiotelephone service to more than a score of liners throughout their voyages on both oceans, and conversations between their passengers and persons in the United States are daily occurrences. Coastal and harbor radiotelephone service, the subject under discussion here, is entirely separate and distinct from the A. T. and T. Company's long-range service to ocean liners. As the name by which it is commonly known implies, its range is limited to the coastal and harbor waters in which coastal shipping and pleasure craft ply. It is operated by the Bell and connecting radiotelephone companies along the coasts adjoining the waters to be served. Its introduction and commercial development followed by some years the successful establishment of the much more powerful service to transoceanic vessels.

First Installation Was on Massachusetts Coast

The first Bell System coastal and harbor radiotelephone shore station was opened for commercial business at Marshfield, Massachusetts, on July 1, 1934, by the New England Telephone and Telegraph Company, after several years of experiments and tests. This station, which serves Boston harbor and coastal waters in the vicinity, is now one of a chain of eight Bell System shore stations on the Atlantic and Pacific coasts, the other seven being near New York (two stations), Norfolk, Miami, Los Angeles, San Francisco and Seattle. The Norfolk station was opened for public service on June 13, 1938. Additional shore stations are operated by connecting radiotelephone companies at Philadelphia, Pa., Lorain, O., and Lake Bluff, Ill., and these connect with any Bell System telephone.

A construction permit has been requested from the Federal Communications Commission by the Southern Bell Telephone and Telegraph Company to build a shore station near New Orleans. Applications by the Lorain County Radio Corporation for shore stations at Port Washington, Wisconsin, and Duluth, Minnesota, are also pending before the Federal Communications Commission. The locations of these fourteen existing and pending shore stations are shown on the accompanying map (Figure 1).

The Bell System shore stations, with 400-watt transmitters, have generally an effective range of about 200 to 300 miles over water, but this range may vary materially with local conditions. The radio frequencies used are between 2100 and 2200 kilocycles for ship-to-shore channels and between 2500 and 2600 kilocycles for shore-to-ship channels. In addition, there is a ship-to-ship channel on 2738 kilocycles and a channel for calling the Coast Guard in emergencies on 2670 kilocycles. Some of the connecting radiotelephone company shore stations use higher frequencies as well. As the range over land is materially less than over water, both transmitting and receiving shore stations are located near the water's edge. The radiotelephone service is available through the shore stations on a 24-hour basis except in the case of the second New York station. Figure 2 shows the San Pedro coastal harbor station, serving the Los Angeles area, and Figure 3 the radio transmitter equipment at the same station.

Newest Shore Station Is Remotely Controlled

In the latest design of shore station equipment, the transmitter and the receiver are remotely controlled. In the case of the Norfolk station, the transmitter and receiver are located in the vicinity of Cape Henry, more than 15 miles from Norfolk. The technical operator and the traffic operator who actually handles the calls are both at the central office in Norfolk, and the equipment on the shore is controlled from this point. While a technical operator must be available at all times, the

FIG. 1. PRESENT AND PENDING COASTAL AND HARBOR RADIOTELEPHONE SHORE STATIONS IN THE UNITED STATES

provision of automatic switching controls, alarms, and signals has made it possible for the systems to take on more and more the aspects of the wire telephone system. One of the new unattended radio receivers, which can be placed on a telephone pole, is shown in Figure 4.

In order to provide service to low powered radiotelephone sets on boats, several auxiliary receivers may be located at different points along the shore. For example, in giving a complete coverage at New York, there are, in addition to the main receiver at Staten Island, four unattended receivers. One of these is located near the southern part of Staten Island and the other three are located at different points on Long Island. In fact, with these receivers, all of New York harbor and practically all of Long Island Sound are in range of a 15-watt ship set.

Boat Owners Provide Their Own Sets

While the shore facilities necessary for this service are provided by Bell System companies and connecting radiotelephone companies, the radiotelephone sets on boats are provided by the owners of the boats. Over a dozen different concerns are building various types of boat sets, varying from 10 to 50 watts in power. The prices of these sets range from a few hundred to a couple of thousand dollars or more, depending on the type of set, the number of frequencies available in the set, the power of the set, and other factors. Many of the smaller sets take up scarcely more room than a medium sized home radio broadcast receiver, and the necessary power is provided by a small rotary converter which operates from the ship's power system. The range of these ship sets varies materially, but even the smaller sets can generally reach 50 miles or more over water and some of the sets have a range of several hundred miles.

The Western Electric 15-watt marine radio telephone set shown in Figure 5 weighs about 50 pounds and is only 15 inches long. It is arranged for four different frequencies, and a hand set telephone is provided with a press-to-talk switch in the handle. The Western Electric Company also makes a 50-watt set, arranged for ten frequencies, and this has voice operated relays which eliminate the need for a press-to-talk switch. A remotely controlled radiotelephone as used in a pilot house is shown in Figure 8.

Two Classes of Service Are Available

Two classes of coastal and harbor telephone service are offered through the Bell System's shore stations: General Service and Dispatching Service. General Service covers random calls between any land telephone and any suitably equipped vessel. The rate for the radio link includes a connection with any telephone within the designated local service area of the radio terminal office. Where points on land outside the local service area of the radio terminal office are involved, the regular person-to-person charge for the land portion of the call is added to the radio link charge. This service is available to any suitably equipped boat at any time and the only charge is for the calls made.

Dispatching Service is intended for communication between vessels of one customer and one or more designated telephone stations of that customer on land, as, for instance, between the dispatching office of the owner of a fleet of tow boats and such boats. The radio link message charge for this service is for a shorter initial period and is also lower than for General Service. For this service, each boat is required to guarantee a minimum use of the service each month.

The yacht owner who has equipped his vessel with a radiotelephone finds it a great convenience to himself and his guests. The ability to keep in touch with his office by telephone may enable a yacht owner to spend many days on the water without anxiety, and many important business transactions have been

Fig. 2. Shore Station for Coastal and Harbor Radiotelephone Service at San Pedro, Cal.

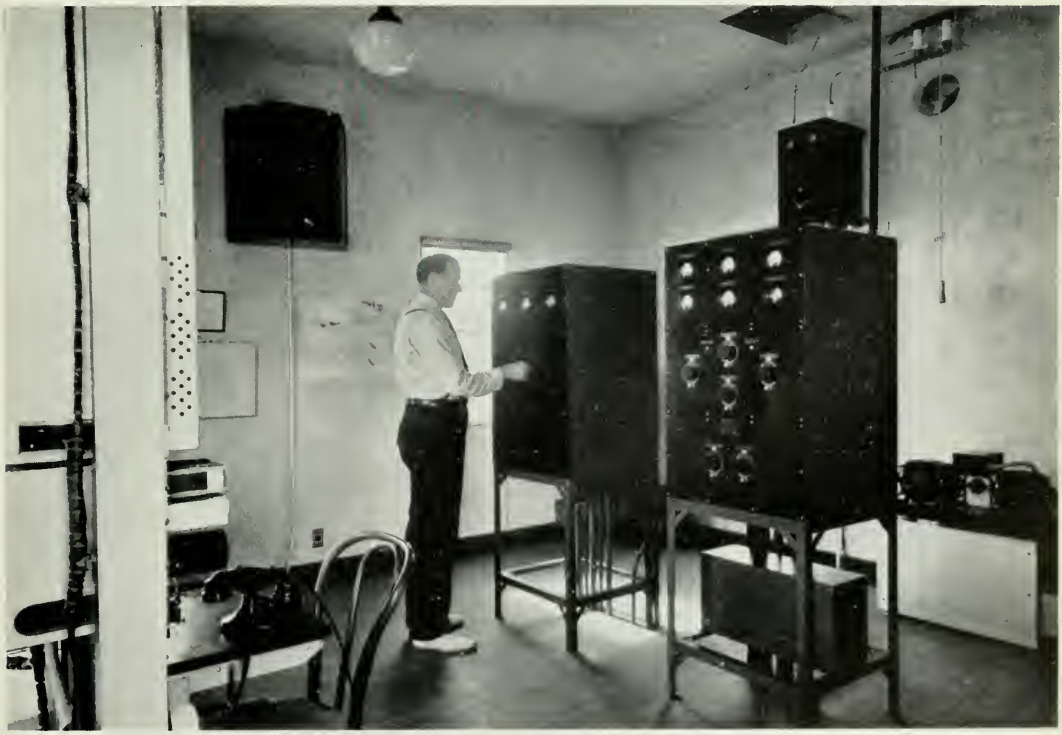


Fig. 3. Radiotelephone Transmitting Equipment in the San Pedro Station

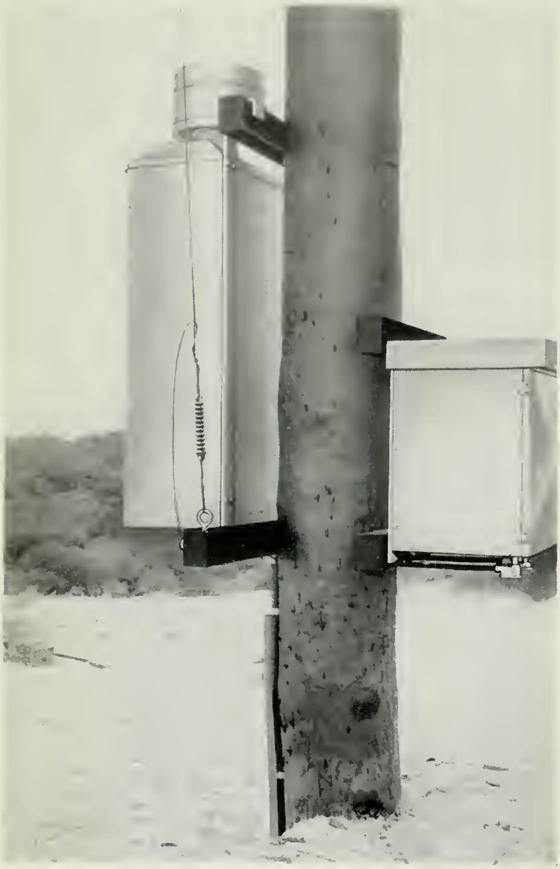


Fig. 4. Remotely Attended Radiotelephone Receiving Equipment

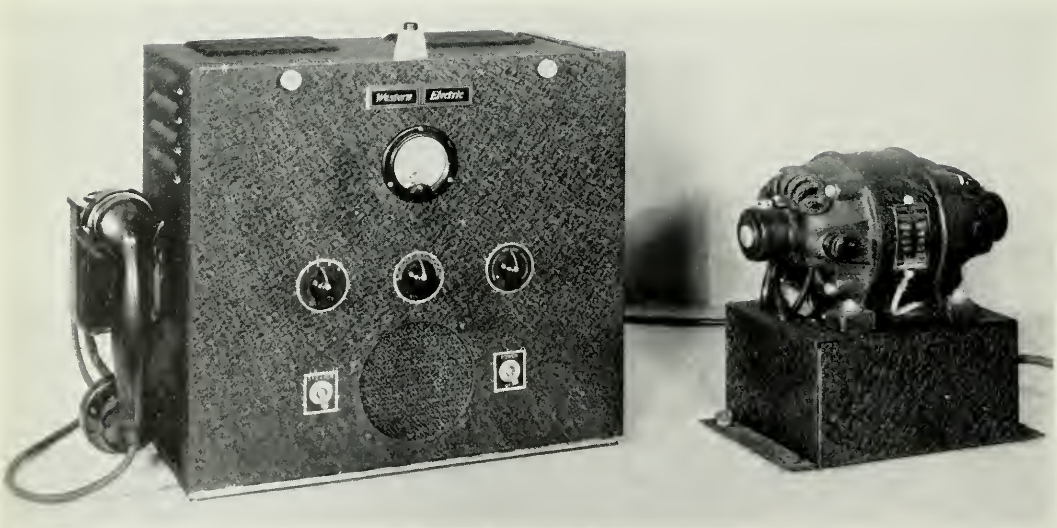


Fig. 5. The Western Electric Company's 15-watt Radiotelephone Set for Shipboard Installation

Fig. 6. The 65-foot Ketch-rigged Yacht "Winsome Two"

Fig. 7. The "Elda." Both These Yachts Have Been Radiotelephone Equipped for More Than a Year

Fig. 8. A Remotely Controlled Radiotelephone in Use in the Pilot House

Fig. 9. The Pilot Boat "Sandy Hook," One of the Two Which Serve New York Harbor. Both Are Radiotelephone Equipped

consummated by radiotelephone. Figure 6 shows the 65-foot ketch *Winsome Two* and Figure 7 the yacht *Elda,* which have been equipped with radiotelephones for more than a year. There are many uses for a radiotelephone, as in summoning assistance in cases of engine trouble or other emergency. In cases of delay in reaching a port, a telephone call to those on land relieves all anxiety.

Promotes Efficiency of Fleet Operation

Companies operating fleets of tug boats, lighters, barges or other vessels can use radiotelephone service to great advantage, as dispatching orders may be given or changed while the vessel is in operation. In this way they cut down on idle tug time and secure economy in operation. This is of vital importance to a towing company, for a more efficient use of tugs means a more profitable business. A better service to the towing companies' customers also results from the use of the radiotelephone, which minimizes delays in shipping. Assistance calls can be placed when aid of other tugs is needed on account of heavy weather or threatened danger to the tug's tow.

Figure 9 shows the New York harbor pilot boat "Sandy Hook," which makes regular use of the dispatch service; a second New York harbor pilot boat is also equipped. Here again the radiotelephone is of great value in keeping in touch with the shore at all times for passing orders, information, etc. Freighters, fishing trawlers, and other commercial craft use the radiotelephone to report their position and, in the case of the trawlers, to keep in touch with market conditions and the price of fish.

When emergencies occur at sea on a vessel equipped for radiotelephone service, the international distress signal is the call "May Day," meaning "Help, we're in distress at sea." It is the "SOS" of the radiotelephone. The words are the

English phonetic spelling of "M'aidez," which in French means "Help me."

On April 15 of this year the technical operators at the Marshfield station heard the call "May Day, May Day," followed by a voice saying "this is the trawler *Exeter,* south-southwest of Seal Island on Brown's Bank." They acknowledged the call and the *Exeter's* captain continued, "Don't know whether we can get a boat off or not—Call the Coast Guard and any boats in the vicinity—I'll try to give you the distance—Wait till I get a chart." Then followed hours of silence.

The Radiotelephone Brings Rescue

The *Exeter's* captain never returned to the telephone on board to report the exact position of his ship. Apparently he had no chance even to explain the trouble. That his ship was in urgent need of help was apparent when he said that he was uncertain whether his men would have time to launch a lifeboat. The position he reported was too vague to be of much assistance in locating him.

Keeping the monitor receiver on the *Exeter's* wavelength to pick up any further messages that might come from her, one of the station's operators jumped to a telephone and called the coast guard base at East Boston, reporting in full the message he had received from the *Exeter.* Meanwhile, the other operator reached the trawler *Hekla* at sea by radiotelephone and reported the message from the *Exeter.* The *Hekla* was fishing some miles from the vague position that the captain of the *Exeter* had reported. Within a few moments, a radio appeal in code to all ships was broadcast from the *Hekla.* The *Hekla's* operator had hardly completed the message before he picked up the broadcast for help sent out by the coast guard.

For hours there was no word from the *Exeter.* Then, just before complete darkness set in, the trawler *Illinois,* which had heard the radio appeal for help sent out by the *Hekla,* picked up a lifeboat. In it were the nine members of the *Exeter's* crew. They had drifted for seven hours after abandoning the trawler in haste. Fire had started in the engine room of the *Exeter,* and the flames had spread with such speed that the men were forced to abandon ship within a few minutes. Not one of the nine members of the *Exeter's* crew was injured, although the vessel went to the bottom with all their personal belongings.

No Special Skill Is Required for Operation

The question is frequently asked as to whether a technical radio man is required for operation of a radiotelephone on a boat. There is no such requirement; but it is necessary to secure a third class telephone operator's license from the Federal Communications Commission, which requires only a knowledge of the laws and regulations relating to the operation of this type of equipment. Each boat also needs a ship radio station license and is assigned a station call letter by the Commission.

When a boat is first equipped with a radiotelephone set, the owner ordinarily informs the telephone company, so that the necessary information for handling calls can be posted on the company's records and an account established for service through Bell stations.

Calls from anywhere in the United States may be placed for any boat equipped for service. All that is necessary is for the calling person to give the name of the boat and its probable location, so that the call may be routed to the proper marine operator. The call is then received on the boat through a loud speaker or, if the boat is equipped with selective ringing, the bell on the boat desired is rung by the operator. The two parties are then connected over the radiotelephone and conversation takes place in the usual way.

The present coastal stations give excellent coverage from the Canadian border to the Carolinas and reach fairly well much of the remaining Atlantic and Pacific coastal waters. As the use of the radiotelephone increases in coastal and harbor waters, additional stations will doubtless be provided. Thus, with the growth in coastal and harbor service, the telephone is again expanding its usefulness and scope. Afloat, as ashore, the utility, convenience, and speed of telephone service make it an increasing aid in the furtherance of business and social contacts.

Gaius W. Merwin

Proving the Value of Telephone Orders to Department Stores

SAID an executive of a large metropolitan department store, in explaining its policy, "We look upon telephone service as an unavoidable operating expense that should be held at a minimum." A year later he said, "Our telephone service is a powerful medium for moving merchandise and we use it to its fullest extent." These two diametrically opposed attitudes illustrate the wide difference of opinion in the department store field regarding the importance of telephone service and the value of telephone orders. What information or experience led to such a change in viewpoint? In the answer lies an interesting story of efforts undertaken by both department store and telephone company people to throw light upon this rather controversial subject.

Some stores actively promote telephone order business (that is, orders for merchandise which are received by telephone) and certain of them have built it up to a point where it contributes as much as ten per cent of their total dollar volume. The officials of these stores hold that by promoting telephone orders they bring in much additional and profitable business that they otherwise would not get. In their advertising they feature their telephone service and solicit telephone as well as counter and mail order business. Their telephone personnel have been trained to sell instead of acting only as order takers.

On the other hand, many stores have followed a quite different policy. They have felt that telephone order business might not be profitable, that it might attract bargain hunters only. They have feared that telephone orders might keep customers out of the store, and thus make inroads on their counter sales, which are the backbone of department store business.

This difference of opinion has been of more than passing interest to those telephone company representatives whose job it is to help business firms with their communication problems and to assist them in making the telephone a more effective, profitable and pleasing medium for the transaction of business. While stores generally appreciate the importance of satisfactory store telephone service, it not infrequently happens that the attitude of their executives toward telephone order business has an important influence on the quality of telephone service which they provide for their customers. In addition, telephone company representatives are often asked for their opinion of the value of telephone order business and for information on problems which concern sales promotion policy rather than telephone service *per se*.

The store's attitude toward telephone order business is so frequently an important factor in the planning of telephone arrangements that it seemed to the mutual advantage of the telephone companies and department stores generally to do some research work in the hope of substituting factual information for opinion or conjecture. In discussions with the management of one of the largest department stores in the country, the telephone people found them to be sympathetic to and in general agreement with such a project. In fact, they generously offered the use of their store for a study to be undertaken jointly by department store and telephone company personnel.

While the amount of time and effort involved would be considerable, it was felt that this would be well worth while in view of the broad application of the findings to department stores generally and the probable benefits not only to these stores and to the telephone companies but also to the general public, who are customers of both. A study was made in this store, accordingly, and much useful information was obtained regarding the place and value of the telephone in retail merchandising. The research work occupied about three months, and is believed to be the most comprehensive analysis in the department store field in which telephone people have taken part.

Since the original study, similar research work has been completed in other department stores. It indicates that, with possible rare exceptions, the findings of the original study apply equally to them. Feeling that these findings might be found useful by stores generally, the National Retail Dry Goods Association brought the study to the attention of its membership of over 2,000 leading department stores. The study has not only aroused interest in telephone and department store circles, but also in the advertising and educational fields, libraries, and the press.

The Practicability of Selling on Incoming Telephone Calls

The store was organized along the functional lines usual in large department stores. The telephone order department did not report to a buying or selling executive but came under the service department, which was in charge of the store superintendent. Since several departments in the store would be affected by the results of the research, the management of the store made arrangements for the participation and coöperation of all interested parties. A study group was formed, composed of two representatives from the telephone company and several from the store. The telephone people worked in the store with the store personnel assigned to the study. In this way it was possible to exchange and coördinate experience with respect to telephone service and facilities, on the one hand, with store operating and merchandising experience, on the other.

Incoming telephone calls were received at the store P.B.X. switchboard. Calls from customers were then routed to a centralized group of telephone order clerks instead of to the telephones at the various counters throughout the store. It was the practice for telephone order clerks simply to take orders or give information and make no attempt to sell. As a first step in the study, it was decided to see whether sales effort on incoming calls was practicable and whether it would increase the dollar volume of business without unfavorable reactions on costs and customer relations.

The first step was to find out why customers called the store, what they expected, and what the store did about it. The information was obtained by observers sitting beside various telephone order clerks and listening to their conversations. Their observations showed that customers called the store for any one of a number of reasons: to order or inquire about merchandise; to request the store to take back merchandise (in store parlance, "returns"); to arrange for the exchange of merchandise; to inquire about deliveries; to make appointments for fittings, demonstrations, and similar personal visits; to make complaints, and so forth. Regardless of the nature of the call, customers seemed to expect prompt, dependable, and courteous service, and there were sometimes signs of dissatisfaction in cases where calls might have been better handled. A record was made, therefore, of those things which appeared to please customers and also of those which appeared to mislead, confuse, or irritate them.

The observations also confirmed that little sales work was done by telephone order clerks, except during occasional campaigns to sell certain special items. The observers therefore made a special point of looking for and noting anything that appeared to be a sales opportunity. It soon became clear that there were many sales opportunities and that they could be classified into a number of different types, each of which would be worth exploring. Three telephone order clerks were selected as being representative of the average force. They were assigned to the study group and asked to try various suggestions for improving sales and service. Other members of the group listened to their handling of contacts in order to observe the degree of improvement and the apparent reaction of the customers. During the trials, frequent group meetings were held to discuss progress and results.

The trials extended over a two months' period, and there was an impressive improvement in handling contacts during this period. Also, experience with desirable types of sales work began to crystallize. Some of the highlights of these trials follow.

Selling Related and Consumption Merchandise

When customers visit a store in person, it is possible to promote sales by attractive counter and window displays. Customers may handle goods. There are opportunities for counter sales clerks, demonstrators, and others to exercise good salesmanship. By these means it is possible to sell customers more merchandise than if the store were organized on the basis of merely taking orders.

What substitute might there be during customers' "telephone visits," for the sales appeal of counter and window displays? One possibility was for the telephone order clerks to "display" merchandise by telephone, by suggesting the purchase of appropriate items to customers and describing them in a clear, concise, appealing manner.

Sometimes an item the customer was ordering would indicate a need for or an interest in another item. The sales clerks assigned to the study therefore prepared lists of such pairs of items: cameras, films; paint, paint brushes; washable fabrics, soap flakes. They then used these lists as reminders for sales suggestions while handling calls at the telephone order board. Soon they acquired such facility in developing relationships that they could make suggestions in most instances without referring to the list.

Since many customers called to inquire about or order items they had seen in the store's newspaper advertisements, it was decided to give reference lists of advertised merchandise to the sales clerks in the study group. In considering the most effective set-up for the list, one study clerk suggested that the store would get more value out of each advertisement if these lists should show, for each advertised item, a description of one or more related but unadvertised items which could be suggested. For example, the description of an advertised bed sheet would be followed by a description of unadvertised pillow cases, mattress pads, and mattress covers, which included selling points which helped the order clerks to describe and sell more skillfully, such as, "won't fade," "won't shrink," "wash like new," "pads won't get lumpy." Such a list was prepared, and it was found possible, through such planning as this, to make sales.

It was thought desirable, therefore, to build up lists of merchandise for all of the frequently ordered lines. These lists seemed sufficiently important to warrant calling upon the best merchandising experience in the store during their preparation, and the study group looked to the store buyers for assistance. The buyer of children's wear was the first to respond. She selected samples of her "full line" and instructed the three study clerks in the selling points of each. As a result, at the end of a week the number of items per sale had doubled, and the study clerks' average sale of children's wear had increased in value from $2.34 to $5.01. The sales suggestions did not unduly prolong the contacts and there was definite evidence that mothers appreciated these helpful suggestions.

As a result, other buyers volunteered assistance. Some of the buyers pointed out that suggestions could not always be made on a related basis. On such occasions, it seemed that the suggestion of what is known as consumption items—*i.e.*, those which the majority of customers purchase and use up frequently—would be most helpful. The buyers thought that such suggestions might often be made on a seasonal basis: house cleaning and storage items in the spring, toys at Christmas, school supplies in the fall. Rapid progress was made with this type of sales work.

However, it should not be assumed that the telephone can be used to move all manner of "problem goods" or to dump merchandise. For example, in this store it was learned that one buyer had found himself with a large stock of sachet which had proven unsaleable over the counter. He arranged for the item to be featured by telephone clerks. They made 900 suggestions to customers before the suggestion was discontinued, and did not secure a single order. This effort to use the telephone department to sell something which the public obviously did not want, therefore, cost the store a substantial number of sales that might have been made if the buyer's suggestion had been a sound one.

After several weeks' experience, the three study clerks were making sales suggestions on about eighty per cent of the calls handled, averaging a sale to each four suggestions, and the average amount per sale was $1.04. This proved to be an easy type of sales work to start and administer. It was found, incidentally, that the simpler suggestions, rather than the unusual or spectacular, often produced the most benefits.

Selling Larger Quantities

It seemed desirable to test the effectiveness of sales work in persuading customers to purchase larger quantities, provided such effort did not seem unreasonable or annoying to customers. With some merchandise the incentive was a reduced price to purchasers of large quantities. Sometimes a special temporary price might make it advisable for customers to "stock up." These lower prices occur during special sales, at the turn of the season, during the introduction of a new line of merchandise, etc. Customers often need quantity replacement of items that are consumed rapidly. It was found that the quantity of an item ordered might be increased by suggesting its use by other members of the family, or as gifts or prizes.

Here again lists of merchandise, in this case including items that are ordinarily purchased in quantities, played an important part in the success of the trial. For each item listed there were shown the selling points that clerks could use in inducing customers to buy the larger quantity. For example, in persuading a customer to buy several rather than a single pair of stockings, the clerk might say, "A run in one of a pair of stockings makes the pair useless—with two matched pairs greater service can be obtained from the remaining three." It was found that the importance of testing such selling points, and then using the ones found most effective, could not be over stressed. Without such lists, the sales suggestions made by any clerk were largely limited by her imagination or personal experience; with such lists, the telephone clerks benefited from the accumulated merchandising experience of the entire store.

While it took time to build up a volume of sales suggestions of this type, the results obtained by the three study clerks during the experimental period were quite encouraging. They suggested larger quantities on about ten per cent of the calls handled, averaged about one sale to each two suggestions, and the average value added to the original order was $1.18.

Selling Higher Priced Merchandise

It had been believed in many stores that only the lowest priced merchandise could be sold by telephone. The investigators proved this to be a fallacy. During the observation period, it had been noted that clerks generally stressed a low price or "bargain" appeal during their telephone sales contacts and rarely mentioned quality, durability, and other equally effective sales appeals. A common reply to a merchandise inquiry was "Yes, madam, we have them. They run from forty-nine cents up." The customer would often reply by requesting a description of the lower priced item, and, if it didn't sound good enough, would either ask about a higher priced item or lose interest and hang up. When a sale was made, it was usually for lower priced merchandise.

Discussions with the merchandising people indicated that the average customer visiting the store ordered merchandise well above the lowest price level, and it seemed reasonable to assume that the average telephone inquirer might be interested in similarly priced merchandise. Consequently, the three study clerks attempted to determine the most appropriate grade of merchandise to quote on telephone calls. It was found on many calls that there was some lead as to the proper grade of merchandise to quote. The most obvious one overlooked was where customers specifically requested high quality merchandise. Charge customers were found to be generally interested in merchandise well above average in quality. Customers often made remarks such as "We are going to the mountains for the summer," "It's for a party Saturday night," etc., which indicated an interest in merchandise of good quality. Still another lead was the customer's address, which, if in a high class neighborhood, indicated a potential interest in quality. Servants calling to order for their employers were quoted quality merchandise as probably better meeting their employers' desires, avoiding, however, over-selling or pressure.

In addition to preparing lists of such leads, price tests were run for various items of merchandise. This was done by quoting different prices and measuring the results in terms of per cent of sales to suggestions, number of items per sale, and average profit per sale. Hosiery prices, for example, were tested from $.50 (by $.10 advances) to $1.25 per pair and it was determined that the most effective price level was $.80.

Such a figure would vary from time to time in the store studied and also between stores, due to changes in economic conditions, differences in type of trade, etc. Enough items were studied to indicate that such price testing in the telephone order department could be used advantageously.

Of all the types of sales effort tried, this appeared to be one of the most fruitful, and was also relatively easy to administer. The three study clerks suggested higher priced merchandise on about ten per cent of the calls handled, averaged one sale to each two suggestions, and averaged an addition of $.80 to the original order. While it seemed likely that results would vary with the times, the store, the merchandise handled, and the store's clientele, this would not seem to justify inaction or indifference to the possibility of selling better quality at higher prices.

Selling Merchandise on Adjustment and Complaint Calls

A large number of telephone calls were received from customers regarding adjustments, complaints, returns, exchanges, and so forth, pertaining to counter and mail as well as to telephone purchases. During the observations, it was noted that very few customers making such calls really had "a chip on their shoulder," and in many instances would place a new order before hanging up. It was concluded, therefore, that the majority of the customers making such calls might appreciate a timely and natural suggestion and consider it helpful rather than objectionable. Subsequent trials indicated this opinion to be substantially correct, although, of course, alertness and discretion were necessary.

Many customers gave leads which enabled the study clerks to make helpful and natural suggestions. The suggestion of items timed with events and seasons of the year, and those which not only had a broad general appeal and utility but also were attractive from a price and quality standpoint, proved to be the most generally helpful.

From the experience of the three study clerks, it appeared that sales suggestions could be made to about forty per cent of the customers on calls of this type. The ratio of sales to sales attempts was approximately twenty-four per cent and the average value per sale was about $1.50.

Converting Merchandise Inquiries Into Orders

A surprisingly high proportion of customers—about twenty per cent—call the store to inquire about a specific item of merchandise and, after receiving the information, hang up without placing an order. While some of them might subsequently place an order, it appeared worth while to see if the business could be obtained by securing more orders while the customer was on the line. Accordingly, the three study clerks tried to sell the inquiring customers instead of merely providing information. This was done by obtaining from customers a good idea of the merchandise they were interested in, making sure that it was in stock and at what price levels, describing its features clearly and concisely, and stressing the sales appeals that would justify the price and create a desire to buy it. Orders were sometimes obtained by suggesting a special order when the item in question was out of stock, not carried, or sold out. Other orders were obtained by suggesting substitutes for items that had been advertised as "no phone orders."

To be successful in this type of selling, the negotiations must be pleasing to the customer and the clerk must show a real interest in the inquiry. The three study clerks were able to make sales suggestions on about five per cent of the calls handled. Counting only the cases where the evidence was conclusive that the business had been obtained through sales effort, they averaged one sale of about $2.40 to each three suggestions.

Converting Returns Into Exchanges

Returned merchandise is considered one of the most troublesome of store problems. A large percentage of the requests to have merchandise returned are received by telephone. While stores are anxious to reduce the number of returns, they must avoid giving customers the impression that they are unwilling to handle legitimate requests.

During the observation period, it seemed in a number of instances that helpful suggestions might have been made which would have resulted in the customer either keeping or exchanging rather than returning the merchandise. It was therefore decided to make a list of all the customers' reasons for returning merchandise and then classify these reasons as "savable" or "unsavable" returns. Examples of "savable" returns were "wrong size or color or style," and "damaged goods." Examples of "unsavable" returns included "not durable," or "fades," "sent several pairs on approval, will keep only one." There were about an equal number of "savable" and "unsavable" types of returns.

The three study clerks made no attempt to save the "unsavable" returns. However, they developed considerable skill in their sales work on the "savable" types of returns. They handled a number of cases which started as returns and ended as exchanges or with the customer keeping the merchandise. It was concluded that an intelligently directed activity along these lines offered a promising opportunity for improvement.

Measuring the Effect of Selling

By the completion of the trial period, the three study clerks were using effectively the selling ideas that had been developed and proved worth while by the trial and error process. It was decided to try to determine just how much additional business might be attributed to their sales effort.

The Modern Telephone Order Department in One of the World's Largest Department Stores, Showing Their Installation of No. 4 Order Turrets.

Good Service and a Sound Policy toward Telephone Sales Enabled a Store in a City of Less Than 200,000 Population to Build Up Its Business to a Point Requiring a Telephone Order Department of the Size Shown Here.

The following plan was devised for obtaining this information. Three more order clerks of about the same caliber as the original three were added to the study group. The new girls were rated as capable according to the existing store standards and practices. They knew nothing, of course, of the sales work of the three original girls. This permitted comparing the results of the new clerks with those of the original study clerks while handling the same type of customers' calls coming in over a common group of telephone lines.

After observing nearly 3,000 calls, it was agreed that sufficient data had been obtained to make a reliable comparison between the results obtained by the three original girls (doing a selling job) and the three new girls (doing an order-taking or non-selling job). An analysis of these observations showed that the original study clerks were able to make helpful sales suggestions on about eighty per cent of the calls handled, closed sales on about twenty-seven per cent of the suggestions, and averaged about $1.20 per extra sale. These sales increased the value of the average telephone order to $3.00, as contrasted with an average of only $2.39 for the non-selling clerks. It appeared, therefore, that if steps could be taken to place and keep in operation for the entire force the procedures used by the three original study clerks, it might be possible to increase the annual dollar volume of business on incoming telephone calls by about twenty-five per cent, which amounted to over $200,000 in the store being studied. The study indicated that selling increases the time required to handle incoming calls from customers in the neighborhood of twenty per cent. The additional business obtainable from sales effort, however, seems in most instances to justify the added cost of sales work. During the observations, it was again noted that customers appreciate helpful sales suggestions and that there was no unfavorable reaction on customer relations.

It occurred to the telephone men that it would assist in doing a good job if the handling of incoming telephone calls from store customers were considered as a "selling" rather than a "non-selling" function of the store. This would mean selecting managers of telephone order departments, supervisors, and order clerks because of ability and experience in sales work, as well as other necessary qualifications. There might also be an important psychological advantage in changing the title "Telephone Order Clerk" to "Telephone Sales Clerk."

Thorough training and supervision, the importance of which is so well recognized in the telephone business, would then be essential to obtain the best results in handling telephone order business. Without this, the expected benefits both in increased sales volume and in satisfactory service would be wholly dependent upon the ideas and actions of the individual telephone sales clerks.

Finally, it seems highly desirable that the interest of the advertising and merchandising people be encouraged. If advertising people are aware of the importance of the telephone as a merchandise outlet, they will want to take full advantage of it by showing the store telephone number prominently in newspaper advertisements and by carefully reviewing each item advertised to determine whether it should be featured for telephone as well as counter sales and mail orders. Once interested, the merchandising people will want to contribute their experience as to what to sell, when to sell it, and at what prices. They may also wish to discuss merchandising principles before group meetings of telephone personnel and give them demonstrations of merchandise and counter sales experience.

Essential Service Improvements

It is axiomatic that sales work, to be a beneficial and lasting part of any business, must be built upon the foundation of good service to customers. In the case of the telephone sales tests described, the study group was left with the strong impression that poor service might drive away much of the cream of telephone order business, leaving only customers willing to tolerate such rebuffs as busy lines, slow answers, discourtesy, indifference, and delays while ordering by telephone: the same customers who crowd at bargain counters to secure "loss leader" and "low mark-up" merchandise. Furthermore, before most customers can be persuaded to buy, they must be in a pleasant frame of mind. Good service is pleasing to customers and whets their buying appetites.

It was the opinion of the study group that customers are quite reasonable and that their demands can be met without undue difficulty or expense. What steps should be taken, then, to build up pleasing, dependable service for telephone shoppers?

In the first place, store customers probably expect to be able to find the store's telephone number without difficulty. Stores can accommodate their telephone visitors by accurately and completely listing and advertising the store telephone numbers in the telephone directory, featuring the telephone number in their newspaper advertisements, printing it on letterheads and bills and inserts, announcing it during promotional radio broadcasts, and publicising it in every practical way.

Customers dislike delays on the telephone road to the store. A delay or report of "line busy" may be a detour to another store. A store's protection would be to provide adequate telephone facilities to accommodate customers speedily and smoothly at all times.

Customers naturally expect to be waited upon with reasonable promptness. Has the store a sufficient number of P.B.X. switchboard attendants and telephone clerks so that telephone visitors may receive attention without undue delay? Many store executives would be surprised if they knew how long customers are kept waiting after the P.B.X. operator has told them "I'll connect you."

Customers want to be waited upon by a person who has been properly trained and who serves customers in a pleasing, helpful and efficient manner. Shouldn't telephone clerks make customers feel that it is a real pleasure to do business with the store by telephone? Customers do not want to be kept waiting on the line while the clerk looks up something, nor do they want to be transferred from clerk to clerk. And, finally, they expect that the action taken by the store as a result of their telephone visit will compare favorably with that resulting from a visit in person to the store. They expect orders to be accurately filled as to quality, quantity and price, deliveries to be prompt, and adjustments to be satisfactory. Does the store know whether it is meeting these expectations?

Incidentally, this phase of the investigation included a complete review of the telephone equipment used by telephone order clerks. A number of opportunities for improvement were found, resulting in the development of a small key cabinet known as the No. 4 Order Turret. It includes, among the features required by these clerks, an incoming line for receiving customer calls, an outgoing line for calling the selling and other departments of the store to obtain information for the customer, and a conference connection between the incoming and outgoing lines so that the customer, the telephone clerk and the counter clerk can all hear and be heard on the same connection. Much information was also developed on the pros and cons of dial versus manual P.B.X. switchboards, whether to handle calls by routing directly from the central office to a centralized group of telephone clerks or routing them by way of the store P.B.X. switchboard, various directory listing arrangements, and other pertinent data.

Department stores have a definite problem in providing adequate personnel and equipment for handling incoming telephone calls satisfactorily at all times, because of the large variations in the volume of telephone order business. The problem is comparable in complexity to that encountered in a telephone company central office. The volume of calls changes by days of the week, and by months and seasons of the year;

it is extremely sensitive to weather conditions and store promotional programs. Some of the variations can be planned for, and stores must maintain records of call volumes so that they will have an accurate basis for providing enough people and equipment for these varying work loads. Other variations may be unexpected and the store must have a reserve readily available for these situations. Without such planning, a store risks the loss of much valuable business and the impairment of its service reputation during peak work load periods and tolerates over-manning and extravagant payrolls during low work load periods.

Comparison of Telephone and Counter Order Business

Having established to their satisfaction that the dollar volume of business on incoming telephone calls could be increased through improvement in service and sales performance, the study group next turned their attention to the question of whether telephone selling is sufficiently profitable to justify its aggressive promotion.

It was decided that the most conclusive evidence could be established by breaking down the telephone order business into its major components and comparing these directly with those of the store's over-the-counter sales.

The comparison of these two types of business was accomplished through a further analysis of the nearly 3,000 observations discussed above, by searching out pertinent information available in store records, and by a study of the total business transacted by the store during a two weeks' period. Among the characteristics compared were "mark-up," which is the amount added to the cost of the merchandise in arriving at the selling price; "handling costs," which include salary, telephone, and delivery costs; "average sales check," which is the average amount per customer purchase per department (a measure on which many major store ratings are based); and

Typical Newspaper Advertisements of Two Large Department Stores at the Top, the Back Cover of a Catalog in the Center. The Bottom Illustration, from "Sales Management," Graphically Portrays Some of the Findings of the Department-store Study.

Using Telephone Directories to Solicit Orders by Telephone. Two Back Covers, a Special Insert, and the "Yellow Pages," Carried These Department-store Advertisements.

"returns," which is the delivered merchandise which the customer requests the store to take back.

Telephone order business compared favorably with counter business. Delivery costs, of course, were higher, since all telephone orders must be delivered whereas this was found to be true of only about forty per cent of the counter orders. This, however, was offset by other cost factors more favorable to telephone business, as for example, sales cost. It was the opinion of the study group, therefore, that telephone order business is sufficiently profitable to justify its aggressive promotion.

An important related question was whether any substantial ratio of telephone orders represented sales which would otherwise be made over the store's counters. The observers made a special three-day check of all calls handled by the six telephone sales clerks, which showed that twenty-two per cent of the customers who called to inquire about or order merchandise by telephone voluntarily indicated that it was impossible, inconvenient, or unnecessary for them to come to the store. To this percentage must be added the number who made no comment but wouldn't or couldn't come to the store. This figure was so substantial that no further survey appeared necessary to establish the point. It was the opinion, therefore, that telephone order business is substantially additional business which the store might otherwise not obtain.

What the Study Proved

A report of the study was prepared. It presented ample evidence in support of the following general conclusions: (1) that telephone orders are at least as profitable as counter and mail orders; (2) that the dollar volume on incoming telephone calls could be increased about twenty-five per cent by a reasonable amount of salesmanship; (3) that this salesmanship is practicable and worth cultivating, and that it helps rather than hurts the store's relations with its customers; and (4) that telephone promotion would bring the store much desirable business which it otherwise would not get, fully justifying a store policy of actively promoting this business.

The report was presented to the store's management and received their concurrence. During the year following the presentation, with the new procedures fully effective only part of the year, telephone order business in this store increased eighteen per cent over the volume of the preceding year, while counter business increased but four per cent. Furthermore, the store improved materially the quality of service rendered to telephone customers. The store management now regards the telephone as a merchandise outlet of real importance and includes it in their plans for moving merchandise.

The experience gained during the research work made possible the preparation of a manual on the management of a telephone order department. It has been used by telephone people while working with a number of department stores and has been found to be of considerable assistance in arriving at practical solutions to the various problems encountered.

Benefits to the General Public, to Department Stores, to the Telephone Companies

The general public depends more and more upon the telephone for purchasing. In addition to good merchandise at fair prices, they desire fast, courteous, accurate and dependable service. The help which telephone company representatives are giving to department stores makes it more likely that the public will receive such service. The stores will want to establish a reputation for providing a pleasing and dependable telephone service and will assign an adequate force of carefully chosen and properly trained people to telephone work.

The stores are assisted in availing themselves of and putting to profitable use the growing merchandising power of the telephone. It improves their service reputation with the increasing number of customers who pay their visits to stores by telephone.

The telephone companies benefit no less. If stores are convinced of the desirability of telephone orders, they will want to encourage customers to do business with them, and will provide adequate telephone facilities to handle this business to the customers' satisfaction. They will want to stimulate telephone orders by including directory advertising in their promotional planning.

This improved service reduces the number of times all trunks are busy, speeds up the answering of calls, reduces the number of transferred calls, and adds to the efficiency of the telephone arrangements generally. In one store, for example, on peak busy days all trunks to the store were busy as many as 13,000 times in a day. This, of course, caused difficulties in the telephone company's central office and reacted adversely on the telephone service generally. It was found possible to reduce the "busies" in this store about seventy per cent, in spite of an increase of thirty-five per cent in telephone order business. In another store, some customers were delayed as long as ten minutes after being answered by the store P.B.X. because all of the lines to the telephone sales clerks were busy. In this case the answering time of telephone clerks was reduced from an average of about three minutes to approximately ten seconds.

In addition, the provision of more telephone service and equipment—more trunks, more extension lines, more order-taking positions—brings a corresponding increase in revenues to the telephone companies. The increased calling from store customers also reflects itself in increased toll as well as local message revenue, since the calling is by no means confined to the local service areas. While such direct message revenue benefits may be more apparent in message rate areas, all places derive the unquestioned benefits which accrue to the telephone companies through the increase in the general value of telephone service which follows any extension of its usefulness to the public.

It is true that telephone company people are in no position to tell stores how to run their business. However, a telephone man who has taken the trouble to learn about the management and merchandising problems in department stores is in a much better position to serve as their communications adviser than if his knowledge were restricted to the functioning of telephone equipment. It is through such understanding of the other fellow's problems that telephone people can do a well-rounded job for any business concern—one which is mutually advantageous to the telephone company, its customer, and the general public.

F. Selwyn Gay

"Open House" at Hawthorne:

A Forward Step in Industrial Relations

DURING the last few years there has developed a growing realization that two factors, which are not yet fully appreciated by all of industry, stand out as important elements in our mass production age. One of these factors is the keen interest which exists on the part of the public in America's tools of production and in the men who operate them. The other is pride of craftsmanship.

That this pride, usually thought of in terms of the individual worker of an earlier and industrially less complex era, is still a characteristic of the American workman, even in mass-production industry, has become increasingly apparent as labor relations receive closer scrutiny. It was evident that such pride was seeking self-expression when a good many employees of the Hawthorne Works of the Western Electric Company requested permission now and again to bring their friends into the plant to see the shops, the equipment, and the various manufacturing processes. Out of the effort of the works management to meet these requests in an orderly and systematic way there grew last Spring—and grew beyond all expectation—the largest "open house" ever held by an industrial concern in this country.

Before the event was over—for it became an event and it lasted for two weeks—employees brought wives, husbands, friends and neighbors numbering more than 30,000 to see Western Electric at work. As the news spread, requests for permission to see what was going on at Hawthorne came from other thousands outside the circle of employees and their friends: from executives of the steel industry at Pittsburgh and the automobile industry at Detroit, from women's clubs and service-club groups, from clergymen and editors, from people in all walks of life in Chicago and its environs. Simply because of limitation of capacity, many of these requests had to be refused. An attendance of 3,000 on the opening night grew until on one evening more than double that figure was reached, and the number of visitors during the whole period, including 16,000 people outside the employee circle, totaled 46,000.

Impressive as that figure is, the significance of Hawthorne's "open house" lies not in numbers, but rather in the demonstration it afforded of the employees' attitude toward the work they do and where and how they do it; and equally in the interest shown by their friends and the public in seeing a large plant in operation and gaining a conception of industry's contribution to the national life.

The Public's Interest in Manufacturing Processes

Hawthorne's "open house" is, of course, not an isolated event. For some time there has been accumulating evidence that the public has a lively curiosity in those great workshops which typify our machine civilization, as witnessed by the eager attendance at various exhibits illustrating mass production methods. Plans of other industries for such exhibits at the New York World's Fair of 1939 reflect the drawing power which the displays of various manufacturers have exerted at previous expositions—Chicago's Century of Progress, the Great Lakes and San Diego Expositions, and others. Searching for an explanation of the popularity of exhibits such as these, showing men and machines at work, it must be concluded that it arises from the public's realization that in them it sees operating before its eyes the methods by which America has achieved its high standard of living. Possessed of material advantages envied the world over, Americans have developed a natural desire to see for themselves how science and industry transform raw materials into the finished articles which they daily use and enjoy.

Not content with setting up an exhibit illustrating an operation or two from its great and extensive processes, Western Electric invited the public in to see an entire section of its main factory in operation, with nearly two thousand employees working and scores of machines humming. The "open house" was not only the largest ever held by an industrial concern, but it marked an important step in the Bell System policy of acquainting the public with the operations necessary to furnish telephone service.

Acquainting Subscribers with Telephone Operations

The term "open house" as used in connection with the telephone is a familiar one to a fairly sizable and increasing portion of the public. During the last few years the operating companies of the Bell System have been throwing open their doors on scheduled days to public officials and business men, to church and civic groups, to subscribers and friends, and to the general public, asking them to "drop in and look us over." During 1937, an estimated total of 707,000 people attended such affairs in the Bell System.

Through these "open houses" the operating companies have been winning new friends for the Bell System and gaining among them a new appreciation of the part which telephone employees play in rendering a vital service. As one Western newspaper said, in commenting on the thousands of people who visited the local office, "they leave surprised and pleased, feeling that they have received an education, as they have, and go home with a better understanding of the huge enterprise and its problems."

Until Western Electric held its "open house" this Spring, those previously given in the Bell System centered in that part of the telephone industry most familiar to the public: the central office. Curious about the connecting link between the person calling and the person called, telephone subscribers are eager to get a glimpse of the many things that happen between the placing and the completion of a call. Thus, visitors at an Associated Company "open house" are usually guided through the central office from top to bottom, seeing en route the impressive equipment and the operations which enter into the handling of various types of calls. In addition, there usually is a suggestion of some of the other phases of work necessary to provide telephone service, such as exhibits of cable and wire, of linesmen's tools, of a cable splicer's cart, etc. Western Electric's "open house" was a logical step in continuing to acquaint the public with the Bell System, a step that went one pace further back to the source, showing how the equipment is manufactured.

Showing the Making of Cable and Handsets

Because the Hawthorne Works covers 200 acres and its buildings contain 3,000,000 square feet of floor space, it was impossible to show visitors the entire manufacturing facilities, so areas containing operations most easily understood were selected. In less than a mile of walking, visitors could view the manufacture of cable, from the rolling of copper rods to the reeling of the finished cable, and could see the manufacture of the combined handset, from the raw material to the packing of the finished product.

The operations represented only about ten per cent of Hawthorne's facilities and required approximately two hours to view. It took 1,700 employees to man the area, leaving about 13,000 to take their families, friends and neighbors through the plant. Those who worked before the public gaze were given special hours, coming on duty late in the afternoon and working until eleven o'clock at night.

Long before the doors opened to the public at 5:45 each evening, crowds of people lined up within the grounds of the plant, waiting to be admitted to the buildings. Then, throughout the evening, until eleven o'clock at night, came a steady stream of visitors.

There was no attempt to put on a "staged" performance, as far as manufacturing processes were concerned. Operations were carried out exactly as though the public were not present, and the crowd was allowed to see for itself what was going on. Although the management had been entirely prepared to absorb some loss of efficiency for the sake of letting the public enjoy their visit, the rate of production was not adversely affected by the sightseeing crowds.

A Route Was Mapped Out

As they came into the Works, visitors were handed a guide book which contained numbered paragraphs describing the operations similarly numbered by placards. By referring to the book, spectators were able to learn about the highlights of the processes they were witnessing. In addition, printed cards were used to identify the sequence of events in some of the more intricate operations. To enable the guests to get around easily, arrows pointed the way to the shops which were operating, and, once inside, the route was clearly marked by ropes and signs arranged so that traffic would flow evenly, and would pass the bests points of vantage with the least walking.

Some of the more spectacular processes, naturally, held the attention of the spectators longer than others, and at these the groups were asked to linger only a limited time so that the oncoming throngs could also have their turn. Many stood spellbound at seeing, for example, a 230-pound copper billet enter a huge furnace, emerge red hot, and writhe like a fiery snake through the rolling machines, finally coiling up into a quarter inch copper rod; and were fascinated to see the telephone itself being assembled so swiftly that the eye could scarcely follow.

Waiting to be Admitted: Some of the 46,000 People Who Visited the "Open House" at the Hawthorne Works

In This Shop, the Visitors in the Foreground Are Filing Past the Handset Assembly Lines; the Bay in the Center of the Picture Displays "Industrial Relations" Exhibits

Visitors Watch Intently as This Smiling Employee Operates a Machine Which Puts the Finishing Touches on Telephone Coils

Watching Phenol Plastic Presses which Transform Dust-like Resins into Glossy Telephone Parts Through Heat and Pressure. Note the Guide Books in Visitors' Hands

Also of interest to outsiders were the exhibits of the various Western Electric services for employees: charts showing the company's vacation, sickness, and benefit plans, its retirement schedules, and its policies on other phases of employee relations, and displays featuring safety goggles, safety shoes, and other precautionary devices used in the plant. These exhibits, as well as the results of safety guidance which are evident in the employees' conduct, made clear to visitors that the employees' well-being is of primary concern to Western Electric: that the industry has more than a pecuniary interest in the employee, and is endeavoring to keep him safe and sound not only in the plant but in the home and on the highway as well, for the good of the community as well as for the particular company for which he works.

The Plant Itself Made a Good Impression

The very physical aspect of the Hawthorne Works, with its well-kept lawn, dotted with flower beds, elicited favorable comments. Among them was that of a writer for the *Chicago Daily News,* who reported: "There was a sliver of a moon in the west last night and inside the big iron gates of the plant there was quiet. There were grass plots carefully groomed. There were well-paved streets and masses of ivy and the whole thing looked more like a college campus than an industrial manor. Lines of strolling couples wandered about, taking their time to enjoy the scene." Even the interior of the plant, well-lighted and clean, made a pleasant impression. That good housekeeping could be practiced in the factory as well as in the home pleased at least one woman, who was quoted in a newspaper as saying that she "wore white shoes and stockings and ended the long hike through the plant without a smudge on either."

There was evident throughout the "open house" the pride of the employees in the conditions under which they work, in the skill necessary to perform most of the operations, in the friendly attitude of workers and management. Their attitude served to confirm the belief that the cornerstone of good public relations is the feeling of employees toward their company. As citizens of the community, they proved to be the best spokesmen for Western Electric's policies.

Knowing that their friends and neighbors were looking on, the employees who stayed at their posts during the "open house" exhibited a like pride in performing their jobs. As Royal F. Munger, financial editor of the *Chicago Daily News,* said, in his column which was entirely devoted to the Western Electric affair: "It is just that strength of pride in trained knowledge and accomplishment . . . that is the best asset of American industry."

An Event of National Significance Industrially

Western Electric's "open house" attracted recognition nationally, and its significance to industry in general was widely recognized. Besides devoting its entire front page to pictures showing scenes inside the Hawthorne plant, the *Manufacturers News* made the following comment on Western's "open house":

"To anyone privileged to attend this unique, practical demonstration of coöperation between employer and employee, two observations are paramount in their interest. First, and very important, it would be impossible to arrange such a program in an orderly and successful manner without already having won fairly, and by every rule of the game, the employee's good will. The management is to be congratulated not only for planning and executing so successful a project, but for putting on a 'show' without it in the least appearing like one. The second impressive point observed was the wholehearted industry and application of the individual worker to his station and work. This attitude and performance on the part of each worker reflects the management's good work of the past years, for sustained, spontaneous interest must rest upon a secure foundation of good will."

Not only did all the Chicago dailies carry stories about the Western Electric industrial party, but newspapers in New York, Milwaukee, and other cities brought it to the attention of readers. In addition, articles or pictures about the "open house" were carried in such magazines of national circulation as *News Week, Advertising Age, Business Week, Electrical World,* and *National Safety News.*

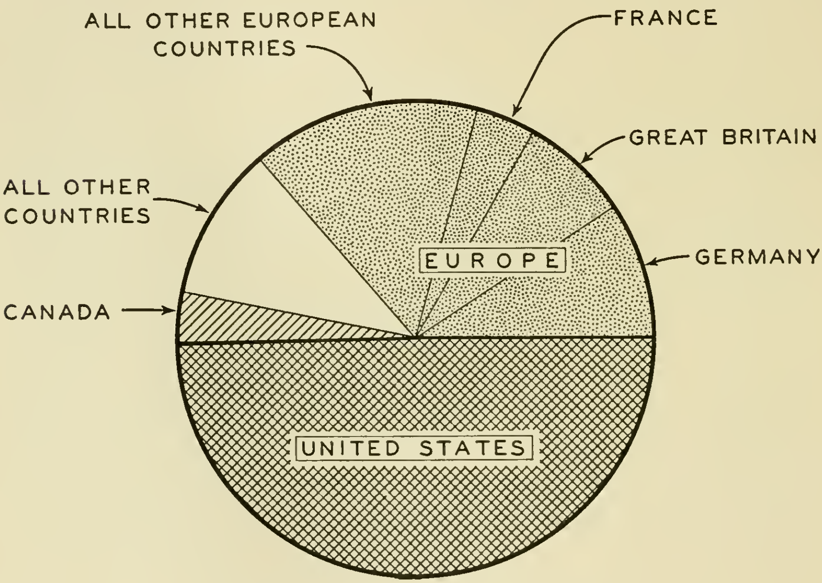
The deepest impression was made however, not upon those who read the cordial comments of editors, but upon the onlooker at Hawthorne who actually viewed the unfolding panorama of manufacture. Before his eyes he saw men and women and machines—the first two skilled, precise, alert, intent; the last truly remarkable for their fitness to their tasks—turning out some of the countless products upon which the greatness of modern America rests. In this case, the product was the telephone, and America's telephone system he knows is furnishing better service to more people than any system in any other country has been able to do. Having been an eye witness to the making of the telephone, he now understood another of the reasons for the high calibre of service it gives, and from this came the intimation that within the walls of other workshops, the country over, raw materials are similarly turned into products that give comfort and convenience and enjoyment—all contributing to the character of our civilization.

WILLIAM H. McGAUGHEY

World's Telephone Statistics

January 1, 1937

STATISTICS of the world's wire communications facilities, compiled each year by the Chief Statistician's Division of the American Telephone and Telegraph Company from information supplied by telephone and telegraph organizations in every country of the world, have recently been published in a pamphlet under the title "Telephone and Telegraph Statistics

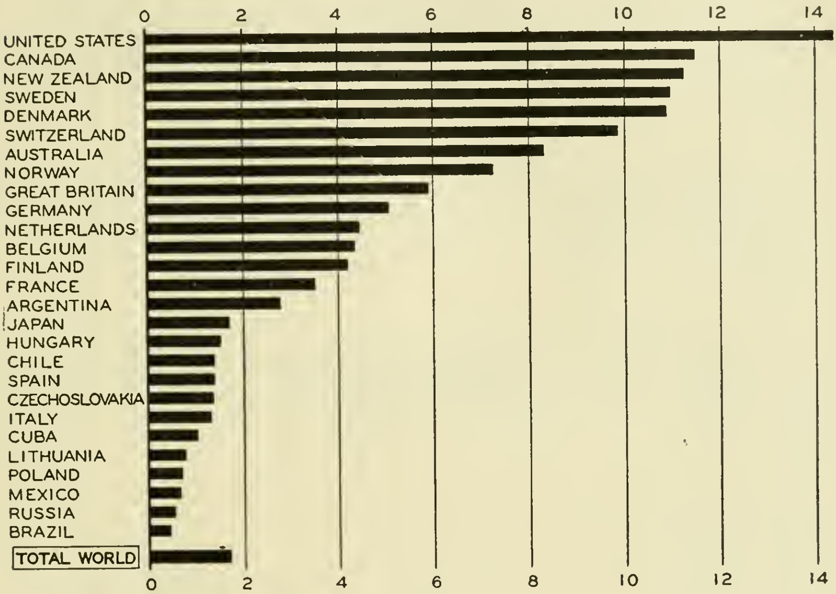


Distribution of the World's Telephones
January 1, 1937

of the World, January 1, 1937." Some of the outstanding facts shown by the tables and charts in this pamphlet are summarized in the following pages, all figures referring to the beginning of 1937 or, in the case of traffic data, to the year 1936.

World Totals

Of the 37,098,084 telephones in service throughout the world as of January 1, 1937, one-half, or 18,433,400, were in the United States *; one-third, or 13,513,152, were in Europe; and the remaining one-sixth of the world total were divided as follows: 1,690,978 in Asia, 1,519,023 in North and Central America outside the United States, 840,880 in Australia and



TELEPHONES PER 100 POPULATION
January 1, 1937

other islands in the Pacific Ocean, 765,435 in South America and 335,216 in Africa. Sixty-one per cent of the world's telephones were owned and operated by private companies, including some 4,105,353 privately operated telephones outside the United States, the remaining 39 per cent being operated by governmental agencies. Of the world total, 18,300,000 tele-

* The total number of telephones in this country is now estimated at 19,600,000.

TELEPHONE DEVELOPMENT OF THE WORLD, BY COUNTRIES

January 1, 1937

Countries	Number of Telephones: Government Systems	Private Companies	Total	Per Cent of Total World	Telephones Per 100 Population
NORTH AMERICA:					
United States	—	18,433,400	18,433,400	49.69%	14.39
Canada	194,624	1,071,604	1,266,228	3.41%	11.48
Central America	12,741	14,295	27,036	.07%	0.38
Mexico	1,337	123,442	124,779	.34%	0.66
West Indies—					
Cuba	610	43,972	44,582	.12%	1.02
Puerto Rico	531	14,272	14,803	.04%	0.84
Other W. I. Places	7,711	15,969	23,680	.06%	0.34
Other No. Am. Places	—	17,915	17,915	.05%	5.03
Total	217,554	19,734,869	19,952,423	53.78%	11.14
EUROPE:					
Austria	279,595	—	279,595	.76%	4.10
Belgium‡	361,685	—	361,685	.98%	4.34
Bulgaria	22,713	—	22,713	.06%	0.36
Czechoslovakia	207,287	—	207,287	.56%	1.36
Denmark†	17,323	391,552	408,875	1.10%	10.89
Finland	4,740	155,729	160,469	.43%	4.20
France	1,481,788	—	1,481,788	4.00%	3.51
Germany†	3,431,074	—	3,431,074	9.25%	5.08
Great Britain and No. Ireland	2,791,597	—	2,791,597	7.53%	5.93
Greece	8 083	30,092	38,175	.10%	0.55
Hungary	136,902	749	137,651	.37%	1.53
Irish Free State†	38,376	—	38,376	.10%	1.30
Italy	—	560,660	560,660	1.51%	1.31
Jugo-Slavia	55,314	—	55,314	.15%	0.36
Latvia†	71,769	—	71,769	.19%	3.64
Lithuania	19,588	—	19,588	.05%	0.78
Netherlands	382,173	—	382,173	1.03%	4.47
Norway**	127,212	83,396	210,608	.57%	7.26
Poland	133,782	111,142	244,924	.66%	0.71
Portugal	15,988	44,405	60,393	.16%	0.83
Roumania	—	70,678	70,678	.19%	0.36
Russia¶	950,000	—	950,000	2.56%	0.55
Spain*	—	341,390	341,390	.92%	1.38
Sweden	686,076	1,490	687,566	1.85%	10.97
Switzerland	412,324	—	412,324	1.12%	9.86
Other Places in Europe	86,480	—	86,480	.23%	1.62
Total	11,721,869	1,791,283	13,513,152	36.43%	2.35

South America:					
Argentina	—	348,184	348,184	.94 %	2.77
Bolivia	—	2,450	2,450	.007%	0.08
Brazil	1,924	220,058	221,982	.60 %	0.45
Chile	—	63,055	63,055	.17 %	1.38
Colombia	8,400	33,000	41,400	.11 %	0.42
Ecuador	3,750	3,000	6,750	.02 %	0.27
Paraguay	—	2,843	2,843	.008%	0.32
Peru	—	23,883	23,883	.06 %	0.36
Uruguay	21,000	13,500	34,500	.09 %	1.68
Venezuela	648	16,740	17,388	.05 %	0.51
Other So. Am. Places	3,000	—	3,000	.008%	0.55
Total	38,722	726,713	765,435	2.06 %	0.80
Asia:					
British India†	29,003	45,053	74,056	.20 %	0.02
China	85,000	92,000	177,000	.48 %	0 04
Japan†	1,197,129	—	1,197,129	3.23 %	1.70
Other Places in Asia	151,925	90,868	242,793	.65 %	0.14
Total	1,463,057	227,921	1,690,978	4.56 %	0.16
Africa:					
Egypt	56,579	—	56,579	.15 %	0.26
Union of South Africa†	169,419	—	169,419	.46 %	1.75
Other Places in Africa	107,186	2,032	109,218	.29 %	0.09
Total	333,184	2,032	335,216	.90 %	0.22
Oceania:					
Australia**	562,868	—	562,868	1.52 %	8.31
Hawaii	—	27,581	27,581	.08 %	6.95
Netherlands East Indies	38,098	3,831	41,929	.11 %	0.06
New Zealand†	178,599	—	178,599	.48 %	11.25
Philippine Islands	1,256	24,195	25,451	.07 %	0.18
Other Places in Oceania	4,124	328	4,452	.01 %	0.19
Total	784,945	55,935	840,880	2.27 %	0.89
Total World	14,559,331	22,538,753	37,098,084§	100.00 %	1.71

* January 1, 1936.
** June 30, 1936.
# February 28, 1937.
† March 31, 1937.
¶ U.S.S.R., including Siberia and Associated Republics. (Estimated)
§ Includes approximately 18,300,000 automatic or "Dial" telephones, of which about 43% are in the United States.

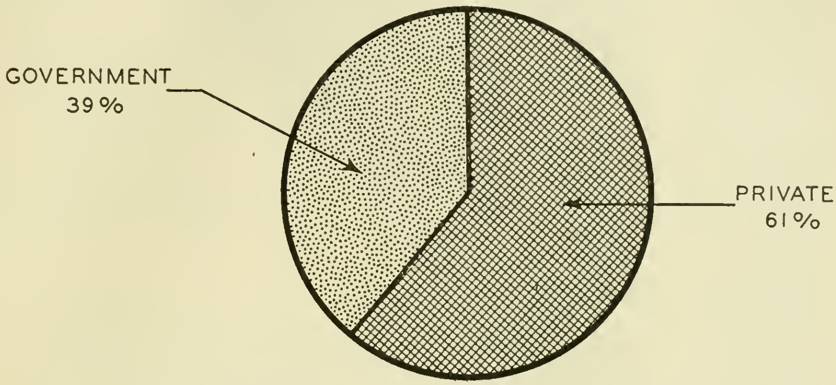
phones, including 7,825,000 in the United States, were dial telephones connected to machine switching exchanges.

The world's aggregate wire mileage for communication purposes, 169,589,500 miles, is enough to circle the globe 6,810 times. Some 96 per cent of this wire is used for telephony, more than half of it in the United States and a third in Europe. The remaining 4 per cent of the total wire mileage is devoted to telegraph service.

Comparative Development by Countries

In measuring the comparative extent of telephone facilities, the number of telephones in service is commonly related to the population served. Such a measure is shown in the table "Telephone Development of the World, by Countries" and the accompanying chart entitled "Telephones per 100 Population." It will be seen that the United States, with one-half the world's telephones but only 6 per cent of the world's population, has nearly 16 times the telephone density of the rest of the world—14.39 telephones per 100 population as compared with 0.91. The average telephone development of Europe is equivalent to only 2.35 telephones per 100 inhabitants; that of the world as a whole is 1.71.

The largest telephone system outside the United States is in Germany, which has 3,431,074 telephones, or 5.08 for each 100 of the German population. Next in order come Great Britain and Northern Ireland, with 2,791,597 telephones, or 5.93 for every 100 inhabitants; France, with 1,481,788 telephones, or 3.51 per 100 population; Canada, with 1,266,228 telephones, or 11.48 per 100 population; and Japan, with 1,197,129 telephones, or 1.70 per 100 population. These five countries account in the aggregate for 27 per cent of the world total, their average development being 4.28 telephones per 100 population. In the remainder of the world, outside the United States and these five other countries with over 1,000,000 telephones each, were 23 per cent of the world's telephones, the average development being 0.47 per 100 population. In addition to the United States and Canada, only three countries had better than one telephone for each 10 of the population, viz., New Zealand with 11.25, Sweden with 10.97 and Denmark with 10.89 per 100 population.

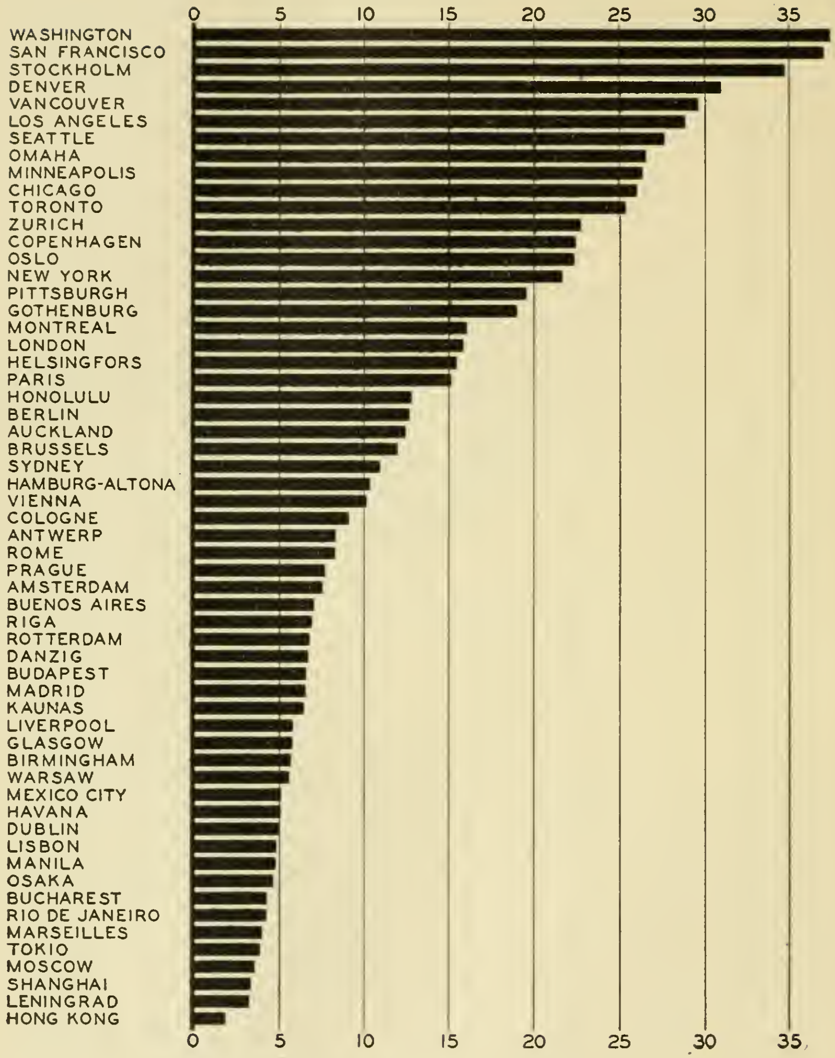


OWNERSHIP OF THE WORLD'S TELEPHONES
January 1, 1937

TELEPHONES IN LARGE CITIES

New York City on January 1, 1937, had 1,569,337 telephones, more than any other city in the world and, in fact, almost as many as Berlin, London and Paris combined. Chicago, with over 900,000 telephones, had more than twice the 428,844 telephones in Paris. The ten largest cities in the United States had more telephones than any single foreign country and more than France and Great Britain combined.

In point of relative telephone development, Washington, D. C., leads the cities of the world, with 37.43 telephones per 100 inhabitants, followed closely by San Francisco with 37.00. San Francisco's 262,733 telephones exceed the combined telephone facilities of China and British India, which together contain 40 per cent of the entire population of the world. Highest



Telephones per 100 Population of Large Cities
January 1, 1937

among foreign cities in telephone development is Stockholm, with over one telephone to every three people. With the exception of Stockholm, telephone facilities in the world's best known foreign cities are far below American standards, as witness London whose 657,235 telephones correspond to only 15.82 per cent of the population, Paris with 15.13 per cent and Berlin with 12.67 per cent.

Telephones in Large and Small Communities

That telephone development in this country is relatively high regardless of the size of communities is indicated by the following figures, showing average telephone density in United States communities graded by number of inhabitants:

	Telephones Per 100 Population
10 cities with over 1,000,000 population	21.60
10 cities with 500,000 to 1,000,000 population	21.97
34 cities with 200,000 to 500,000 population	19.28
All communities with 50,000 to 200,000 population	17.98
All communities with less than 50,000 population	10.33

It will be seen that, while greater telephone density prevails in the larger cities, resulting primarily from greater concentration of business activities therein, the average telephone density in the smaller towns and rural areas—the places with less than 50,000 population—exceeds one telephone for every ten people. This telephone development in the more sparsely settled areas of the United States is higher than that found in all but two European countries in their entirety, and even exceeds the telephone development of important capital cities such as Budapest, Moscow, Prague, Rome, The Hague, Tokio, Vienna and Warsaw. The total number of telephones serving these smaller American communities exceeds the aggregate number of telephones in France, Germany and Great Britain.

No city in this country contains as much as nine per cent of the total number of telephones in the country. Abroad, however, the tendency seems to be toward concentration of the ex-

TELEPHONE DEVELOPMENT OF LARGE CITIES
January 1, 1937

Country and City (or Exchange Area)	Estimated Population (City or Exchange Area)	Number of Telephones	Telephones Per 100 Population
ARGENTINA:			
Buenos Aires	3,040,000	213,428	7.02
AUSTRALIA:			
Adelaide	317,000	32,204	10.16
Brisbane	313,000	31,255	9.99
Melbourne	1,018,000	119,000	11.69
Sydney	1,267,000	138,908	10.96
AUSTRIA:			
Graz	153,000	11,657	7.62
Vienna	1,877,000	190,192	10.13
BELGIUM:#			
Antwerp	529,000	44,310	8.38
Brussels	984,000	117,900	11.98
Liege	422,000	26,913	6.38
BRAZIL:			
Rio de Janeiro	1,850,000	78,402	4.24
CANADA:			
Montreal	1,060,000	170,037	16.04
Ottawa	191,000	37,634	19.70
Toronto	787,800	199,727	25.35
Vancouver	190,000	56,317	29.64
CHILE:			
Santiago	829,000	30,351	3.66
CHINA:			
Hong Kong	870,000	16,054	1.85
Shanghai††	1,660,000	56,020	3.37
CUBA:			
Havana	706,000	35,752	5.06
CZECHOSLOVAKIA:			
Prague	950,000	73,057	7.69
DANZIG:			
Free City of Danzig	275,000	18,432	6.70
DENMARK:			
Copenhagen	856,000	191,908	22.42
FINLAND:			
Helsingfors	275,000	42,607	15.49
FRANCE:			
Bordeaux	260,000	21,591	8.30
Lille	202,000	17,544	8.69
Lyons	655,000	37,561	5.73
Marseilles	920,000	36,507	3.97
Paris	2,835,000	428,844	15.13
GERMANY:†			
Berlin	4,258,000	539,662	12.67
Breslau	624,000	45,182	7.24
Cologne	762,000	69,492	9.12
Dresden	800,000	68,764	8.60
Dortmund	577,000	26,180	4.54
Essen	672,000	33,139	4.93
Frankfort-on-Main	651,000	64,252	9.87
Hamburg-Altona	1,630,000	168,322	10.33
Leipzig	757,000	68,577	9.06
Munich	844,000	86,718	10.27
GREAT BRITAIN AND NO. IRELAND:†			
Belfast	415,000	21,585	5.20
Birmingham	1,248,000	71,043	5.69
Bristol	443,000	27,047	6.11
Edinburgh	457,000	40,495	8.86
Glasgow	1,130,000	64,761	5.73
Hull	352,000	22,166	6.30
Leeds	487,000	32,399	6.65
Liverpool	1,249,000	72,433	5.80
London—(City and County of London)	4,155,000	657,235	15.82
Manchester	995,000	64,362	6.47
Newcastle	516,000	24,571	4.76
Sheffield	512,000	24,966	4.88
HAWAII:			
Honolulu	147,000	18,818	12.80
HUNGARY:			
Budapest	1,400,000	92,027	6.57
Szeged	140,000	2,209	1.58
IRISH FREE STATE:†			
Dublin	472,000	23,412	4.96

TELEPHONE DEVELOPMENT OF LARGE CITIES (Concluded)
January 1, 1937

Country and City (or Exchange Area)	Estimated Population (City or Exchange Area)	Number of Telephones	Telephones Per 100 Population
ITALY:			
Milan	1,114,000	95,097	8.54
Naples	875,000	28,283	3.23
Rome	1,179,000	98,147	8.32
JAPAN:†			
Kobe	938,000	40,564	4.32
Kyoto	1,107,000	46,903	4.24
Nagoya	1,120,000	39,969	3.57
Osaka	3,102,000	144,494	4.66
Tokio	6,086,000	236,228	3.88
LATVIA:†			
Riga	388,000	26,903	6.93
LITHUANIA:			
Kaunas	107,000	6,906	6.45
MEXICO:			
Mexico City	1,410,000	71,466	5.07
NETHERLANDS:			
Amsterdam	783,000	59,209	7.56
Haarlem	168,000	13,317	7.93
Rotterdam	621,000	41,895	6.75
The Hague	529,000	51,024	9.65
NEW ZEALAND:†			
Auckland	207,000	25,859	12.49
NORWAY:**			
Oslo	250,000	55,967	22.39
PHILIPPINE ISLANDS:			
Manila	425,000	20,316	4.78
POLAND:			
Lodz	960,000	16,621	1.73
Warsaw	1,320,000	73,672	5.58
PORTUGAL:			
Lisbon	670,000	32,504	4.85
ROUMANIA:			
Bucharest	800,000	34,055	4.26
RUSSIA:*			
Leningrad	3,100,000	99,463	3.21
Moscow	4,100,000	144,669	3.53
SPAIN:*			
Barcelona	1,110,000	55,569	5.01
Madrid	1,015,000	66,148	6.52
SWEDEN:			
Gothenburg	263,000	50,026	19.02
Malmö	144,000	24,275	16.86
Stockholm	452,000	157,220	34.78
SWITZERLAND:			
Basel	153,000	35,258	23.04
Berne	115,000	27,552	23.96
Geneva	149,000	28,748	19.29
Zurich	277,000	62,955	22.73
UNITED STATES: (See Note)			
New York	7,238,000	1,569,337	21.68
Chicago	3,460,000	900,653	26.03
Los Angeles	1,365,000	394,403	28.89
Pittsburgh	1,031,900	201,935	19.57
Total 10 cities over 1,000,000 Population	22,274,800	4,811,304	21.60
Milwaukee	781,000	147,816	18.93
San Francisco	710,000	262,733	37.00
Washington	572,500	214,308	37.43
Minneapolis	511,000	134,563	26.33
Total 10 cities with 500,000 to 1,000,000 Population	6,623,100	1,455,118	21.97
Seattle	420,600	116,238	27.64
Denver	312,500	96,737	30.96
Omaha	242,900	64,553	26.58
Hartford	241,200	59,382	24.62
Total 34 cities with 200,000 to 500,000 Population	10,471,700	2,018,965	19.28
Total 54 cities with more than 200,000 Population	39,369,600	8,285,387	21.05

NOTE: 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 groups.

* January 1, 1936.
** June 30, 1936.
\# February 28, 1937.
† March 31, 1937.
†† International Settlement and French Concession.

TELEPHONE DEVELOPMENT OF LARGE AND SMALL COMMUNITIES

January 1, 1937

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 Communities of 50,000 Population and Over	Telephones Per 100 Population: In Communities of less than 50,000 Population
Australia**	G.	341,200	221,668	10.41	6.34
Austria	G.	216,982	62,613	9.85	1.36
Belgium#	G.	254,977	106,708	7.15	2.24
Canada	P. G.	689,594	576,634	19.35	7.73
Czechoslovakia	G.	106,263	101,024	5.99	0.75
Denmark	P.	216,663	192,212	20.08	7.18
Finland	P.	60,007	100,462	12.00	3.03
France	G.	818,517	663,271	7.72	2.12
Germany†	G.	2,232,749	1,198,325	7.84	3.07
Great Britain and No. Ireland†	G.	2,062,000	798,000	7.65	3.97
Hungary	G.	104,007	33,644	4.92	0.49
Japan†	G.	805,735	391,394	3.64	0.81
Netherlands	G.	246,768	135,405	6.99	2.69
New Zealand†	G.	74,111	104,488	13.19	10.19
Norway**	P. G.	83,707	126,901	20.62	5.09
Poland	P. G.	145,810	99,114	2.79	0.34
Spain*	P.	211,528	129,862	4.07	0.66
Sweden	G.	267,151	420,415	24.76	8.10
Switzerland	G.	188,550	223,774	21.04	6.81
Union of South Africa†	G.	104,082	65,337	7.42	0.79
United States	P.	10,581,802	7,851,598	20.31	10.33

Note: P. indicates that the telephone service is wholly or predominantly operated by private companies, G. wholly or predominantly by the Government, and P. G. by both private companies and the Government. See first table.

* January 1, 1936.
** June 30, 1936.
# February 28, 1937.
† March 31, 1937.

isting telephone facilities in the larger towns and cities. Thus, over 23 per cent of all British telephones are found in the city and county of London, while there are more than 25 people to each telephone in the less populated British communities; Berlin accounts for over 15 per cent of all German telephones, in contrast to a small town development of 31 people per telephone; 29 per cent of all France's telephones are concentrated in Paris, whereas there are 47 people on the average for each telephone in French communities with less than 50,000 population.

Telephone Traffic

With access to some 93 per cent of the world's telephones, currently estimated at close to 40 million, telephone users in the United States completed approximately 27 billion local and long distance conversations during the year 1936. This corresponds to 850 messages per second and to 210 messages per average capita. Available statistics indicate an annual calling rate of only 12½ telephone conversations per average capita in the rest of the world, indicating that in this country the telephone is approximately 17 times more useful than appears to be the case elsewhere in the world.

K. Fick

BELL TELEPHONE QUARTERLY

VOL. XVII OCTOBER, 1938 NO. 4

THE BELL SYSTEM MEETS ITS GREATEST TEST

FUNDAMENTALS OF A PUBLIC RELATIONS
PROGRAM FOR BUSINESS

TWENTY YEARS OF CARRIER TELEPHONY

WORLD'S FAIRS AND BELL SYSTEM EXHIBITS

AMERICAN TELEPHONE & TELEGRAPH CO. • NEW YORK

Bell Telephone Quarterly

A Medium of Suggestion and a Record of Progress

CONTENTS FOR OCTOBER 1938

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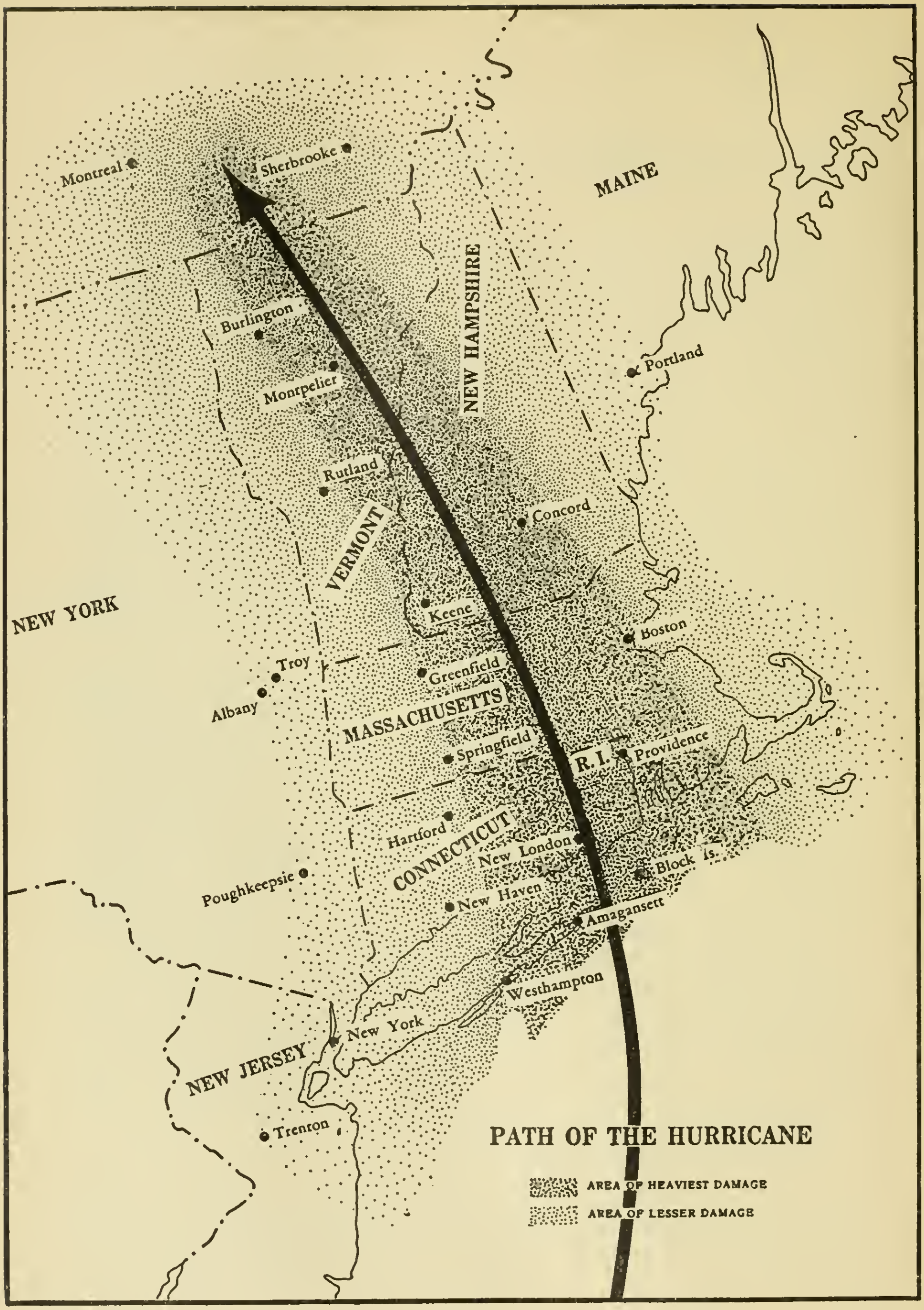
The Bell System Meets Its Greatest Test

Editor's note: Again the Bell Telephone Quarterly *recounts the prompt and effective functioning of the Bell System, through its integrated organization, in meeting the challenge of a wide-spread disaster. In previous issues have appeared "Mobilizing for the Fight Against Sleet," January, 1925; "The Telephone's Part in the Mississippi Flood Fight," July, 1927; "The Bell System Fights the Floods," April, 1936; and "Meeting the Challenge of Sleet and Flood," April, 1937.*

To obtain background for the following article, the author left New York for the area most critically damaged by the hurricane which struck the northeastern states on September 21 as soon as highways were reported passable, and drove through Connecticut, Rhode Island, Massachusetts, the southern part of New Hampshire, and a section of Vermont.

HURRICANE. FLOOD. TIDAL WAVE. FIRE. These are the Four Horsemen of Destruction which Nature turned loose last month to ride in swift fury across the north-eastern part of this country. Behind them they left stricken some of the most thickly populated and highly industrialized sections of the nation, and some of the most beautiful. While not at any one time and place did all four march flank to flank, their path—whether singly, paired, or three abreast—was marked by loss of life (the toll now approaches 700); by destruction of homes and property; by damage to business and industrial structures, to utility plants and systems, to rural and agricultural areas, to every means of communication. Where went these forces, there devastation never before experienced in that part of the world remained.

There remained, inevitably, a wreckage of telephone plant which confronted the Bell System with the greatest test it has ever been called upon to face: a test of its organization, of its


Montreal
Sherbrooke
MAINE
NEW HAMPSHIRE
Burlington
Montpelier
Portland
Rutland
Concord
VERMONT
NEW YORK
Keene
Boston
Troy
Greenfield
Albany
MASSACHUSETTS
Springfield
R.I.
Providence
Hartford
CONNECTICUT
New London
Block Is.
Poughkeepsie
New Haven
Amagansett
Westhampton
New York
NEW JERSEY
Trenton
PATH OF THE HURRICANE
AREA OF HEAVIEST DAMAGE
AREA OF LESSER DAMAGE

men and women, of its resources of equipment and supplies—of its ability to keep lines of communication open under inconceivably difficult circumstances and to restore the service over a vast territory as quickly as the recuperative powers of a nation-wide System make possible.

The meeting of that test is the story which the following pages try—most inadequately—to tell.

What Happened In and To Eight States

There was, to begin with, rain. It came down intermittently at first, then steadily, for several days—beginning, in New England and eastern New York, on Saturday night, September 17. Suddenly—unexpected, unforeseen—there were, along the hilly watersheds, floods. Tributaries spilled their overflow into every low place, hurried their bulk of racing water into the bigger rivers of the region, and, almost over night—there was a flood. Strangely, it was the "little rivers"—the lovely New England streams beloved of trout-fishermen—which did the great share of the damage. Throughout this upper New England area, the height of water and the damage done by these lesser streams greatly exceeded that of the record flood of 1936.

By contrast, the two great rivers of New England, the Connecticut and the Merrimac, behaved with somewhat greater decorum. They overflowed far and wide. They flooded low-lying towns and parts of cities. Their high water caused great damage. But—neither came within two to three feet of reaching the crests of their 1936 floods, which were so extremely destructive. And the communities along their banks, many of them, had learned a lesson from their previous experience and were better prepared to cope with the high water.

Meanwhile, and far from all this, trouble of another kind was brewing.

Out somewhere off the West Indies a tropical hurricane came into being. On September 18 the Weather Bureau announced its birth, predicted its rate of progress in a generally westerly direction, emphasized its severity. Three days later, on the afternoon of September 21, that hurricane, having traveled a path outside all the experience of the Weather Bureau and increasing in violence as it went, struck the north-eastern Atlantic seaboard.

Its center of greatest violence passed over the central and eastern part of Long Island, struck the New England coast in the general area between Saybrook, Conn., and Westerly, R. I., progressed northward over eastern Connecticut and western Massachusetts into New Hampshire, in that state veered slightly to the west across upper Vermont, entered Canada apparently in the region between Montreal and Quebec, and passed thence into the wilderness above—and out of this picture. Sustained wind velocities of from 90 to 120 miles per hour were reported at various points, and at the Blue Hill observatory of Harvard University, just outside Boston, a gust of 186 miles per hour was registered.

This was the path of the *center* of the storm. Its total extent was, of course, widespread. Winds of gale force extended roughly from the northern shore of New Jersey to Cape Cod, along the seaboard, and covered a like area as the storm proceeded north. With them they brought torrential rains to add to the already flooded streams.

It was this wind, this monstrous, invisible power, which did most of the damage over the greater part of the afflicted territory. It unroofed, overturned, demolished people's homes. It seriously damaged substantial structures. It blew down trees. From New Jersey to Maine, that is the characteristic mark of the hurricane: trees down. And, seemingly, every second tree which fell, in its falling tore loose telephone drop wire, ripped through open wire lines, knocked poles down, or bore cable to the ground.

As if not satisfied with what havoc it could create alone, the hurricane brought with it a tidal wave,* its height variously estimated at from 15 to 30 feet and of force immeasurable, to ravage and inundate the seacoast from Long Island and central Connecticut to the tip of Massachusetts. In many places it left the coast line almost unrecognizable. It completely erased whole shore communities. Wherever its resistless might struck, the tidal wave carried devastation on its crest. Linked as it was with the worst of the hurricane, the conditions which followed its recession are indescribable.

Fire was purely localized tragedy, of course. Springing to life among heaps of wreckage or in wind-shattered buildings, it threatened in several communities, large and small, to become holocaust. In each locality so endangered, the fear of conflagration increased the confusion, the uncertainty, the sense of hazard. From the telephone standpoint, fire peaked higher the traffic load at local switchboards, melted a cable here and there, complicated still further the task of restoration: relatively, minor difficulties in the vast whole of trouble.

That, then, is such picture as hasty words may give of what can happen in and to eight states when, in the course of a few days, they are visited by hurricane, flood, tidal wave, fire.

Half a Million Telephones Were Silenced

"The hurricane of September 21 in the northeastern states brought the greatest damage to outside plant and caused the largest number of service interruptions in the history of the Bell System." These somber words, amplified later in the same paragraph by reference to flood and tidal wave, open an official report on the situation disclosed by an early survey of the territory. Later information, as received day by day, served not to modify but to intensify the import of that first sentence.

* According to the U. S. Weather Bureau, this was not a true tidal wave but a "storm wave," compounded out of low atmospheric pressure, high tides, the pressure of the wind, and the cumulative power of advancing and receding waves. The effect was that of a tidal wave and it is generally so described.

Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey—these are the states affected in greater or less degree. They are served by four Bell telephone companies: New England Telephone and Telegraph Company, The Southern New England Telephone Company, New York Telephone Company, New Jersey Bell Telephone Company. The trunk routes through this region are furnished and operated by the Long Lines Department of the American Telephone and Telegraph Company. Statistics can show only the barest outline, the skeleton, of the story; but they may give some indication of what happened to those companies and in those states.

In New Jersey, 35,000 telephones were out of service. In New York the number was 56,000, of which 30,000 were in the Long Island Area and 15,000 in the Upstate Area. Connecticut's loss was 105,000. In the rest of New England the out-of-service report reached a disheartening total in excess of 300,000. For the two New England companies, the telephones "out" amounted to approximately 25 per cent of their combined total telephones. Numerically, the telephones out of service in the four companies came to about half a million.

One of the most discouraging aspects of the restoration problem was that at certain times and places the number of telephones made working was seemingly almost equaled by the number newly reported "out." The New England Company has record, for instance, of 79,000 stations "out," after the hurricane, because of wires broken and working cables severed during highway clearance operations and the removal of trees from private property. Some days after the disaster, rain seeped into damaged cables and put another 12,000 telephones on the trouble report. Restoration of local service was for a time a Sisyphean undertaking.

Station loss is one measure of the situation. It tells only by implication of the damage to drop wire and to local, toll, and Long Distance open wire and cable. With the first task at hand that of patching, of running twist, of affording the quickest means somehow, anyhow, by which the messages might go through, there was no time for that sort of count. One revealing figure, however, is that of the Southern New England Company, whose early estimate was that in Connecticut upwards of 3000 separate splices of cable would have to be made. The two New England companies saw immediate need for more than 20,000 poles; the two adjoining companies to the south for another thousand or more.

Electric light and power lines suffered in the same way as did outside telephone plant. Forty-nine out of the Southern New England Company's 85 central offices, for instance, were without commercial power for longer or shorter periods. But because of long-standing emergency preparations, no messages failed to go through solely for lack of power. In some instances where power failure was temporary, the batteries held up. In others, permanently installed emergency gasoline engines saved the day. In other cases, gasoline motor generators and welding machines, arranged for long since against the need, were rushed to the central offices both of the Associated Companies and of the Long Lines Department, sometimes behind the screaming siren of a police motorcycle. More than one central office operated for a week or longer on batteries charged by such emergency apparatus which thundered on, day and night, outside the building.

Traffic, it scarcely need be said, leaped upward to new peaks even as the wires to carry it decreased to half or less at many points and—in some particularly hard-hit communities—practically to zero. Some random notes on traffic—telling of anxiety over loved ones, of the need for help, of reassurance, of the search for information on the part of individuals, public officials, relief organizations, of all the questions and answers and bad news and good which catastrophe creates—may show something of the situation at the switchboards.

Local traffic in New York City, Westchester and suburban New Jersey was far above normal immediately following the hurricane, as it was in such places as New Haven, Hartford, New London, Providence, Worcester and Boston. Just the opposite was the case in Littleton, Keene, Peterboro, Winchedon, Narragansett and some 170 other towns and small cities which were isolated and at which a large percentage of the telephones were out of order. Here the problem was that of handling emergency conditions rather than heavy traffic. All service was terminated in several towns when the central offices had to be abandoned because of damage to them by flood.

Long Lines traffic in New York City reached an all-time high on Friday, September 23, when 53,600 calls were recorded—an increase above normal of 40 per cent. Toll traffic in places suburban to New York was nearly double the normal average for several days.

Long distance traffic in New England was double normal in most places. In Boston, on the day after the hurricane, 42,600 calls were recorded, also an all-time high and 130 per cent over normal. Due to the heavy traffic and the loss of toll circuits, completion in Boston reached a low of 52 per cent on September 23.

The A, B, and C cables between New York and Boston—the "underground" backbone of Eastern seaboard communication—failed on Wednesday morning (before the hurricane, be it noted) when a normally well-behaved stream went berserk and demolished a bridge at Atwoodville, Conn., a few miles above Willimantic, which carried the cables across. A section of an important route between Norwich, Conn., and Providence, R. I., was practically demolished, as was the New Haven-Providence line which runs along the shore, mainly by falling trees. The Springfield-Albany cable and the most important cable route entering Vermont were severed when a bridge over the Connecticut River at Chicopee Falls was carried away. Lines entering Vermont from New Hampshire were also down. So many cities and towns in these two states were temporarily without service that both were for a time virtually "off the map," telephonically speaking. A bridge washed out at Wareham, Mass., and severed cable communication with the western part of Cape Cod.

Meeting the Challenge of Catastrophe

That summary can do little more than suggest the crisis in New England's telephone service which one day in late September brought. To relate in any detail the ramifications of the whole problem of reconstruction and recovery, to do more than touch upon the infinity of obstacles faced and overcome, to attempt to portray the universal response of employees, in the true spirit of service, to the challenge of catastrophe, is beyond the limits of space—and time—of this article. As in every disaster, there are certain events, certain circumstances, which stand out sharply focussed in the foreground. To include a few of these here may serve to make the picture more vivid, although still far less than complete.

Every telephone man and woman can picture without difficulty the immediate reaction of the Bell System men and women throughout the entire endangered territory. Soon as trouble became apparent, operators off duty and those on leave returned to their central offices, reported, took places at the switchboards—all as a matter of course. Former operators volunteered everywhere, were welcomed and put to work. Operators due for tours of duty braved floods, dodged falling trees, struggled against the hurricane, to reach their posts. Very many arrived late, buffeted, water-soaked, exhausted—but they arrived. These soldiers of the switchboard gave no thought to time, refused to go home, snatched a few hours' rest and again took up their cords. Calmly they worked as buildings shook in the wind, as great trees crashed around them, as menacing waters rose nearer.

So, too, their brother workers gave of themselves without limit. Plant forces knew no hours. Beside them worked commercial employees—salesmen, business office representatives, any who could be of help. Test desks were key points; there all who knew the work responded to the need, and for days and nights the posts were manned to the limit of the equipment. Engineers took to the field with the plant crews. Paymasters with cash in hand set up offices at central locations. Men from the Accounting Department went out to relieve foremen and supervisors of time-consuming detail. Many a subscriber was startled to receive a masculine response to a request for "Information."

Nowhere, nor at any time, was there hysteria, confusion, or discouragement. This was the worst thing that had ever happened in New England—they knew that, these telephone folks; but though their shoulders might be bowed under double loads, their chins were up!

Many telephone buildings served as havens of refuge from terror and peril, especially for people in the smaller towns, and also were put to temporary service as Red Cross stations and as headquarters for relief organizations.

New London, Conn., was desperately crippled. A large brick armory next to the telephone building was blown to pieces. Fire followed the hurricane and tidal wave and raged unchecked to within a block of the central office, where a telephone truck was kept ready to batter down the back fence if at the last moment flames blocked all other avenues of escape.

Providence, R. I., located at the head of Narragansett Bay, was hardest hit of all of New England's big cities. Not only was the force of the hurricane severe; in the low-lying commercial and industrial section, the flood waters of the tidal wave rose six to eight feet above sidewalk level, surging through the first floors of stores, office buildings—all the important central structures of a metropolis. The resultant havoc was beyond description. All normal activities were completely suspended for several hours, and the task of pumping out basements continued for days.

When the Connecticut River rose to its highest crest on record, in 1936, water filled the basements of the two main telephone buildings in Hartford, Conn., and flooded the first floor of one to a depth of several feet. Batteries and associated power equipment were drowned and telephone service in much of the city was disrupted for several hours. The Southern New England Telephone Company subsequently moved the power plant upstairs, reinforced and waterproofed the basement of the building nearest the river and built removable water-tight bulkheads for all its ground-floor doors and windows. When the Connecticut's rising waters again threatened the building, business-office records were moved to upper floors, and the bulkheads were put in place and caulked. The river rose to within about two feet of its 1936 level—and thus several feet above the window-sills on the ground floor—but the bulkheads held it out. Telephone damage in Hartford last month due solely to high water was, in comparison with 1936, slight.

When the bridge at Chicopee Falls, Mass., succumbing to angry waters, took important cables down stream with it, various means were attempted to get a line across the torrent. These failing, the Long Lines men on the job appealed to the Coast Guard. Soon there arrived by airplane from Rockaway, L. I., a Chief Boatswain's Mate and, with him, a Lyle gun—the device used to shoot a line to a shipwrecked vessel. Standing on the bridge approach, he loaded, aimed, fired. The projectile easily cleared the 700 feet of turbulent river, landed safely on the other side; the light line it carried was intact. With this, rope was pulled across, to be followed in turn by wire and then by strand. Soon linemen were riding this to patch in twist for temporary circuits. By morning, a new section of cable, placed and spliced, was supported high above the roaring river. The Coast Guard performed a similar service at a smaller stream near Occum, Conn., using a shoulder gun instead of the cannon type.

There was river trouble in upper New York State too, as well as in New England. In addition to the smaller streams which caused typical damage, the flooded Mohawk River provided opportunity for ingenious and courageous maintenance work west of Amsterdam. When the approach to a bridge which carried New York-Buffalo cables was washed out, construction forces during one night erected supporting fixtures for a catenary span, and, when the strand was in place, again crossed the river tying the cables to it.

Radio telephone service played an interesting and important part in bridging gaps in telephone service.

The ultra-short-wave radiotelephone service between the New England Company's radiotelephone station at Green Harbor, Mass., and Provincetown afforded the only telephone communication between Cape Cod, from Provincetown to Hyannis, and the rest of the world. Portable short-wave equipment provided for emergency use after the 1936 floods was used to establish telephone communication between Block Island and the mainland. Other portable equipment, some of it flown up from Florida, provided a link between Boston and Keene, N. H., and other points in that state. These emergency radio circuits carried a heavy load of traffic, which averaged better than 50 messages a day—and reached peaks of more than 100—until physical circuits were restored. Over the Keene-Boston radio link a call was successfully completed to San Bernadino, Cal.

To the handling of long distance calls into the affected area an important contribution was made by the Long Lines Traffic Control Bureau at New York. This bureau has the dual responsibility of keeping track of the condition of all telephone circuits in the northeast and of redistributing the traffic in such a way as to keep the flow even over the various routes. This may mean detouring calls around crippled or congested lines; often it means anticipating breaks or a sudden flow of calls. At all times it calls for a skill and alertness to act instantly on every development.

The minute a traffic problem arises—as it did so quickly and so greatly on September 21 and the difficult days thereafter—this bureau goes on 24-hour duty. On this occasion its staff saw little rest; but, thanks to the skill they had developed and the foresight with which their arrangements were made, there was not a working line into New England which did not carry its full share of the heavy load that flowed through that region.

Help Rolls In from Near and Far

Invaluable as were the countless temporary and emergency measures which were everywhere undertaken—often before the tempest had ceased its attack or high water appreciably subsided—there yet remained the tremendous requirement of repairing and rebuilding hundreds upon hundreds of miles of communication lines, of restoring hundreds of thousands of telephones to service.

This was the staggering task, the unexampled challenge, which faced the Plant Departments of the Bell companies in New England, New York, New Jersey. To it they summoned their resources of man-power, knowledge, skill. Grimly they accepted the challenge Nature had flung at them—but with calm confidence.

Regular plant forces of these companies swung into action at the first signs of trouble. That goes without saying. Then, as what had actually happened to outside plant in New England was realized, plant forces there were quickly augmented: by former plant men, now in other departments, drafted back to their old jobs; by former employees who responded to the call; by contract gangs; and, of course, by local men hired temporarily for the urgently necessary tasks of tree removal, general cleaning up, and such work as can be performed by unskilled labor. Thus increased, the plant forces of the New England Company totaled 6,000; of the Southern New England Company, 1,900—seventy-nine hundred men actually on the firing line, working from dawn to dark—and often longer—to restore service to more than 400,000 telephones in six states. That was their job. They went about it. They could do it, and that they knew. But—it would take time.

Meanwhile, a whole disaster-smitten population was frantically trying to get messages through. As always under such circumstances, telephone service was needed in proportion as it, too, had suffered damage. That need could be met—service could be made available to more places and to more people—in shorter time if these men of New England could have help.

In the hour of New England's need, that additional help came. The Bell System swung into concerted action!

Men and materials: those were the vital requirements of the New England and Southern New England companies. Almost at once there appeared on the highways and the wrecked streets of their territories, telephone trucks—singly or highballing in convoy behind police escort—bearing the license plates of distant states. Men: all that could be used. Men: trained in Bell System methods, familiar with Bell System equipment, needing no instruction but only to be shown the task. Men—and their own trucks, their own tools, their own foremen and supervisors. Bell System men!

And, that the record be complete, it should be noted that 42 operators from Philadelphia, Cleveland, Detroit, were brought to New York by train and flown thence to Boston, where they took their places beside their sister operators at the Long Distance switchboard.

At the first word of disaster, the Western Electric Company slipped into well-oiled emergency gear: 3-shift, 24-hour operation. The Hawthorne and Clearing Works in Illinois, Kearny, Point Breeze, the New York headquarters, the local distributing houses—particularly the Boston, New Haven, and Brook-

On the preceding page—

Flood: *The Connecticut River takes a highway bridge down stream at Chicopee Falls, Mass. (Associated Press Photo).*

Hurricane: *A typical New England scene after the storm's passing—Main Street in Windsor, Vt.*

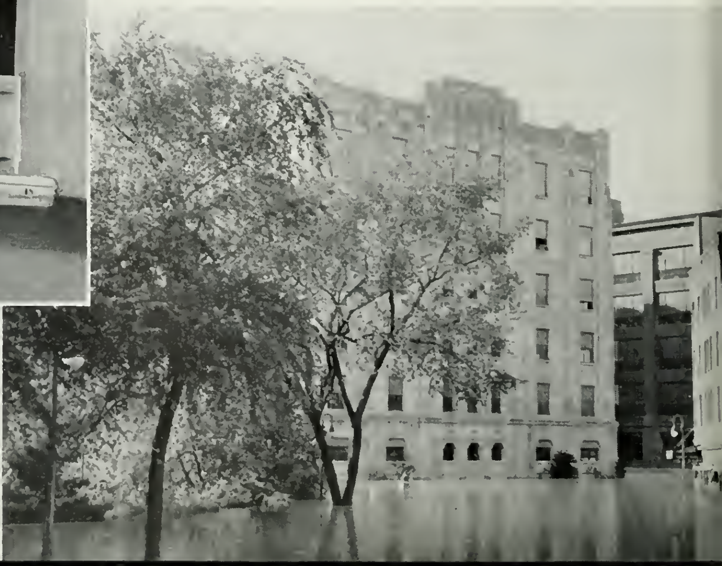
Tidal Wave: *Its aftermath on the main New York-Boston railroad line near Stonington, Conn. (Associated Press Photo).*

Fire: *Burning over a large area in New London, Conn., it added its terror to that of hurricane and tidal wave. (Photo courtesy Dr. Robert T. Henkle.)*

Floods in central New England made many highways impassable, as here at Waterville, Mass. (Int'l News Photo).

This view toward the front door of the central office at Orange, Mass., shows why the operators had to quit their positions.

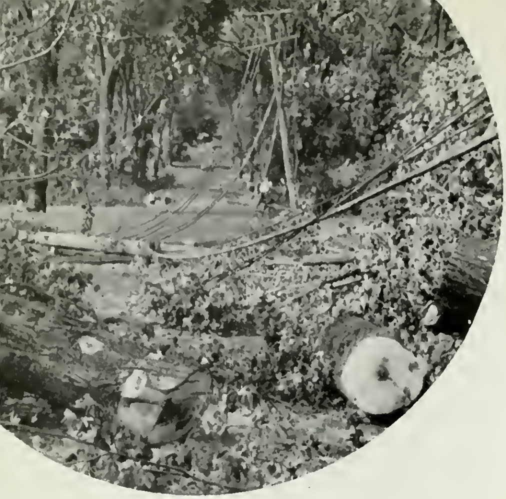
This coursing torrent was once a street in Ware, Mass., where overflowing of the Ware River isolated the town for several days.



After the great flood of 1936 in Hartford, Conn., bulkheads were built for all doors and windows of the telephone building nearest the river. The picture at the right shows how they kept the water out last month; the small picture above shows boatmen patrolling the outside of the building, with water several feet above the first floor windowsills.

This flood sweeping across River Street, Brookfield, Mass., illustrates why much of central Massachusetts was isolated for a time.

In circle: Coast Guard Chief Boatswain's Mate about to fire Lyle gun to carry line across the Connecticut River at Chicopee Falls. Lower right: Pulling a heavier rope across the river after the Lyle gun's light line had cleared the 700-foot flood. Below: Long Lines Department lineman riding a suspension strand above the Connecticut as a result of the Coast Guard's assistance. Note temporary twisted pair already suspended across the river.



Trees, power lines, telephone cables in tangled confusion in Hartford, Conn.

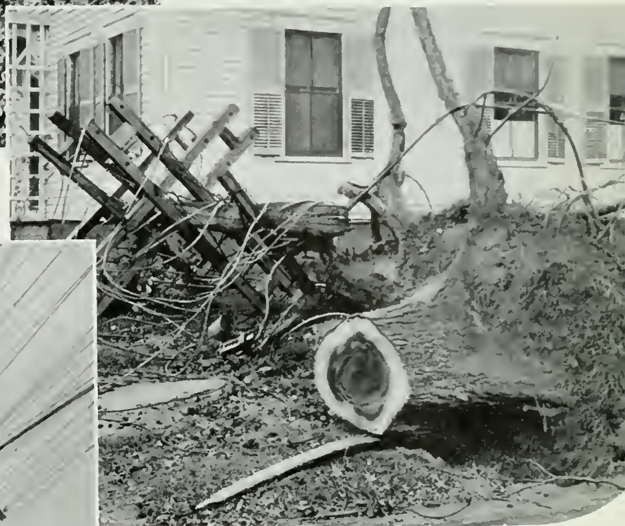
Most of this barn blew through the telephone line at Wapping, Conn.

A scene at Southbridge, Mass., which was typical of thousands of similar situations.

Trees fell, poles were borne down, over a vast territory. This destruction is in the Bronx-Westchester Area of the New York Telephone Company.

A national guardsman on duty before the smashed windows of the New England Company's business office at Newton Corner, Mass.

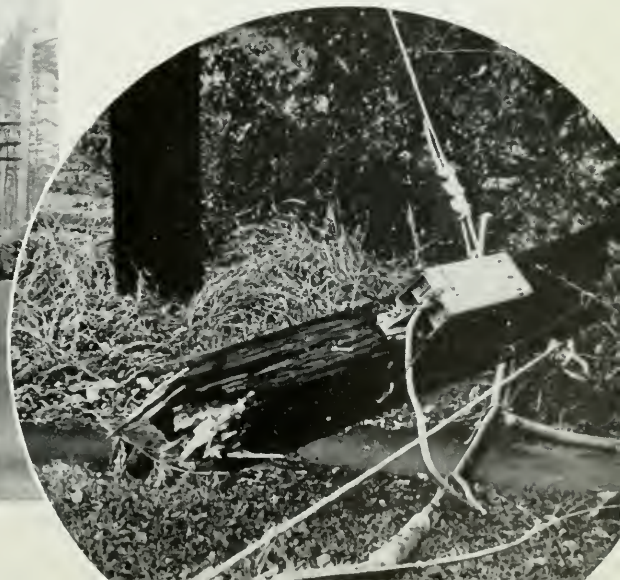
Typical of what the hurricane did to outside plant are the pictures on this page: Left, at Brookfield, Mass.; Below, at Stoneham, Mass.



Where there were no trees, pole lines sometimes survived intact the fury of the wind, as in the case of this line at Rutherford, N. J.

Destruction of a pine forest—and a telephone line—near Peterboro, N. H.

Terminal box, cable junction, guy wire, and pole tip all crashed here, in Brookfield, Mass.



New England street scene.

The steeple of this Willimantic, Conn., church crashed through a local telephone cable.

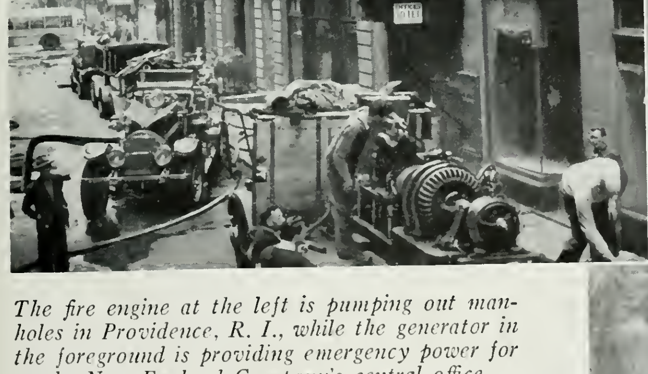
A 3-foot section of tree trunk plummeted through the roof of the Deep River, Conn., central office and bounced up to the top row of dial equipment.

Front of the Southern New England Company's central office at Middletown, Conn., after the hurricane.

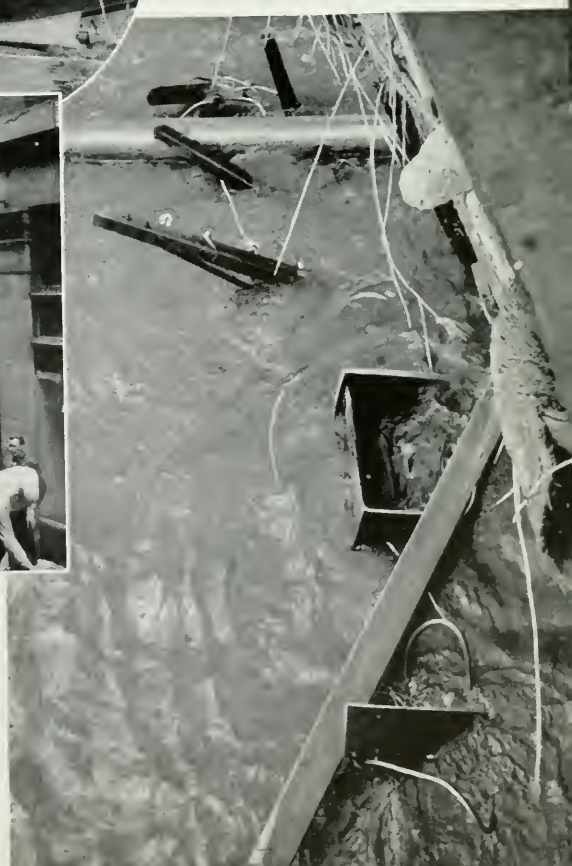
Telephone cables supporting a huge elm at Manchester Center, Conn.

Above: This is all the tidal wave left of a row of substantial cottages at Hawks Nest Beach, near Lyme, Conn.

Left: This motorboat was made fast to a telephone pole at Stony Creek, Conn.



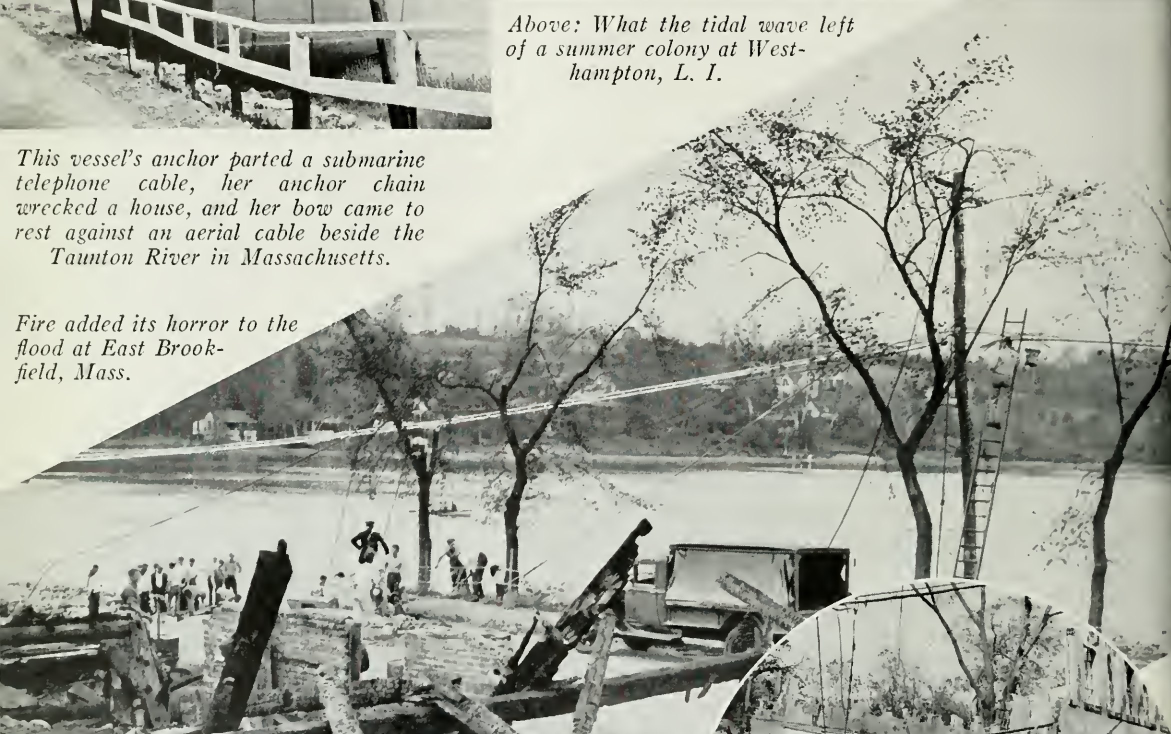
The fire engine at the left is pumping out manholes in Providence, R. I., while the generator in the foreground is providing emergency power for the New England Company's central office.



Debris of outside telephone plant in Shinnecock Canal near Westhampton, L. I., after the wave had receded.

Above: What the tidal wave left of a summer colony at Westhampton, L. I.

This vessel's anchor parted a submarine telephone cable, her anchor chain wrecked a house, and her bow came to rest against an aerial cable beside the Taunton River in Massachusetts.



Fire added its horror to the flood at East Brookfield, Mass.

Flames melted telephone cables, adding to the general destruction of plant, as here at New London, Conn.

What hurricane and tidal wave didn't demolish, fire did, in this section of New London.

At this emergency headquarters of the New England Company in Boston, the Plant, Traffic, Commercial and Engineering Departments coordinated their efforts to provide emergency service for hospitals and doctors, for fire and police departments, for governmental and civic bodies, etc.

W. H. Harrison, Vice President & Chief Engineer of the A. T. & T. Co. (right), conferring with Long Lines District Plant Superintendent J. M. Desmond in eastern Connecticut on September 23.

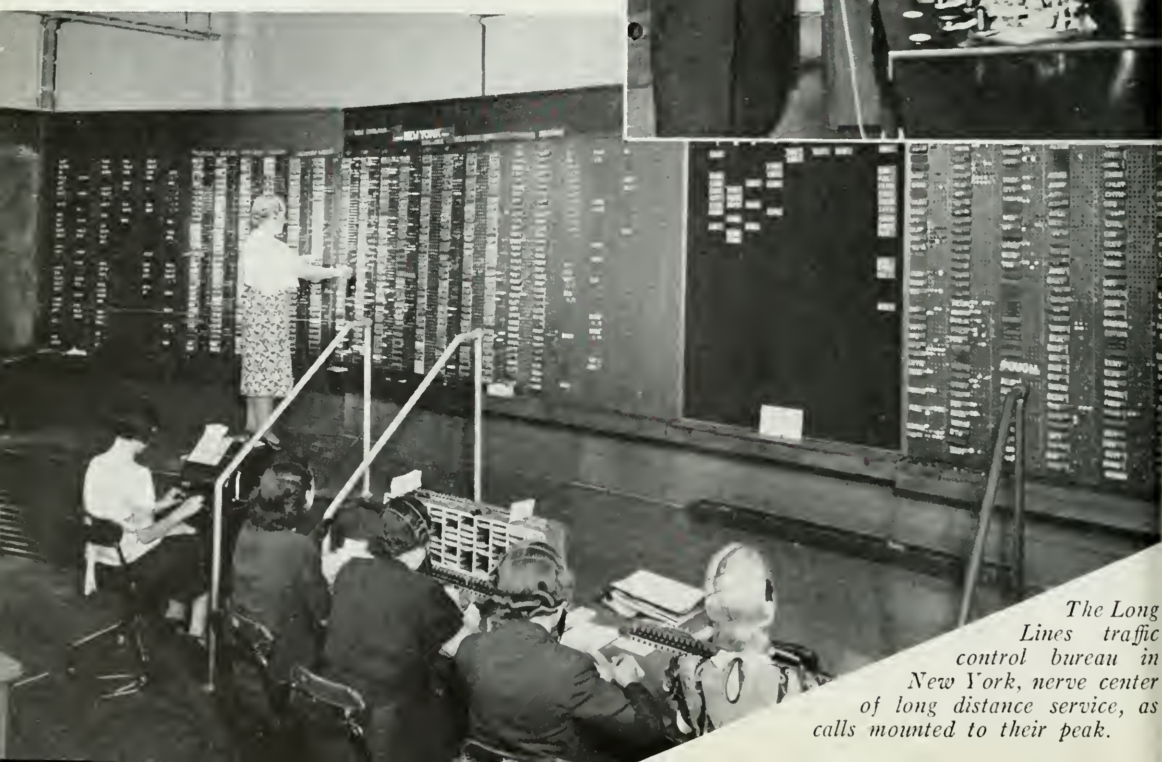
Headquarters of the Installation Department in Providence, R. I., directing restoration of service under difficult conditions.

Night conference in Western Electric Company's distributing house at Watertown, Mass. Without electric light and power, all emergency supplies were carried and loaded by hand.

The test desk in New Have would normally have one man o duty at midnight. This pictur was taken at that hour on th night of the hurricane.

Below: Patching cords at the Ne England section of the Lon Lines telegraph testboard in Ne York City immediately afte floods and hurricane made neces sary the rerouting of circuits

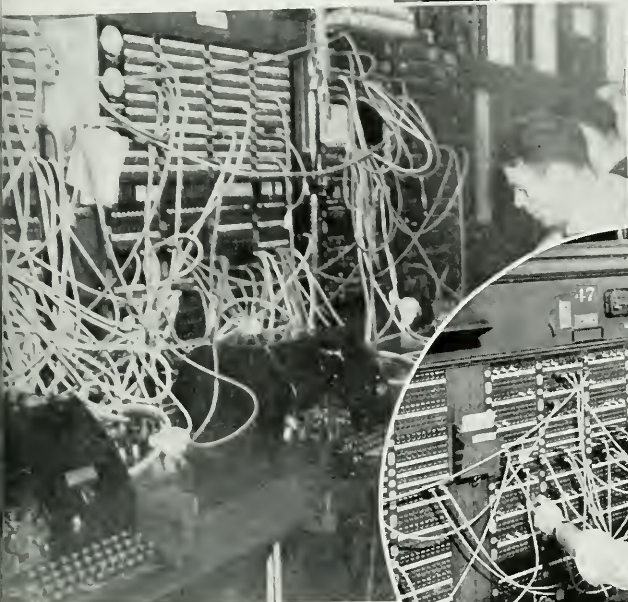
The central test desk at Providence, R. I., after hurricane and tidal wave struck.

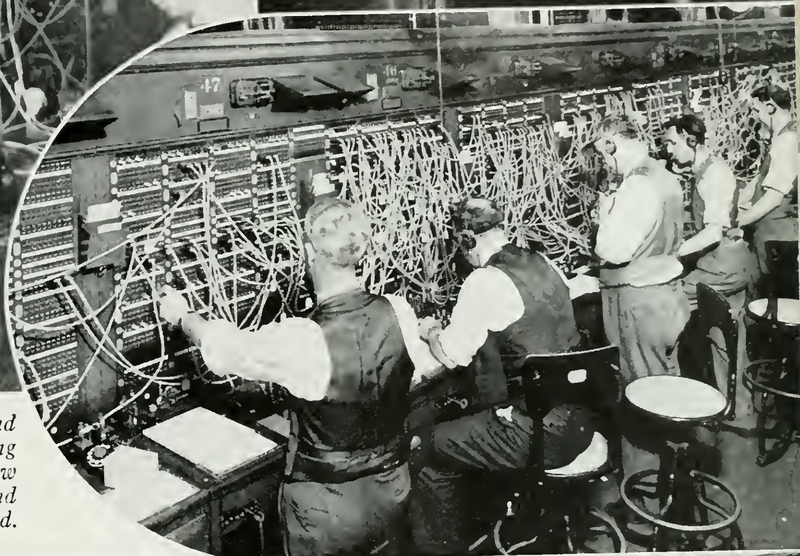


The Long Lines traffic control bureau in New York, nerve center of long distance service, as calls mounted to their peak.

More patches at the Long Lines telegraph testboard in New York City.

Below: These patches at a Connecticut long distance telephone testboard show how messages were routed through on circuits still working.





Right: "Detours" being found for telephone calls at the Long Lines telephone testboard in New York City at the peak of demand for circuits into New England.

Every one of the 110 positions at this block long toll switchboard at Hartford, Conn., was constantly filled for several days following the disaster.

Each white plug at this switchboard at Keene, N. H., shows a line out of service. After the hurricane, only 50 out of 1853 lines were working.

Below: Long distance operators from Philadelphia about to leave Newark Airport for Boston. Other operators were brought on from Cleveland and Detroit and flown from Newark to assist at the Boston long distance switchboards.

Left: Messenger lights and flashlights furnished the only illumination at the Providence, R. I., long distance switchboards as operators struggled to handle, over reduced circuits, the largest number of calls ever received.

Below: Operators at Middletown, Conn., worked by the light of kerosene lamps as a frantic public rushed to make calls on the night of the hurricane.

Right: Trucks from the central and western divisions of the New York Company's Upstate Area pause in Albany to pick up their crews, who had come ahead by train.

Above: New York Company Upstate crews stop to refuel in New Haven, on their way to eastern Connecticut.

Splicers and helpers of the New Jersey Bell Company leaving Grand Central Terminal in New York for New England.

The first contingent of New Jersey Bell construction crews crossing the George Washington Bridge on their way to help their fellow workers in the east.

Out-of-state licenses show that these construction trucks traveled many miles before parking for the night in New London, Conn.

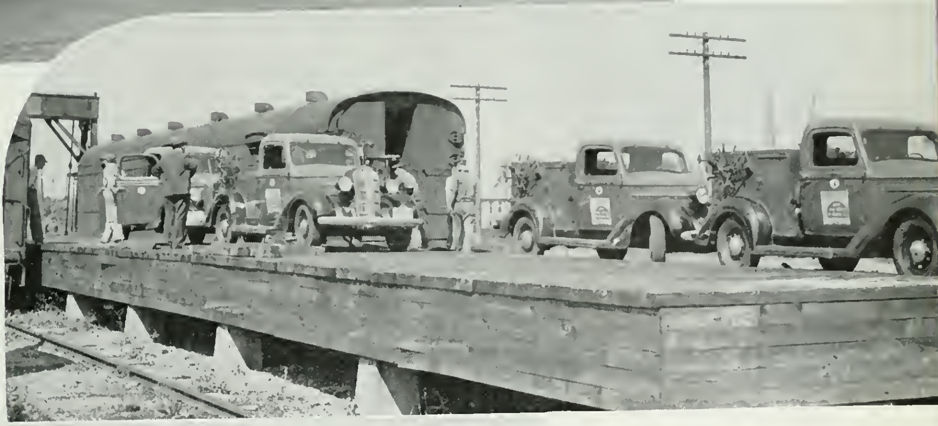
Right: Bell of Pa. rucks passing through New Haven en route o Connecticut shore owns three days af- er the hurricane. Below: More Penn- ylvania trucks in Danbury, Conn., the same day.

Right: A Chesapeake & Potomac Company crew on the job at Jamaica Plain, Mass.

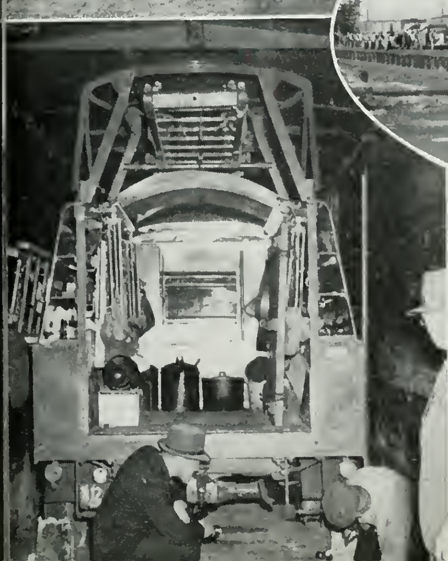
Two C. & P. men from Alexandria, Va., getting the lay of the land from a Southern New England Co. man at Madison, Conn.

This convoy of telephone trucks, bearing western license plates, is en route through Pittsfield, Mass.

Ohio Bell trucks arrive at Palmer, Mass., in the rain. Below: other Ohio Bell trucks at Dayton ready for shipment by rail to Danbury, Conn.



Left: Indiana Bell linemen and splicers detraining at New Haven, Conn., en route still farther east. Below: Unloading Indiana Bell trucks at New Haven prior to starting overland for the New England Company's territory.



" Bedding down " an aerial cable truck for the rail journey east.

Above and right: Trucks and men of the Michigan Bell Company after unloading in Hartford, Conn., on the way to Massachusetts.

Below: At Northampton, Mass., as thirty-seven trucks with crews of the Indiana and Illinois Bell Companies stopped on their way east.

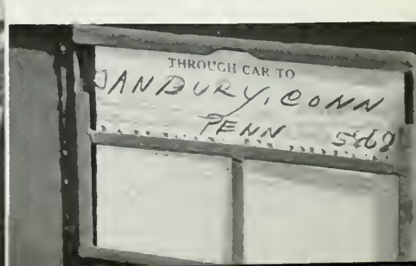
Aerial cable trucks of the Illinois Bell Company waiting in Chicago to be loaded on a special train for New England.

An aerial cable truck being secured in a gondola for the ride to the devastated area.

Above: Men and equipment of the Northwestern Bell Company at Keene, N. H. Left: Loading Northwestern Bell trucks at Omaha, Nebr., for the long trip.

Right: Southwestern Bell Company trucks being loaded in St. Louis, Mo., with Vermont their destination. Below: Southwestern Bell men waiting for their special train to carry them to New England.

Why the trucks got there as soon as the men.



A truck convoy leaving the Kearny, N. J., Works of the Western Electric Company at night with reels of lead-covered cable for the storm-wrecked area.

Cable yard at Providence, R. I., showing a small part of the tremendous quantity of cable which Western Electric shipped into New England.

Circle: Loading cable reels at the Kearny Works for quick transit to New England.

The cable dock at Western's distributing house at West Haven, Conn., was a scene of intense activity following the disaster.

From Western Electric's Boston distributing house many hundreds of miles of wire and cable were shipped into the storm-stricken area.

Upper right: Cable delivered in readiness to be placed across the Connecticut River at Chicopee Falls, Mass., as soon as the poles are ready to support it.

Trucks were thus identified to speed their journey.

Apparatus, too, was swiftly but carefully loaded at the Kearny Works.

Leading trucks of a Western Electric cable convoy on the road to Boston.

Untold miles of twisted pair were quickly run to restore temporary links in important circuits. This scene is in Eastern Connecticut.

A Diamond State Co. lineman goes to work on a battered cable at Westbrook, Conn.

Splicing temporary twisted pair into an important open wire toll route east of New London, Conn.

Clearing open wire of fallen pines between Peterboro and Dublin, N. H.

A Pennsylvania Company splicer on the job at Westbrook, Conn.

Right: A new pole goes up in Melrose, Mass. Below: A New Jersey Bell Company man at work in Mystic, Conn.

This new cable restores the Brookfield, Mass., section to communication with the rest of the world.

This splicer in Providence, R. I., is drying out cables while the manhole is still partly flooded.

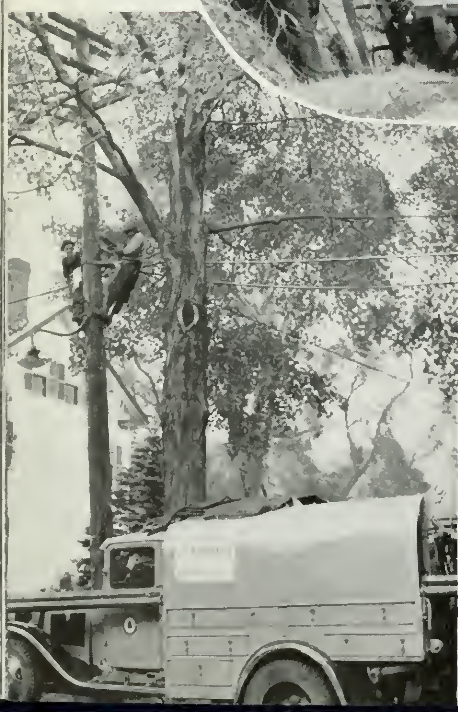
A New York Company crew removes a fallen tree from a cable near Selden, L. I.

Using a tree as a telephone pole to provide emergency service for the Melrose, Mass., Hospital.

A Long Lines lineman rides temporary strand where the Mount Hope River took out important New York-Boston cables.

A Pennsylvania Bell crew doing restoration work at Narragansett pier, R. I.

Below: A New Jersey Bell crew preparing to string a new cable at Mystic, Conn. Lower left: A Chesapeake and Potomac crew at work in Melrose, Mass.



Right: Long Lines men splicing temporary twisted pair at an important cable break at Atwoodville, Conn.

Above: Restoring service at Bogota, N. J.

Below: A Pennsylvania Bell gang on the job at Madison, Conn.

In the wake of the storm at Saybrook, Conn.

Below: Splicers at work at the Atwoodville Long Lines cable break.

Left: Work goes on far into the night. These Southern New England men are making temporary repairs on a New Haven-New London toll cable at Lyme, Conn.

New York Company construction crews resetting poles along the Montauk highway near Westhampton, L. I.

Right: A new submarine cable to replace one under the Taunton River in Massachusetts which was severed by a dragging anchor. Circle: Control station near Keene, N. H., for the short wave radio circuits which temporarily bridged the gap to Boston.

Pennsylvania Bell men pulling together in and for New England.

lyn houses—the important suppliers, all were co-ordinated in one effort to one end: to get the supplies into New England and Long Island where they were needed, as they were needed, and all that were needed. They did!

Movement of men and supplies into New England was greatly hampered by the interruptions to railroad operation and by the carrying away of bridges, the washing out of highways, the omnipresent blockade of fallen trees. Plant crews, whether local or of other Bell companies, were often forced to take roundabout routes; were at times entirely debarred from certain areas. Western Electric supplies moving in by truck encountered the same obstacles. Western also shipped large quantities by private car, by airplane, and by boat.

That plant crews rolled into New England from as far south as Virginia, from as far west as Arkansas and Nebraska reveals at once two things: the urgency of the situation and the extent of the response. In the second week after the disaster, there were at work in New England more than 2300 trained men loaned, with their 615 motor vehicles, by 14 companies:

Companies	Crews	Construction and Repair Men	Foremen, Supervisors, Service Men and others	Motor Vehicles
New York	156	417	85	128
Rochester Tel. Co.	3	14	4	4
New Jersey	56	187	40	47
Penna. & Diamond State	129	317	62	124
C. & P. (Washington)	13	39	4	6
C. & P. of Baltimore City	19	68	15	15
C. & P. of Virginia	18	51	8	14
Ohio	92	224	47	106
Michigan	32	104	34	38
Indiana	38	104	24	26
Illinois	26	84	17	32
Northwestern	40	153	35	33
Southwestern	32	97	25	29
Long Lines	14	66	13	13
TOTAL	668	1925	413	615
Sent to				
New England Co.	416	1267	306	336
So. New England Co.	252	658	107	279

Crews from the eastern states generally came into New England overland in their own trucks. Those from the more distant companies came by train as far east as the railroads were then operating—the men in Pullmans and the trucks in freight cars routed as express—unloaded their equipment, and moved forward to the scene of action under their own power. Several groups came as units, including in their number clerks, automotive maintenance men, supervising foremen, and—in some instances—division or state construction superintendents.

Men must have materials to work with. The following statistics show the enormous quantities shipped by the Western Electric Company up to October 14, most of which, of course, was delivered in the early days of the emergency—and all of which, with a few negligible exceptions, was standard, inspected material, meeting the Bell System's rigid specifications. For purposes of comparison, the entire System's average monthly demand is also shown.

	Storm Orders Shipped to October 14	*1938 Average Monthly Demand For Bell System*
Lead Covered Cable	607,000,000 cond. ft. (3,797,000 lin. ft.)	1,206,000,000 cond. ft. (3,804,000 lin. ft.)
Drop Wire	53,613,000 lin. ft.	27,195,000 lin. ft.
Prepared Cotton Sleeves	16,632,000	10,036,000
Strand	6,910,000 lin. ft.	3,426,000 lin. ft.
Cable Rings	3,211,000	1,322,000
Copper and Steel Sleeves	2,956,000	963,000
Copper and Steel Line Wire and Ties	2,380,000 lbs.	2,020,000 lbs.
Pole Line Hardware	2,039,000 lbs.	1,178,000 lbs.
Drop Wire Clamps	535,000	460,000
Lead Sleeving	494,000 lbs.	273,000 lbs.
Bridging Connectors	491,000	113,000
Solder	132,000 lbs.	115,000 lbs.
Paraffin Wax	110,000 lbs.	45,000 lbs.
Pine Poles	21,800	28,500
F Type Cable Terminals	21,700	10,000

What Men-and-Supplies Can Accomplish

Men and supplies! That is the combination—plus, of course, all that is implied in the phrase *Bell System*—which has come out on top. In the six states of New England, where more than 400,000 silent telephones had been the challenge, all had been restored to service in a fortnight save where restoration and rebuilding were particularly difficult. Every telephone is back in service, every town reconnected into the nation-wide telephone network, long since. Most of the crews from beyond New England have gone home again, rolling away to west or south, bearing with them the gratitude of the people of New England and the hearty " So long, fellows—and thanks a lot! " of the men by whose sides they had worked in many a city and town, on many a highway and country road.

Not all the crews who came into the wrecked area have yet left, however. As this is written, some crews, who can be spared a while from their home territories, are helping to put some of the original emergency repairs into better shape, in preparation for the thorough and necessarily longer operation of permanent restoration.

It is an inspiring spectacle, this co-ordination of effort of every branch of the Bell System toward one end. Associated Companies, Western Electric, A. T. and T. General and Long Lines Department, the Bell Laboratories—their resources of every sort are vast, their spirit is indomitable, their teamwork is unbeatable.

Public Recognition and Appreciation

That the public comprehended the magnitude and the gravity of the telephone companies' situation, and that it appreciated the valiant and well-organized efforts toward rehabilitation of the service, were made evident by many commendatory statements, both privately by individuals and publicly by the press, by officials, and by civic bodies. Such approval was, of course, most heartening to those on the battlefront of restoration.

Public expression of approval is most readily typified by editorial comment in newspapers, many of them far from the scene and untouched by the disaster. Excerpts* from a few are representative of many others:

From the Franklin, N. H., *Journal Transcript:*

We take a good deal of pleasure in paying tribute to the remarkably efficient service rendered during the ' emergency period ' this week Wednesday night, particularly, by the local telephone exchange. Operators must have worked at fever pitch, but they were calm and collected and decidedly helpful. . . .

The earth was a howling wilderness and all hearts were struck with a new, strange fear. Excessive rains had seemed enough to worry about before the cyclone struck. The weather bureau predicted a night of heavy rain. In the midst of all this discomfort and uncertainty, the fact of quick service given as matter of factly as if all was well with the world, was solid comfort to the customers. . . .

From the Keene, N. H., *Evening Sentinel:*

Though the hurricane, and accompanying flood, which devastated Keene was 10 days behind us the arrival in this city Sunday night of 189 expert telephone men and a great fleet of heavily loaded trucks from Iowa must have reminded the people of Keene that reinforcements are continuing to arrive and go into action in the work of rehabilitating the utilities wrecked by the storm. As the crew from the west arrived we must have recalled that famous song we have often heard sung, the lilt of which rings in the ears of every person who may have heard it from throats of the sons of Iowa—the song that men from the land " where the west begins " sing—" Iowa, Iowa."

" Editorial paragraphs " from the same paper:

The sight of the telephone trucks rolling along the highway and into Keene made one contrast that picture with the pictures of the trucks loaded with uniformed, armed soldiers rolling into Czechoslovakia.

* Occasional statistical inaccuracies do not affect the cordial tenor of these editorial expressions.

Here the army of occupation came ununiformed and on an errand of mercy and succor. The faces of the men were jolly and friendly, not set with a belligerent tenseness. And the men got out of their trucks ready to set right to work at the task of restoring a service to the public.

People in Keene are getting a new and large respect for the telephone company because of the prompt way the company brought in men from all over the country to get the service restored in the Keene-Peterboro district.

We thought it was pretty smart business when the men began to arrive from Maine and New Jersey and New York and went right to work.

But we were even more impressed by the sight of 27 trucks and eight or ten light autos rolling into Keene from Rutland, Vt., last night after debarking from a two train special which brought them east to Rutland from Chicago.

When you think of men coming here from Iowa, Nebraska and Minnesota to put our service in order, it makes you feel pretty good.

Times like the present show the value of a national tie-up in the utilities, a tie-up that can bring immediate concentration of experienced men and ready equipment on the spot in short notice.

Further, it shows the value of standardization in details of mechanics of the particular utility involved and the standardization of equipment to handle repairs.

From the Nashua, N. H., *Telegraph:*

Probably no public utility suffered more damage, sustained the loss to equipment and its business, and is having a greater problem in the matter of rehabilitation than the New England Telephone Company. Five hundred or more lines out of order in this city is only a small proportion of the more than two hundred thousand of its phones out from northern Vermont to Cape Cod. We take our hats off to the crews of linesmen in this city working day and night to get the service restored. . . .

Notable also is the vast resources of men and material which were rushed into this stricken area. Three thousand men and women experienced in telephone work from New York, Pennsylvania, New Jersey, car loads of cable, millions of feet of wires, poles by the thousand, and so on. Really a marvel of modern day will, energy and resource.

From the Hartford, Conn., *Times:*

Two things, possibly among many, are noteworthy as telephone construction workers from as far away as Delaware and Virginia reach Connecticut to help repair the flood and hurricane damage.

That it was necessary to summon aid from so far away affords one measure of the extent of the destruction. Few people need to be told that the telephone plant was hard hit. That is evident on every side—in city streets and on the State highways. Practically every tree that came down brought wires with it, either serving a single building or a whole community.

The wonder is not that it was so difficult to communicate between cities, or that so many homes and business places were without telephone service, rather, the degree to which that fate was escaped.

Also, the aid from afar illustrates an advantage of having a single, nationwide telephone system. There are other advantages, of course. Rival companies in a town or in a state would, certainly, be a nuisance. Existence of the Bell System throughout the country serves the convenience of telephone users generally. The present incident illustrates what unification means in time of disaster. . . .

From the Detroit, Mich., *Free Press:*

The dispatch of 150 expert telephone workmen by the Michigan Bell Telephone Co. to the hurricane-stricken area in New England is an instructive illustration of how intimately and intricately modern means of communication have tied up all parts of the United States.

A great telephone organization in one section of the country can extend more than sympathy to another section with the wires down. . . .

From the Allentown, Pa., *Morning Call:*

The value of the unification of the utility systems of the country in very large units and the existence of working agreements between the various units is well illustrated in the immediate response that was made by Allentown to the plight of the people of New England.

When news of last week's disaster was received in this city and other cities where the Bell Telephone Co. operates phone systems, there was no question as to what should be done. Almost instantly, highly trained men were sent out of this city to the stricken areas. Simultaneously from scores of cities, similar forces of men with the necessary tools and equipment were on their way to put the telephone house of New England in order.

There did not have to be long questioning as to the responsibility of the men nor the responsibility of the phone services for the men's work and materials. The unification of the system assured that the men would be paid or their companies would be reimbursed for their services, the use of their equipment and the materials which they put into their work. . . .

From the New York *Journal of Commerce:*

. . . The most difficult task was faced by the telephone companies affected. At the height of the storm, fully 500,000 telephone stations in New England were out of service, and telephone trunk lines were destroyed throughout the territory. Today, service has been restored to every community affected, and work is rapidly going on to connect individual telephones once again.

This vast work of reconstruction has required not only the 3,278 men who constitute the regular construction and maintenance staff of the New England Telephone & Telegraph Co., but also 450 former employes who volunteered for service during the emergency and 2,385 employes of other telephone companies affiliated with the American Telephone & Telegraph Co., many of whom have come from west of the Mississippi. Fully equipped and arriving in 1,500 trucks, these groups of workers from other telephone companies could immediately join in the work of rebuilding New England's telephone system only because the parent company had effected standardization of equipment and methods in the telephone industry throughout the country.

An important contributing factor was the fact that an associated manufacturing company, the Western Electric Co., has specialized so long in providing materials and equipment for the Bell System. Western Electric has shipped more additional material into New England in the past fortnight than was ever made necessary by a natural disaster in the past. . . . The remarkable record of the telephone company, and similar aid given their subsidiaries in New England by parent public utility and telegraph companies, constitute an emphatic demonstration of the value of the holding company in maintaining public service in the face of natural disasters.

From the New York *Times:*

Organized society, like the human body, cannot recover from surgical shock with a shattered nerve system. Society's nerve system, of course, is communication. When the recent hurricane struck this region it put 51,000 telephones out of commission in this State alone and silenced at least 450,000 more in New England. On the lines that remained in service the demands were doubled.

The effort of the telephone companies to restore normal communication vividly illustrates the value of integration on a national scale. The first need, obviously, was to meet the tremendous pressure on the lines which remained open in the stricken areas. Calls immediately went out to former operators on company lists within the damaged districts. Then, almost before the great wind had stopped blowing, experienced long-distance operators were rushed by plane from Cleveland, Buffalo, Philadelphia and Washington to Boston, Hartford, Providence and other centers.

The next urgent need was to open disrupted lines. Sister companies in sixteen States undertook the organization of telephone relief. The New York company had a serious problem of its own with the devastation on Long Island, but it sent 601 men into New England. New Jersey, Pennsylvania, the District of Columbia, Maryland and a half dozen other States all contributed their share. The Southwestern companies sent 122 men from Oklahoma, Arkansas and Missouri, and the Northwestern companies loaned 188 from Iowa, Nebraska and Minnesota. Altogether 2,352 linesmen from other States entrained for New England.

They came in 596 fully equipped trucks. These were loaded on flat cars and the railroads delivered them as near the path of the hurricane as possible. They went the rest of the way over washed-out and tree-clogged roads on their own power.

Some of the difficulties of the crews seemed almost insurmountable. . . . But the severed lines must go up, and thousands of tired linesmen are still unwinding their restoring reels through smashed and tangled forests.

From the New Haven, Conn., *Register:*

In a regional dispatch from Boston on post-hurricane conditions one paragraph reads as follows: "The relief task was hampered by failing telephone communication. The New England Telephone and Telegraph Company, which at one time lost a quarter of all its phones, reported 44 communities still were cut off and 185,000 telephones were out of order. Two thousand linesmen were on hand from as far away as Virginia."

That is easy to believe from the number of fleets of out-of-state telephone repair trucks that have been seen eastward bound along the highways in the past few days. A good many persons have stopped to watch the passage, under motorcycle police escort, of New Jersey Bell System and Virginia caravans loaded about to the wheels with coils of wire and other repair supplies, in a hurry to get into action in the stricken areas.

The effort is plain. So is the blessing of standardized operations, of far-flung co-operating organizations, developed efficiency whose fingers can reach far out beyond local areas and state lines for trucks, materials and men which and who can be spared in the gigantic campaign to get essential communication restored at the earliest possible moment. . . .

These gratifying expressions of a realization of what a unified communication system does in reality mean to the nation are an appropriate stopping-point for an account which has tried, in many more words, to tell the same story.

JUDSON S. BRADLEY

Fundamentals of a Public Relations Program for Business

A paper prepared by Arthur W. Page, Vice President, American Telephone and Telegraph Company, for presentation and discussion at the Seventh International Management Congress held in Washington, D. C., September 20th, 1938.

IN THIS discussion I am assuming that public relations are designed to give a business a good reputation with the public, establish it in the public mind as an institution of character and an institution which functions in the public interest. I am not including a discussion of publicity, advertising or other activities that have a purely sales purpose.

Anybody who does business with the public is in a public business and subject to regulation by the public in many ways —by a great variety of laws, from those to do with incorporation or partnerships to fair trade practices and blue sky legislation; by various forms of public supervision; by the public's giving or withholding patronage; and by praise or blame from political leaders, radio commentators and the press. The public lays down the rules for its service, partially in laws and partially in public opinion, which at any time may be made into law. The task which business has, and which it has always had, of fitting itself to the pattern of public desires has lately come to be called public relations.

There are obviously a great number of ways of handling the problem. I am going to suggest one method, not because I think it is better than many others, but so as to have a concrete outline before you.

The first thing in this program is to have the management of the business write out a statement of policy. This is equivalent to saying to the public: "We should like to serve you and we offer you the following contract which we think would be fair to all concerned and mutually profitable."

No one can write out such a document without thinking over the company's responsibilities to the public, as a purveyor of goods or services, as an employer, as a taxpayer, perhaps as a trustee of the public's investments, and so forth. It might occur, also, that a document of this kind which the management would be proud to sign, when literally applied to the business, might not fit in all particulars. This immediately brings up the question whether the business or the policy was wrong and which should be changed. In other words, this writing out of a policy is a device for making the management take the time to study seriously and carefully the relation between the public and the business, to see whether the business has public approbation and whether it ought to have it—to see itself as nearly as is possible as the public sees it.

The second part of the program I suggest is that, a policy having been established, some machinery be set up to see that two things happen—(1) that the business does not deviate from the policy by inattention or neglect, and (2) that the details of the policy be changed to fit the changing public desires. The machinery to do this is ordinarily called the Public Relations Department.

A company can, of course, work out a policy and set up machinery to keep it revised without a public relations department as such. But keeping attuned to the public wishes may be so vitally important that it seems but a matter of insurance to detail some one to spend all his time on that job. As knowing the public is not an exact science, the gentleman detailed to the job cannot answer questions with the precision of an engineer, or even within the latitude taken by legal counsel. But by constant attention, study and experience he can learn some things and he can see that the problems concerning the public get the attention they deserve from the rest of the management.

However, to do this effectively he will have to be a part of the policy-making councils of the company, for it is of the essence of the daily conduct of affairs. It cannot be an isolated function. Even though a company has set up a positive program and has a realistic philosophy about its relations with the public, it must still be prepared to meet new aspects of public opinion which arise at any minute. It may be questioned by one group for having too much debt, and another for not having enough; by one group for having too many college graduates, and another for not having enough; at one time in our history the public would have censured a company for building ahead in a depression, at another for not doing so; sometimes there is criticism of lack of salesmanship, and sometimes of overselling. In other words, the public is a somewhat whimsical master. To keep in tune with it means eternal vigilance in watching its moods.

Not long ago I saw a review of a book about Governor Hutchinson, British governor of Massachusetts just before the Revolution. The review stated that the people of Massachusetts had convicted Governor Hutchinson of treason against the state which they anticipated forming. That process of reform, so strikingly stated in the review, has been exactly the process of reform that the American people have continued to practice on both individuals and business ever since. When the public gets an idea that certain business practices should be changed, it picks out a victim, tries him and convicts him under the law it intends to pass. The job of business is to guess what practices the public is really going to want to change, and change them before the public gets around to the trial for treason.

So much for the policy side of the public relations program I want to present to you.

There is another side. Most of the day-by-day relations of business with the public are not conducted by management but by the other employees. Salesgirls, salesmen, receptionists, repairmen, telephone operators—these are the people who largely represent business to the public. A company may have the best overall public policy in the world in the minds of management, but if the spirit of it is not translated into acts by those who represent the company in contact with the public, it will be largely discounted.

To make any policy effective it would seem to me that the contact employees must be given an understanding of it so that they can be reasonable and polite. In order to be reasonable a person must know the reasons for what he does. If a customer objects to something and is told that it is a rule of the company and nothing more—well, that seems pretty arbitrary. And yet, if the employee does not know the reason for the rule, he can't explain it. Generally speaking, I am sure that public relations are improved pretty much in proportion as the employees in contact with the public understand the reasons behind company policy and practices. And, likewise, the process of getting an understanding of these things is likely to develop better personnel.

And along with this kind of reasonableness and an integral part of it, is politeness. I mean by this, as near unfailing courtesy as human nature allows, plus a genuine desire to make the company a friendly and helpful institution. This means giving employees some latitude and encouraging initiative. No routines and instructions can fit all cases. Employees who know what the objectives of the routines are can safely depart from them in exceptional cases to the great benefit of public relations.

It takes time and money to inform all contact employees of the reasons behind routines and about the fundamental policies of the company, and about anything else which they are likely to be asked by the public. Yet without adequate knowledge to answer, they cannot make the company appear reasonable and it is more difficult for them to be polite and helpful. To have such knowledge spread down through the ranks of an organization means that from the foreman up to the top management, all supervisors must look upon the process as one vital to the success of the business. Being reasonable and polite to the public must be done by the company as a whole and cannot be done for the company by a special department. It is a way of life.

Perfection, of course, is impossible in anything, but a rather considerable degree of reasonableness and politeness ought to be easily achieved because these qualities are natural to most people, if not diminished by the pressure of routines, techniques and ratings on other aspects of the job. But if it is clear that politeness and reasonableness are also rated high by the management, they ought to come back to their proper place. Moreover, the employee himself has a better life if his contacts with the public are pleasant and he is justified in having a better opinion of his job and a greater satisfaction in it if all who mention the enterprise of which he is a part—and an understanding part—speak well of it.

In discussing politeness and reasonableness, I do not mean something employees can be trained to put on like a cloak. I am not talking about stage management. I am talking about character—running a business so that the more the employees know about it the better they feel about it, and running it with people who know what they are doing, have a pride in their profession and want that profession held in high esteem by other people because it deserves to be.

A business that recognizes a broad responsibility to the public and takes its employees into its confidence will probably maintain a fairly analytical state of mind at the top, for there will be many questions coming from the employees and from the public through the employees. And these will be most useful straws to tell which way the wind of public opinion is likely to blow.

Under this program I have set up as a basis for your discussion, you have—

1. A top management that has analyzed its overall relation to the public it serves and is constantly on watch for changes in the public desires.
2. A system for informing all employees concerning the general policies and practices of the company.
3. A system of giving contact employees the knowledge they need to be reasonable and polite and the incentive of knowing that those qualities count in pay and promotion.
4. A system of getting employee and public questions and criticisms back up through the organization so that management may know what the public thinks of the business.

The main emphasis of this program is a manner of conducting a business. Along with this goes frankness in telling the public about the company's operations. Much of this will be done by the contact employees, but much of it must be done in other ways—by advertising in newspapers, magazines, on the radio, by official company statements, speeches and many other ways. I shall not discuss the techniques of advertising and publicity except to state that their function in public relations is to tell the public as much as it will listen to of the policies and practices of the company which make up the contract under which it wishes to serve the public.

This very question of publicity is an interesting example of the changing viewpoint of the public. Twenty-five years ago the complaint against big business was that it was secretive. No one knew what were its policies and practises or what it was doing. There were demands that various aspects of business be made public. This tendency has continued, but of late, if business has not only made the facts available, but by advertising and otherwise got public attention to them, there has been a disposition to object to this as propaganda. There is, of course, a question of propriety and wisdom in the kind, degree and methods of publicity and on this the public's verdict is as final as on any other subject.

Publicity is an important part of public relations, but in business as in most human affairs, what you do is more important than what you say. It is always possible to make a good statement on a good set of facts, but no more in business than in politics can you fool all the people all the time, and if you expect to stay in business long, an attempt to fool even some of the people some of the time will end in disaster.

The final set-up of the program then is a management alive to its public responsibility, an informed, reasonable and polite personnel, and procedures for informing the public—in other words, an organization made up of many people, which, wherever it touches the public, acts like a wise and considerate individual.

I think you all will agree that the public is a whimsical master. It seems as if all of it never thinks alike at any one time and it never seems to think alike twice. And yet there are certain currents of thought that appear to be more or less constant.

Most people dislike arrogance and are afraid of too much power in others. They, therefore, fear size and monopoly, for big things are often powerful and monopoly is often arrogant. Moreover, they suspect things they do not understand. The consequence is that, practically speaking, business is confronted by the public with a "show cause" order why it should be big. In order to justify size it must be prepared to demonstrate that size is in the public interest in service, economy or some other way. It must be able to demonstrate that big size can be as reasonable and polite as little size. If business wants to be big, it must be able to show that its size is justified in public service. And this brings me back to the point where I began—that every business, big and little, should be able to explain the contract under which it expects to serve the public.

Business is the means of producing the things men live by —the necessities of food, clothes and housing, our entertainment, our luxuries. It is the essence of life and the most useful profession of mankind. The men who do it are the players of the game. The lawyers, the doctors—men of the so-called professions—interpret rules and tend the players. Yet these professions have worked out a relationship to the public, a code of conduct for themselves, and a basis for high morale. They have made their contract with the public. Businesses, not I think en masse, but each one separately, have the same thing to do. Public relations, in this country, is the art of adapting big business to a democracy so that the people have confidence that they are being well served and at the same time the business has freedom to serve them well.

The less confidence the public has in big business, the less freedom the public will give big business. And as you restrict its freedom, you restrict its ability to serve.

It is, therefore, to the interests of both that there be established a state of confidence concerning the relations between big business and the public. Can there be established such a state of confidence? How effective can our public relations be? I have a belief that they can be very much higher than we have yet attained or than most people believe is attainable. You hear a great deal of discussion about the relations of large corporations with the public in which the phrase occurs—" Oh, well, they are attacking this corporation and that, or this or that utility, for political reasons." That is offered very often as an excuse. But it is not a valid excuse. The actual fact is that big business has to meet the political test. The political test comes down to this. If the reputation of big business is good enough with the public, no one representing the public —whether in press, politics or any other capacity—will be hostile to it. Because of the ordinary human suspicions of size, big business will always be closely scrutinized. It will have to be a better citizen than if it were smaller. It will have to be good enough to have public confidence. Many people feel that there isn't a possibility of getting to such a state. But certainly there is no reason to believe that good public relations are impossible until business, by and large, has put the same thought and effort on the subject that it has put on research, production and selling.

ARTHUR W. PAGE.

Twenty Years of Carrier Telephony

TWELVE Telephone Channels on a Single Cable Pair! Sixteen Telephone Conversations on an Open-Wire Pair! Hundreds of Telephone Channels on Special Conductors Called Coaxials! Such statements have appeared frequently in the last year or two and in all cases the answer to the question, "How is it done?" is the same, namely, "Carrier Current Systems."

These remarkable achievements are the result of many years of development work extending back almost to the beginning of telephony itself and involve not one but a very great number of inventions. Early in the electrical communication art the idea occurred to many inventors of transmitting more than one message over a single pair of wires. These first inventors, of course, experimented with telegraphy as nothing was then known of telephony. In fact Bell himself was engaged in such experiments when he invented the telephone. They called it harmonic telegraphy in those days and not "carrier" for tuned reeds were used for generating the different messages and harmonizing reeds for separating the messages at the far-end of the circuit.

Although the attention of Bell was diverted from his original study of harmonic telegraphy to the problem of practical telephone transmission, others continued the work and later conceived the idea of multiplex telephony as being the next step. Articles were published discussing the possibility of multiplex telephony as early as the year 1886 but not until about twenty years ago did a practical carrier system materialize. Since that time, however, its application has become extensive. More than 700,000 miles of carrier telephone channel are already being operated in the Bell System, constituting more than 20 per cent of the total mileage of telephone toll circuits of 100 miles or more in length.

Basic Principles of Carrier Telephony

The basic principles of the carrier art were well established before the year 1900 by many inventors, including Professor Pupin, John Stone-Stone, Hutin and LeBlanc. Articles were published or patents obtained which described detail methods of carrier transmission. These methods included means for identifying individual telephone messages by combination with frequencies above the voice range, transmitting several messages over a single line and unscrambling them at the far-end of the circuit. The identifying frequencies are called carrier currents, mixing them with the voice currents so as to enable the individual message to be identified at the far-end of the circuit is called modulation, and the corresponding restoration of the original voice frequencies after their separation is called demodulation.

These processes can be easily understood by comparison of the ordinary telephone circuit with the carrier circuit. At the top of Figure 1 is shown a simple telephone circuit consisting of a transmitter, a line and a receiver. The battery at the left causes a direct current to flow through the transmitter. When the transmitter is subjected to sound waves produced by the voice it varies the direct current in such a way that the voice-produced waves are superimposed upon the direct current flowing in the transmitter circuit. The coil shown prevents the direct current from reaching the line but the variations are transmitted over the telephone circuit and are utilized in the receiver for setting up corresponding vibrations in the air which produce audible sounds. If the battery in this circuit is replaced, as shown in the lower half of the figure, by a generator of high frequency carrier current, the voice waves impressed on the transmitter would cause corresponding variations in the amplitude

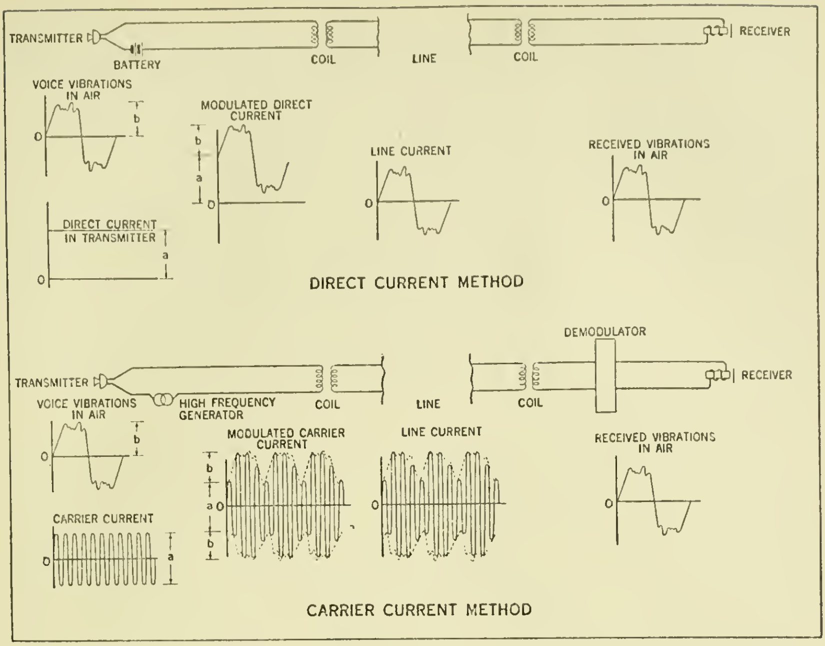


Fig. 1. Modulation and Demodulation

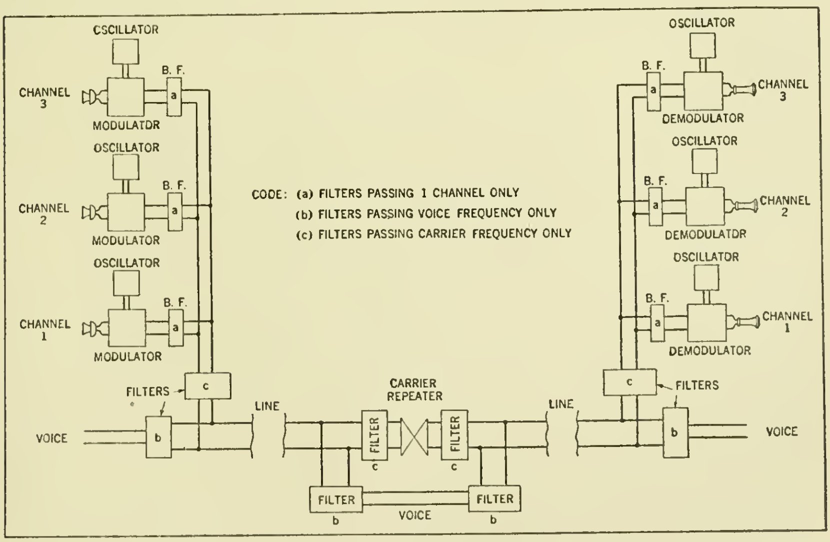


Fig. 2. Schematic 3 Channel Carrier System

of the high frequency current. This is known as modulation. These varying high frequency currents would pass the coil and out onto the line. It is interesting to note that an ordinary telephone receiver connected to the line would not produce audible sounds provided the carrier frequency was above the limits of the human ear. However, if this varying high frequency current is properly transformed at the receiving end by a device called a demodulator which functions in a reverse manner to a modulator, the original voice frequency would be restored and result in audible sounds in the telephone receiver. The corresponding carrier transformations are shown at the bottom of Figure 1.

When several carrier channels, each using a different carrier frequency, are mixed together on a single line as shown in Figure 2, it is necessary to provide means for separating the individual channels. In the early days of harmonic telegraphy it was possible to separate the channels by tuning, either mechanical or electrical. In telephony, a wide band of frequencies is required to encompass the harmonics of the voice. At least a 2500 cycle band is needed to include the important voice frequencies which extend from 200 cycles to above 3000 cycles.

When these bands of frequencies are acted upon in the modulator of a carrier system, the entire band is effectively shifted in its position in the frequency spectrum, its final location depending on the frequency of the carrier current supplied to the modulator. This is shown in Figure 3 where several voice bands are modulated with different carrier frequencies and transmitted over the line together. The three carrier channels and the voice channel constitute a band about 14,000 cycles wide. At the receiving end it is necessary to divide this wide band into parts corresponding to the original messages by means of devices which select the band of frequencies corresponding to each single channel and reject the frequencies of the other channels. The tuned circuit which was satisfactory for the narrow bands of telegraphy could not be used in telephony and other means had to be found.

After the bands are separated, each band is mixed in a demodulator with a carrier frequency corresponding to that used in its own modulator at the sending end of the circuit. This combination in the demodulator results in the restoration of each band to its original position in the voice part of the spectrum as shown in the right hand side of Figure 3.

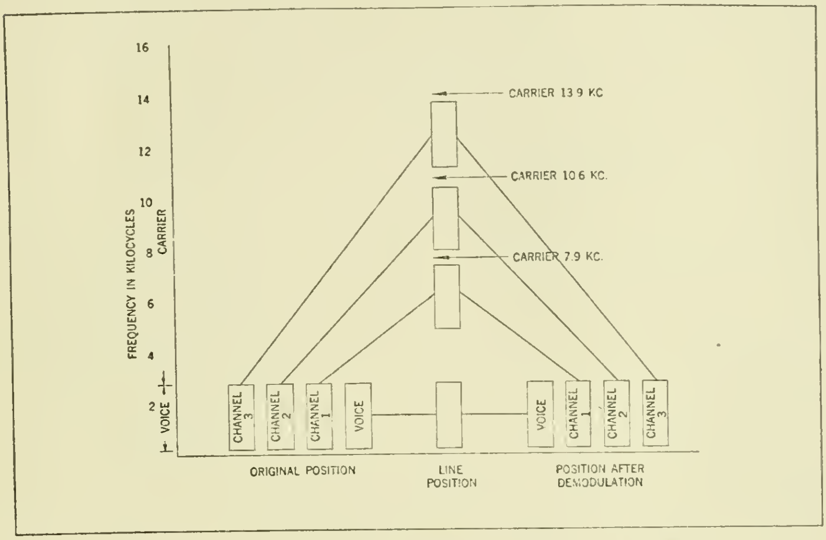


Fig. 3. Typical Carrier Frequency Transformations

Early Limitations

The limitations of the available instrumentalities for modulation, demodulation and separation in the formative period of carrier development greatly hampered inventors in reducing their ideas to practical form. They realized they needed stable generators of high frequency currents, better modulators than the telephone transmitter shown in the simple analogy above, and for multiplex operation more satisfactory methods of separating the carrier current bands of different messages at the far-end of the circuit. It was not until about 1915 that the development of the vacuum tube and the invention of electrical filters made it possible to devise a workable carrier system suitable for application to the regular telephone service. Vacuum tubes had, of course, been invented several years before, but not until that time had they been developed to a point where they were of practical use in telephony, as evidenced by the completion of a transcontinental line in that year.

The vacuum tube in addition to being useful as an amplifier provided a means of producing carrier currents uniformly and cheaply. The interconnection of the output and input of a vacuum tube results in oscillations that continue at a frequency determined by the constants of the circuit to which it is connected. Also the versatile vacuum tube can be used as a modulator or a demodulator depending upon the circuit connections which are employed. The invention about this same time of the band filter by G. A. Campbell, which enabled specific bands of frequencies to be separated from other frequencies, was the last link which was needed to complete the development of a practical carrier telephone system.

The availability of these devices greatly stimulated development activity on carrier telephone systems, with the result that a commercial installation was made between Pittsburgh and Baltimore in 1918 after various laboratory set-ups and field experiments. This first system provided good telephone channels but was somewhat crude in appearance, considerably more expensive than present systems and occupied a much larger space than the modern product. Development work went on from this first installation, however, making few changes in fundamentals but refining and improving the system until now we have cheaper, more compact and more reliable types of equipment. The large carrier telephone development of the Bell System would never have occurred if these cost reductions and improvements had not been made.

Even after the apparatus and circuit design had been made practicable by the vacuum tube and filter developments, there were many other problems to be solved chiefly in connection with the lines. The facilities of the Bell System at that time had naturally been built to provide good voice frequency transmission and many limitations developed when an attempt was made to use them at higher frequencies. For instance, loaded lines as then designed would not transmit the higher frequencies at all, and even on non-loaded open wire lines the voice

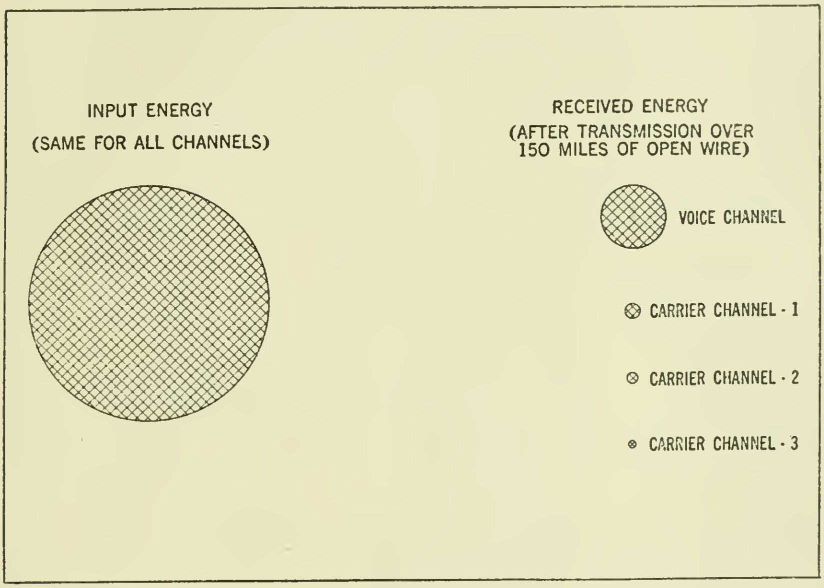


Fig. 4. Comparison of Sending and Received Energy

currents in their elevated position in the frequency spectrum diminished much more rapidly than when they occupied their usual position in the lower part of the spectrum. This is illustrated by the chart numbered Figure 4 which shows for each of the four channels the relative amounts of energy received at the distant end of a typical line with equal inputs at the sending end. This meant that repeaters had to be provided more frequently for the carrier channels than for the voice channels. It is for this reason that the schematic drawing Figure 2 shows a carrier repeater between the terminals, while the voice currents pass over the line without amplification.

Other transmission effects are also exaggerated at the higher frequencies. For instance, crosstalk between pairs is much more severe at the higher frequencies, requiring more frequent transpositions to reduce it to tolerable values. Where the same carrier frequency is used in both directions of transmission, the interaction between the opposite directional channels becomes so severe that it was usually found desirable to utilize different frequency bands for the two directions in the same manner that two-cable pairs are used for opposite directions of transmission in ordinary four-wire cable circuits. Similarly, small pieces of cable in the open wire lines, such as frequently occur at river crossings or other similar locations, were found to constitute serious obstacles to carrier transmission, while at voice frequencies they were relatively unimportant. This problem of transmitting carrier currents through unavoidable sections of cable was solved by the development of a special type of loading which required loading coils to be located in manholes every few hundred feet along the cable instead of every 6,000 feet which is customary for long toll cables operated at voice frequencies. For cable longer than a mile or two the cost of this closely spaced loading became an important factor. With the extension of the carrier technique to toll cables, studies showed that no loading and more repeaters were preferable both for economic and other reasons. Actually the carrier system now used for toll cables employs non-loaded pairs and a 16 mile repeater spacing.

Successive Types of Systems

A brief review of the successive types of carrier systems used in the Bell System may serve to illustrate the type of problems which have been encountered and overcome during the course of development of the dependable, high quality carrier systems which are available today. The first carrier system which was installed in 1918 between Baltimore and Pittsburgh was known as the Type A system. This was a four-channel system with a spacing of 5,000 cycles between the carriers of the individual channels. The same frequencies were used in both directions of transmission, requiring that hybrid coils be used to provide the separation between the two directions of transmission in the same way as had been done previously in two-wire repeater operation. The carrier frequencies at the two ends of the circuit were synchronized by a special narrow band channel in addition to the four speech carrier channels, thereby wasting a portion of the useful frequency spectrum. Oscillators in the early days were so unstable that independent frequency generators at the two ends of the circuit could not be kept in synchronism any other way. Figure 5 is a photograph of a complete 4-channel Type A carrier terminal. It will be noted that this equipment was not mounted on relay racks, such as are now ordinarily used for central office apparatus of this nature, but consisted of a line-up of small apparatus bays approximately a foot square and about eight feet high. About twelve of these small racks constituted one end of a complete four-channel system.

As the carrier filter art developed, it was found practicable to utilize less frequency space for the individual channels. This enabled different frequency bands to be used for the opposite directions of transmission without materially raising the top frequency used. This had the advantage of simplifying the crosstalk problem and other interaction effects between opposite directed channels. In fact with the same frequencies used for both directions of transmission, crosstalk would have prevented more than one or two systems to be applied to a full 40-wire open-wire line. This would naturally have greatly restricted the application of the Type A system.

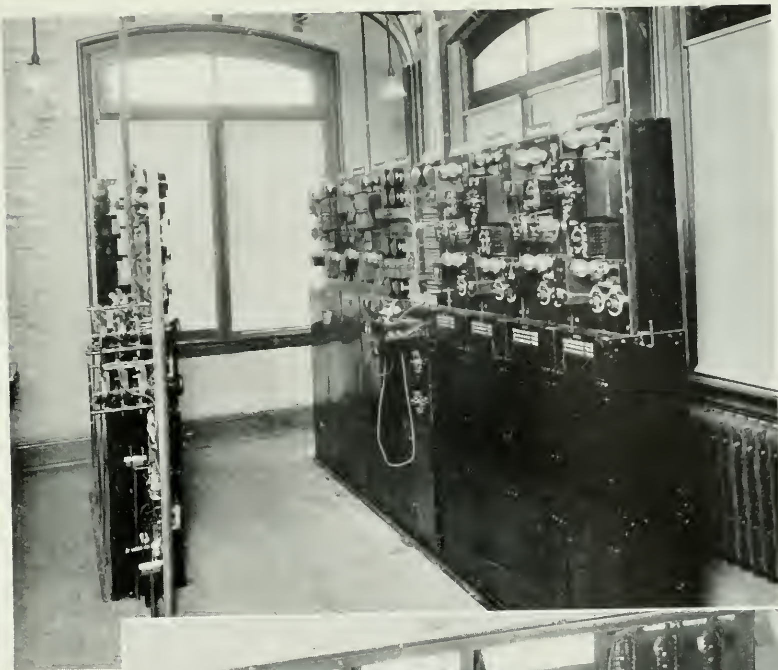
A few Type A systems had been installed to meet urgent service demands, but before any considerable number were placed in plant, a new design had been worked out embodying the new filter art. This new system was known as the Type B. It avoided balance problems and simplified the cross-talk problem materially by using different carrier frequencies in the two directions of transmission. This change permitted several systems to be operated on the same 40-wire lead although somewhat more frequent transpositions of the wires were required than had been the case with strictly voice frequency circuits. As noted in connection with Figure 3 it is necessary to supply to the demodulator a carrier current exactly the same frequency as that used in the modulator at the sending end of the circuit. In the " A " system this synchronization was accomplished by a separate channel but in the " B " system, in order to avoid the sacrifice of frequency space for this purpose, the necessary demodulator current was transmitted along with the voice currents for each channel. This latter plan, however, involved other disadvantages, the most important being that the load capacity of the repeaters and amplifiers in the circuit was materially reduced because of the necessity for amplifying these demodulator currents.

Figure 6 is a photograph of a B system installation. It will be noted in this picture that the trend toward relay rack mounting has had its effect and this system was mounted in this fashion. Four bays of relay space were required for one end of a complete three-channel system with its associated test panels.

Advances in Carrier Design

Somewhat later, improvements in oscillator design made it practicable to dispense with the necessity of transmitting demodulator currents over the line. It became practicable to design oscillators which would maintain their frequency with only small deviations through the day. The next advance in

Fig. 5. Complete 4 Channel Type A Carrier Terminal



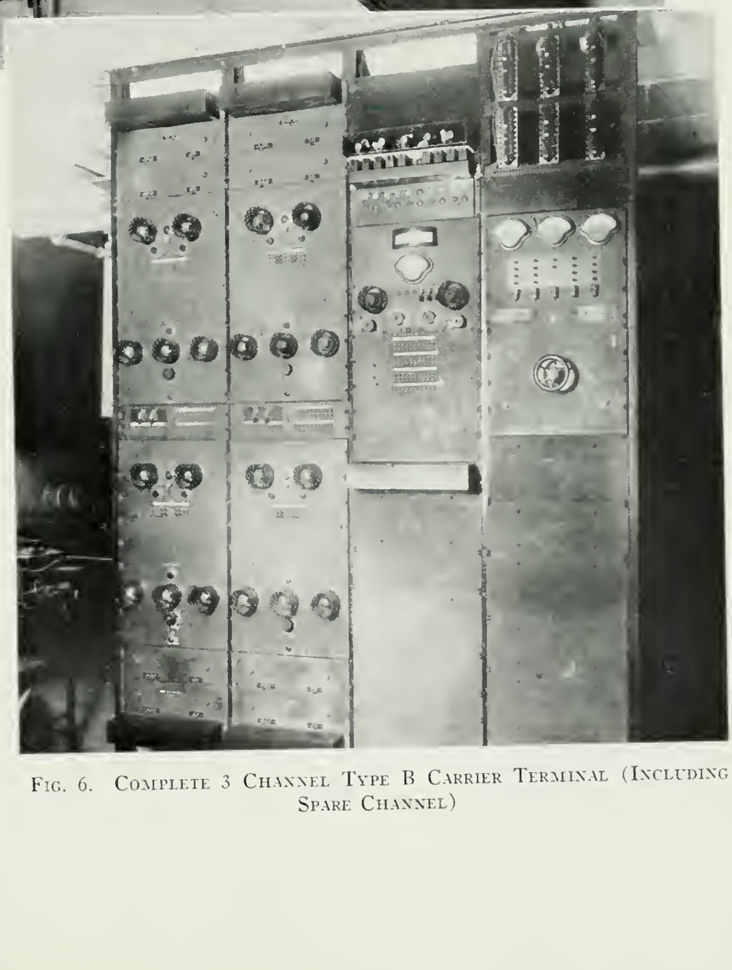


Fig. 6. Complete 3 Channel Type B Carrier Terminal (Including Spare Channel)

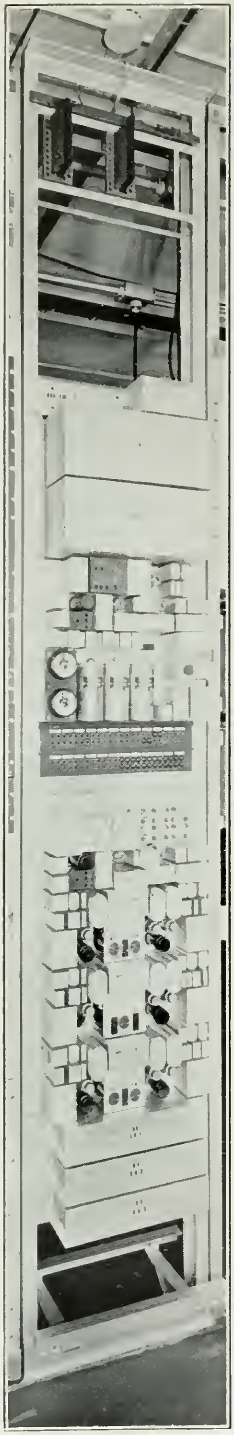


Fig. 7. New Type C Carrier Terminal

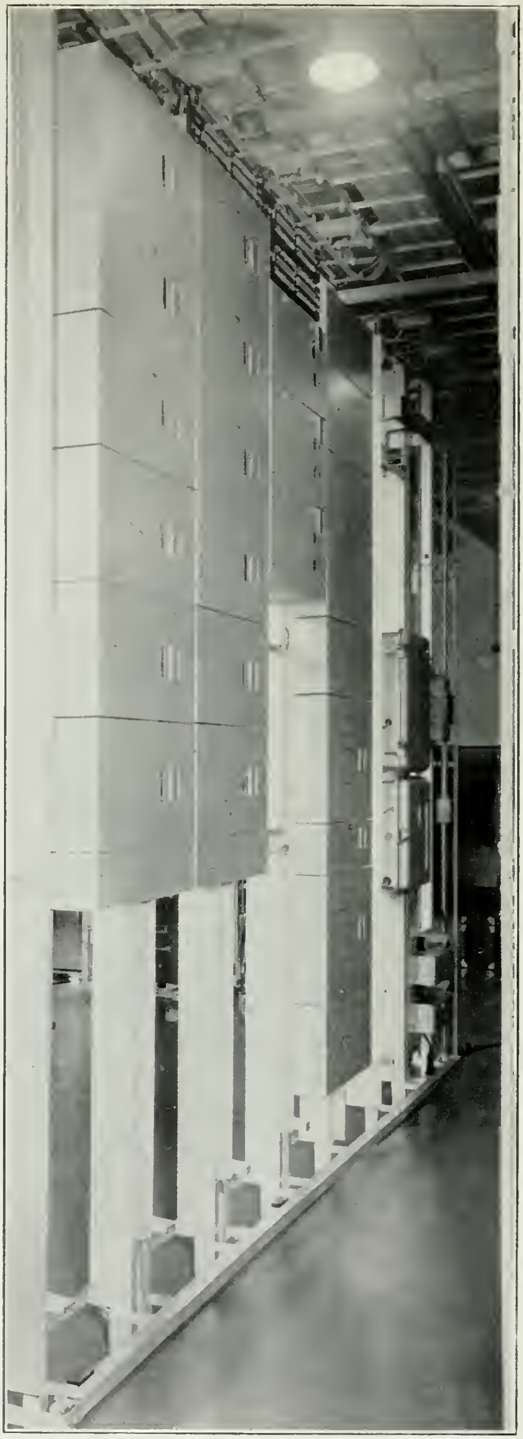


Fig. 10. Two 12 Channel Type K Carrier Terminals

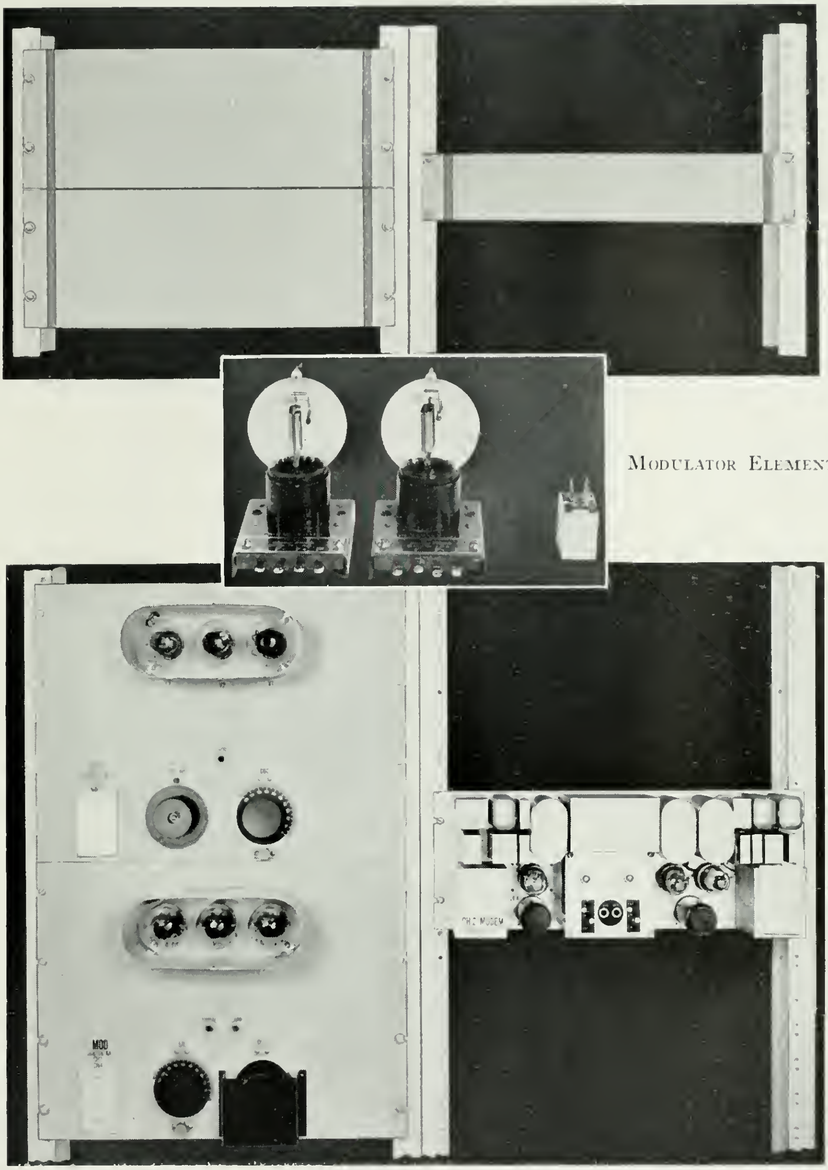


Fig. 8. Comparison of Elements of Old and New Systems

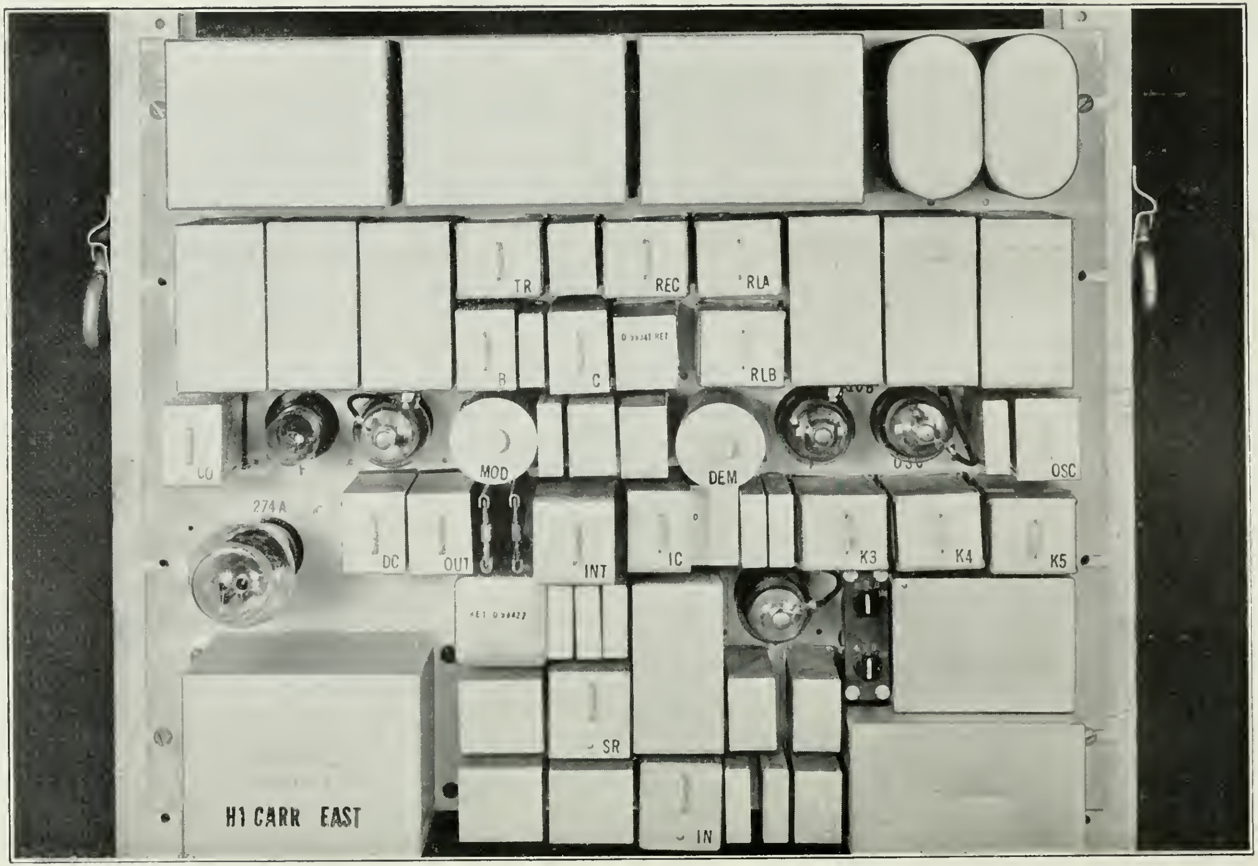


Fig. 9. One Channel Type H Carrier Terminal

carrier design, therefore, was to use separate oscillators at the two ends of the circuit and not transmit the demodulator current supply over the line. The Type C system which embodied this principle included oscillators whose design was sufficiently stable to permit only occasional frequency adjustments for synchronization purposes. Once per day was found to be adequate even in the early " C " systems.

The Type C systems for more than a decade have remained standard for use on open wire lines. Minor improvements have been made from time to time but the fundamental circuit and principles of operation remain the same. Figure 7, a photograph of an installation of the most recent Type C system, shows the reduction in size and complication which has been effected. The new system occupies only one bay of relay rack space as compared to three bays for similar systems manufactured 10 years ago. It is generally more efficient and more satisfactory than the earlier systems.

A striking example of the reduction in size which has occurred during the refinements of the C system is a comparison on Figure 8 of the filters used in the early systems and the filters used in the modern ones. It will be noted in the older design two filters occupied about fourteen inches of relay rack space, while in the new design two filters are mounted back to back and the entire vertical space for the two filters is only about 3½ inches. This makes a reduction of four to one in the relay rack space occupied by filters.

Another change which has recently been made tends to simplify and reduce the space required for a carrier system. This is the adoption of copper oxide modulators and demodulators in place of the former vacuum tube modulators. Figure 8 shows the relative size of the two vacuum tubes previously used in the Type C modulators and the copper oxide varistor unit which is now used for both modulators and demodulators in the modern Type C system. A complete modulator and demodulator with their associated input coils, etc., occupied a space of 28 inches, while the copper oxide modulator and demodulator with their associated coils, etc., occupy only about 7 inches of relay rack space.

While carrier channels have usually been installed in units of three, there have been occasions where a lesser number of channels would be adequate and where the simplification of line problems involved with lower frequency transmission would be helpful. It is not generally economical to install a single channel of a Type C system, as a large amount of equipment is common to the several channels and the cost of the single channel would, therefore, be higher than necessary. Furthermore, it would not be practicable to take advantage of the possible economy in frequency band transmitted that should naturally result from a one-channel design. For these various reasons, therefore, a single channel system was developed utilizing the carrier frequencies immediately above the voice band and omitting many of the inherent complications of the three channel system. The most recent design of single channel system is known as the Type H. This system, pictured in Figure 9, occupies only about 16 inches of relay rack space—somewhat less than one-third of that used by the latest three-channel C system shown in an earlier photograph (Figure 7). These systems are frequently put in remote locations where no central office power is available for operating them and the panel therefore includes a power pack as an integral part of the system.

Twelve Channel Systems

Also, work has been under way for several years on a new carrier system for open wire which will provide twelve more carrier channels in the frequency range above that used by the Type C systems. This new system is known as the Type J. Within the last few weeks, the first commercial installation has been completed between Dallas and San Antonio. Other systems are being installed and will be completed within the next few months. The added twelve channels requires the exploitation of frequencies as high as about 140,000 cycles. The basic modulating and demodulating units of this new system duplicate the Type K carrier cable channel units mentioned below but, of course, different arrangements are required for connection of these channels to the open wire lines. This extension of the frequency range puts a new burden on the design of the line circuits on which the carrier is superposed. Better transposition systems, new entrance cable arrangements, more attention to wire sag and many other changes are required in open wire engineering. The utilization of this new development work will mean that a forty wire open wire lead will have circuit possibilities greater than a full size voice cable designed a few years ago.

All of the above mentioned systems have been intended primarily for use on open wire lines. This fall the first commercial installation of a carrier system designed for long cable circuits is being put into service between Detroit, Michigan, and South Bend, Indiana. This new system is known as the Type K and provides 12 circuits on each two cable pairs equipped. Figure 10 is a photograph of a typical terminal installation of K equipment. The bay lineup shown includes 24 channel units and some miscellaneous equipment common to other channels not shown in the photograph.

Many practical problems were involved in the adaptation of the carrier art to cable construction. The rapidity with which the carrier currents diminish in strength as they pass along a cable pair requires repeater installations approximately every 16 miles as compared to the repeater spacing for voice circuits which is about 50 miles. The large number of repeaters in tandem on a given system requires many refinements of design so that the currents reach their destination without distortion. Changes of equivalent with temperature are so large that the problem of compensation becomes very complicated.

Crosstalk rapidly increases as frequency goes up and the elimination of crosstalk between the pairs carrying different systems, separated by only a fraction of an inch, was no easy matter. Complicated methods of neutralizing the crosstalk currents were developed so that frequencies up to 60,000 cycles could be utilized on existing types of cables. It was found impracticable, however, to operate systems in opposite directions in the same cable, so that two cables have to be made available for a cable carrier installation. The second cable on an existing route may be a small one, only including the number of pairs required for the return transmission of an equal number of carrier pairs in the existing cable. Where a new cable route is involved, two separate cables can be used, or where it seems economical two groups of conductors, each equivalent to a single small cable, may be located in the same lead sheath by use of a suitable shield between the groups of conductors.

The carrier art continues to advance and at the present time the Bell Telephone Laboratories are engaged in the development of a commercial carrier system involving frequencies in the million cycle range instead of around 100,000 or less. These new carrier systems must be operated on special conductors called coaxial units and open up an entirely new transmission technique. No installations other than the field trial between New York and Philadelphia have been made up to the present time, but it has been demonstrated on this trial that several hundred telephone channels will be practicable on a single unit of the coaxial type.

Field of Use of Carrier Systems

In considering the economic field of application of carrier systems, it is hardly necessary to point out that in order to be used in place of other forms of construction, they must provide circuits at least as good as existing types and at a lower cost. The transmission objectives have been fully met in the latest systems for they provide circuits of higher intelligibility and capable of being operated at lower net losses than any of the voice frequency forms of construction. By practically always operating on non-loaded conductors, transmission of the voice currents at a speed approaching that of light is attained.

It may not be generally realized that the speed of transmission becomes an important factor in the longer telephone connections. The actual elapsed time, together with a technical effect called "echo," may become very troublesome in carrying on a telephone conversation over a very long circuit. The higher speed of the new carrier circuits gives them a great advantage in this respect so that the factors mentioned are not important even in connections several thousand miles in length, such as might be involved when interconnecting two continents.

Economic balance comparisons of carrier and other forms of construction are, of course, made on an annual charge basis as investment in carrier equipment is usually much lower than in pole lines or cables, but the equipment carries a higher rate of annual charge. The figures applying to the carrier system must include not only the cost of the terminal equipment itself, but the cost of the intermediate carrier repeaters, any change in the voice circuits required by the superposition of the carrier, the expense of preparing the line for high frequency transmission including new transpositions, loading or other changes. Also, in some cases extra power plants have to be provided or existing batteries enlarged to take care of the added current drain imposed by the carrier apparatus.

Naturally on the short circuits the terminal represents the largest cost item and becomes a smaller proportion of the cost per mile as the circuits which they provide are lengthened. Therefore, the field of use for carrier is usually in connection with the provision of the longer toll circuits. In the early days of carrier, 250 miles was about the shortest distance where the annual charge comparison between the open wire carrier systems and other methods of providing the circuits would be favorable to the carrier method. As development effort reduced the complexity of the carrier systems and cut down the equipment costs, the proving-in point continued to drop so that at the present time the three channel systems will frequently prove in for distances as low as 70 miles and single channel systems below 40 miles.

Of course, there were special cases even in the early days where three channel systems were proved in for distances much shorter than 250 miles. These cases involved special situations where the addition of wire on an existing lead would involve major reconstruction work or where a few carrier systems would postpone for a year or two the construction of a new line or the installation of a toll cable. For this reason, the figures mentioned above merely give a general indication of the field of use of these systems. J systems are so new that their field of use is not yet entirely clear. In open wire areas where sleet and other storm hazards are not severe they will probably have a large development particularly in providing the long through circuits. A good example of such development is the Fourth Transcontinental line, recently described in the QUARTERLY, on which several J systems will ultimately be installed.

The Type K carrier system which was developed for use on toll cables has an economical field of use for toll cable circuits over about 100 miles in length. It will probably have its greatest use in connection with the provision of relief along routes where at least one cable already exists. In case of a single cable route some of the pairs in the existing cable will be allocated to carrier use and a small size paralleling cable will be provided including only enough copper for the expected economical development of the K systems. Further additions of full size cables to existing cable routes will soon be the exception rather than the rule as was the case a few years ago.

Also, in many places, where new cables are to be installed, cables materially smaller than full size will be found economical. For instance, two one-quarter size cables or a half size cable divided in two parts by a shield for K operation will provide about 900 telephone circuits as compared to 225 circuits from a full size cable containing only voice frequency four-wire circuits. The new coaxial development will also provide circuits economically for distances of 100 miles or more and the exact line of demarcation between the field of use of the coaxial and K type of construction is not yet entirely clear. As experience with the two systems progresses, it is entirely probable that in many of our long haul cables of the future, particularly on routes having long through circuits, the coaxial system will play a large part.

Typical Examples

The wide variety of carrier applications is shown by the following examples of the various types of carrier systems now

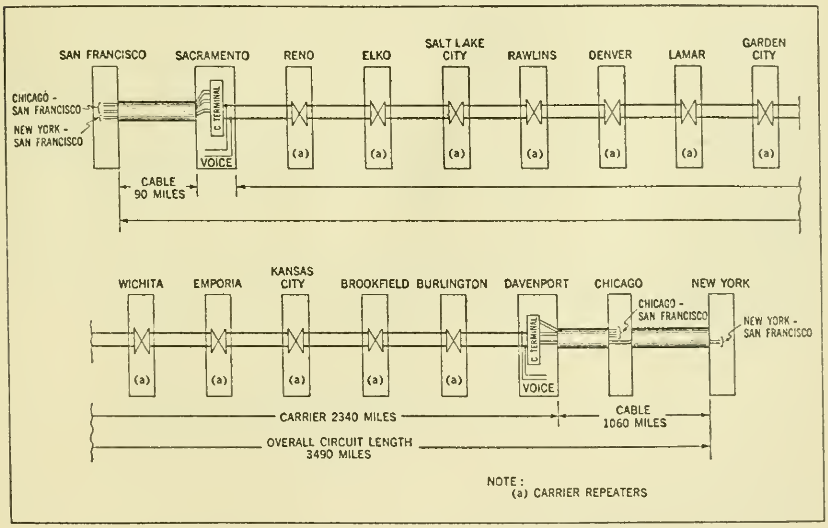


Fig. 11. Layout of Long Type C System

working in the Bell System plant. The longest type C carrier system in the United States at the present time forms part of the New York-San Francisco circuits. The layout of this circuit is shown on Figure 11. It will be seen that there are two cable sections about 1130 miles in total length in which voice frequency four wire transmission is employed while the remainder of the circuit is formed by a channel of 2360 mile Type C carrier system. There are twelve intermediate carrier repeaters in this section and the amplification provided by these repeaters amounts to about 3,540,000,000,000,000,000,000,000,000,000,000,000 times. This tremendous amount of amplification is required in order to restore the enfeebled currents to their original value as they travel across this long stretch of open wire line.

The shortest type C system now operating is one between San Pedro, California and Catalina Island. This installation is one where the open wire type of system has shown its adaptability to submarine cable construction and has been used to

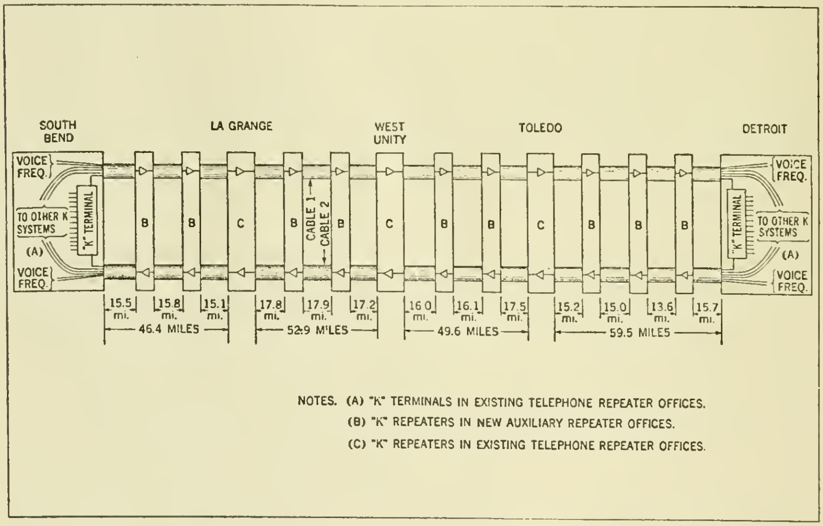


Fig. 12. Layout of First Commercial Type K Carrier Installation

defer expensive relief in this 30 mile underseas section for many years. In this case the standard Type C system has been modified somewhat so that a total of twelve Type C channels are now operated over the two cables existing between these two points.

The layout of the first Type K carrier installation to be cut in commercial service is shown on Figure 12. It provides circuits between South Bend and Detroit, a distance of about 210 miles. In this distance there are twelve intermediate repeaters with an average spacing of about sixteen miles between repeaters. It is interesting to note that this close spacing of repeaters has required the construction of many new repeater stations, but all of the new repeater points between the terminal and the two existing voice repeater stations are operated from these existing stations so that the problem of providing and housing operating forces at each of the new points is avoided. This completed project is typical of the way that K systems will be used to relieve existing cable routes as the capacity of the present voice cables is reached.

As we look forward to future engineering of the toll plant in the United States, carrier systems will occupy an increasingly important position. Although about 20 per cent of our longer toll circuits are now supplied by carrier, another twenty years will probably see less than 20 per cent handled by other than carrier means.

Arthur F. Rose

World's Fairs and Bell System Exhibits

WORLD'S Fairs are community enterprises, promoted in the economic interest of some municipality but offering advantages to the larger units of state and nation; and their financial support classifies along similar geographical lines. The chosen site is usually entailed to some later public service, to serve as a park or university campus or, utilizing the more permanent buildings of the exposition, as a center for museums and galleries. Appeal is made, therefore, to local business organizations not only on the basis of goods and services to be sold but on the basis of wide public welfare. Bonds are sold to hotels, main-street stores, realtors, contractors, banks and public utilities—to those who may be expected individually to profit and to those who may be expected to contribute because of identification with the community.

Broadening its appeal, the exposition organization seeks appropriations from state and national governments and their support through the construction and maintenance of exhibits. From the industries which are national advertisers, and so expected to profit by any quickening of the financial pulse, it claims coöperation in the form of ground rents and exhibits. Every exposition, in addition to consuming in itself a certain amount of industrial output, serves as a general stimulant to business activity. The breadth and intensity of this effect depend upon the size, location and success of the exposition. The Chicago "Century of Progress" exposition of 1933, for example, which was boldly carried out during years of depression, has been generally credited with a favorable effect on business conditions.

Beyond the nation, representatives of the exposition solicit participation by foreign governments, although the extent to which this is achieved, and hence the extent to which the exposition proves to be truly a world's fair, depends upon many factors, not the least of which are the political conditions of those countries and the concessions, such as free rent, that can be offered. Beyond these major groups, appeals for participation are made to organizations of all sorts, social, religious or educational; buildings are planned with space to be rented for exhibits of almost any size and of any publicly acceptable kind.

All these participants contribute to the educational program of the exposition, displaying their wares, accomplishments, ideals and services. Beyond them, however, is an almost equally large participation by concessionaires who provide visitors with food, drink, services and amusements. Between exhibit and concession sometimes only a fine line can be drawn; usually the criterion is whether or not there is something for sale and immediately deliverable.

In the United States, during 1939, there will be two world's fairs: at San Francisco, starting February 18, the Golden Gate International Exposition; and at New York, starting April 30, the New York World's Fair. The Bell System will be represented in both.

Mr. Gifford had already established a precedent for such participation in the case of two smaller expositions, one at San Diego in 1935, and one at Dallas in 1936. In each case the American Company arranged for the space and designed and erected a Bell System exhibit. The local operating company then undertook, at its own expense, the maintenance and operation. The division of responsibility seemed to work out very satisfactorily; the exhibits received innumerable compliments from visitors, and so also did the operating personnel for its courtesy and efficiency. This division, of course, followed the organizational relationship of the Bell System, exemplifying local responsibility for service backed by a national organization.

The exhibits at San Diego and at Dallas, and also the earlier exhibit at the Century of Progress Exposition in Chicago in 1933, were carried out under the general oversight of Vice President A. W. Page, of the American Telephone and Telegraph Company, in charge of public relations, and of Vice President F. B. Jewett, who is also the President of Bell Telephone Laboratories. To the Laboratories was delegated the conception and execution of the exhibits; and within that organization the responsibility was placed upon the writer and his associate, M. B. Long. This organization of responsibility has been continued for the New York and the San Francisco expositions.

At these two expositions of 1939 the Bell System should have a greatly improved exhibit because much has been learned from the crowd reactions at Chicago and also at San Diego and Dallas. At Chicago, it will be remembered, the two most popular exhibits were the demonstration of long distance telephony and the acoustical illusion of the dummy "Oscar" with his microphonic ears. Apparently the greatest public interest was attracted by exhibits which were either of striking scientific novelty or of a type which permitted individual visitors to participate, as did the demonstration telephone call. At San Diego, profiting by that experience, there was introduced the "hear-your-own-telephone-voice" equipment—now popularly known as the "voicemirror." This permitted a visitor to say a few words over a telephone and then immediately to hear those same words reproduced by a magnetic-tape recorder and so to learn how his voice sounds to others over the telephone. At Dallas another participating exhibit was tried out in the form of a hearing test. Eleven telephone booths were set up in a quiet space, where visitors could make tests of the acuity of their own hearing by listening to spoken words which gradually decreased in loudness until they were no longer audible. About two thousand individuals a day could be accommodated; and the exhibit ran to capacity.

When, therefore, Mr. Gifford agreed with the exposition managers to participate in the 1939 expositions there was a considerable amount of experience and a more or less complete philosophy of showmanship upon which to plan these exhibits.

Hundreds of possible exhibits have been imagined and critically analyzed. Most promising were those which met one or the other of the two criteria which previous experience had established. The first was the possibility of attracting participation by visitors in doing something of personal interest to themselves, using equipment and techniques of the Bell System. The second was scientific novelty, comprehensible to the general public. Novelty alone, however, was not considered sufficient. The exhibit had to be a direct outgrowth and adaptation of Bell System researches in electrical communication. It had to be an intriguing "stunt," such as a distinguished scientist might perform for the amusement of guests in his laboratory. "Oscar," for example, the popular dummy at Chicago, had been made possible by Bell System knowledge of speech and hearing and by its high quality instruments for picking up speech and for reproducing it at the ear of a listener. Similar, but not such striking, success had accompanied the "scrambled speech" exhibit at some of the earlier expositions.

To meet these criteria to the full, there had to be ruled out a number of exhibits which on first consideration were very attractive. For example, the manufacture and assembly of a telephone handset is an interesting operation which illustrates the complexity, delicacy and precision of telephone equipment, and also the manufacturing economies which accompany its production. Manufacturing operations, however, to be attractive to exposition visitors, should be spectacular, like the electrical welding of the body of an automobile. They should also be easily visible and very obvious, like the assembly-line operation of putting wheels on an automobile chassis. The assembly of a handset meets none of these requirements. Its parts are many and very small; and the reason for each of them is highly technical. The public, also, usually takes most interest in the manufacture of products which it wears, eats, drinks, or smokes and, in general, of products which it buys on a competitive basis. A machine for knitting stockings would attract a much larger crowd than would an equally ingenious machine for covering telephone cords. For these and other reasons a number of possibilities were necessarily eliminated which at first thought might enter into a telephone exhibit.

A world's fair crowd, according to observations of the successful exhibits at other expositions, is one of great mobility, of short-lived interest, easily diverted and, in fact, demanding diversion. The whole atmosphere of flags, music, brightly colored buildings and transient crowds works against an exhibit which demands more than short timed attention. An exposition, by its very size and variety, calls for a quick "once over" rather than for the leisurely study which exhibits get in a museum or gallery.

The New York fair, for example, covers 1216 acres—partly water, but the shores given up to concessions and divertissements—of which the Bell System occupies slightly more than three acres.* The inevitable tendency for most visitors will be to move fast, to try to get all the way around and to "see what it is all about." If a conscientious visitor should devote his time to the various exhibits, restaurants and amusements upon the basis of the acreage they occupy and, in doing so, should spend a whole week, twelve hours a day, his proportionate time on the Bell System grounds would be only about thirteen minutes. Most out-of-town visitors, of course, will not stay long enough in New York to devote anywhere near that amount of time to the exposition †; but to meet the requirements of conversation in their home towns, they must have seen the major or most striking exhibits—the ones which everyone else

* 139,000 square feet.

† For strangers to New York City its many permanent attractions, its stores and theaters will be in competition with the Exposition. There are things in that city which are "musts" for visitors.

will mention on returning. They will have to travel fast, giving to most of the exhibits they pass only a limited survey. For that reason, a world's fair is not the medium for the inculcation of abstract ideas, but rather for publicising concrete things or acts, names and simple facts which he who runs may read.

No matter what exhibitors, themselves, may wish, the crowd always has a tendency to treat a world's fair like an amusement park, to look upon the entire thing as a show and to judge each exhibitor by the novelty, drama and attraction of the show which he puts on. Some of those who saw "Oscar" at Chicago and listened through his ears may not have understood the phenomenon which had amused them but nevertheless, along with others who could not even get a seat to listen, they went away to tell their friends, in substance: "when you go to Chicago don't fail to see Oscar at the telephone show."

From the standpoint of an exhibitor who wishes to give publicity to abstractions, to the principles underlying his product or to the philosophy of the service which he offers, such limited advertising possibilities might at first be somewhat disheartening. But that merely means that he must adapt his publicity to the medium which he is using. A large and successful world's fair offers a unique opportunity for publicity, but only if the advertiser will select from the messages which he wishes to deliver the one best fitted to the occasion. Visitors attend world's fairs with a willingness to be interested and impressed. For most of them a world's fair is a distinct event in their lives, which they remember for years; and a favorable impression once made has a permanence which does not usually accompany other forms of advertising. They do not, of course, remember the details; but the impressions stay with them and are disseminated by word-of-mouth to others who could not attend. The Columbian Exposition in Chicago during 1893, the St. Louis Exposition of 1904, the San Francisco Exposition of 1915, live in the memories of many of their visitors; and for many the impressions that they there obtained of companies and products have been an unconscious influence ever since.

On the other hand, a world's fair is a community enterprise and exhibitors must enter it somewhat as a result of community spirit and as their contribution to the general welfare which the exposition is supposed to encourage. On that basis the exhibitor who puts on a good show, since that is what the public seems to expect, is credited with so doing, just as national advertisers on radio programs are credited with the musical or dramatic shows which they put on. Some of their listeners may turn down their loudspeakers when the announcers describe the products, but, nevertheless, all know that they are listening to and enjoying a performance supplied by a specific company; and all have a certain amount of gratitude to that company and some unconscious partiality for its products. For that reason a world's fair exhibit has some of the characteristics of radio broadcasting.

To put on a show which will appeal and attract, some exhibitors have to rely on orchestras, on marionettes, on vaudeville programs, on radio studios with costumed performers, or on similar amusements not directly related to their industries. The Bell System, however, is fortunate in that it can set up shows employing apparatus and techniques which are either adaptations of the equipment and methods which it employs in telephonic service or outgrowths of its acoustic researches. Acoustic developments are very suitable to a world's fair because when large shifting crowds are to be entertained an exhibit must be either big enough to be seen or loud enough to be heard.

Large crowds within the exposition gates are to be expected at both the 1939 fairs. Because of the much higher density of population within a reasonable transportation time of the New York site, its peak attendance, and also its daily average, should be higher than that of San Francisco. No one, of course, can predict with accuracy, but certain figures can be cited as indicative. At San Francisco, because of its location on Treasure Island—filled land adjacent to Yerba Buena Island in San Francisco Bay—the maximum daily attendance is limited by available ferry slips and by the automobile capacity of the San Francisco-Oakland bridge to 400,000—according to some estimates to eighty or ninety per cent of that figure. At New York, plans for entrances, streets, and all the factors which affect traffic have been made for a peak of 800,000 or more. A million persons a day is, of course, not unprecedented at Coney Island or Jones Beach; and this estimate therefore does not appear out of line with possibilities.

What attendance is to be expected by an industrial exhibit, like the Bell System's, is even more difficult to estimate, but some facts stand out from the three recent expositions. First, it should be noted that the exposition gate, except for the opening day, always includes a variable number of "repeats" —of persons who have attended before. The writer remembers a citizen of Chicago who attended its 1934 exposition over sixty times. His family was away for the summer; the Black Forest restaurant served good food and offered an attractive floor show; so he ate dinner there instead of at a city restaurant. He, and others like him, treated the exposition admission as a cover charge for a favorite restaurant. Others repeated to accompany friends and out-of-town relatives whom they steered around to the exhibits that they "should see." The proportion of the total, or daily average, of gate attendance, therefore, which an exhibitor should expect involves some estimate of the proportion of "repeats." At Chicago in 1933 the Bell System exhibit had an attendance of about twenty-eight percent of the exposition gate. The peak was about 370,000 and on that day the exhibit was crowded by about 85,000 visitors—far more in fact than it could effectively accommodate.

Both New York and San Francisco introduce new factors into the problem of estimating attendance. At New York, for example, it is proposed to charge seventy-five cents admission instead of the fifty cents which has been the price at previous expositions. At San Francisco, although the admission is to be fifty cents, the transportation must either be by ferry or by automobile via a toll bridge and with a parking charge on the island. San Francisco will have the geographical advantage of a plot one third the New York size and correspondingly smaller distances to travel between exhibits. At New York the size is such that those who wish to give the exposition a quick once over will have to pay fares on the intramural buses. Neither of these situations is particularly favorable to the exhibitor who wishes his show to be seen, once at least, by as many individuals as possible. In both cases the minimum cost for a family promises to be about fifty percent higher than for previous expositions. If that proves to be a deterrent to members of the lower income groups it will result in fewer visits on their part and hence greater likelihood of their hurrying past many exhibits or missing them altogether. If that is so, it will work to the disadvantage of all exhibitors but particularly of those whose exhibits are small, poorly located or not sufficiently spectacular. It will discriminate in favor of those exhibits which early catch popular attention and are advertised by word of mouth.

The San Francisco fair will run for 288 days and the one at New York for 185. The longer run at San Francisco was undoubtedly set because of climatic conditions, starting dates for schools, and seasonal dates for Pacific coast tourists. In considering what these dates may mean to an exhibitor, it is necessary to distinguish between the number of different individuals who visit an exposition and the total crowd. Both expositions, of course, count very frankly upon a large repeat attendance from persons living in their immediate vicinity. The repeat attendance, however, is of less interest to an exhibitor and of greater interest to concessionaires. Although it is impossible to estimate, one may assume that a definite but unknown number of different individuals will be effectively attracted by each exposition, and will visit it. The longer run—over a hundred days greater—at San Francisco means that those attracted by that exposition will have a larger number of days to choose for their attendance, and hence, other things being equal, their attendance per day will be smaller than it would if the run were shorter. That is predicated upon the assumption that in any season there are only about so many persons who will have time, money, opportunity and motive for attending an exposition which is located some distance away. If that is so, the peak crowd for which an exhibitor must plan will be less at San Francisco not only in proportion to the smaller total gate which is expected but also somewhat in proportion to this factor of a greater time distribution. In planning the Bell System exhibit at these two localities, therefore, handling a large crowd was considered much more of a problem at New York than at San Francisco.

At the two expositions the exhibits, with one exception, will be similar. But their capacity for individual participation and for observers will be markedly different. At New York the Bell System exhibit should be able to handle effectively five or six times as many visitors as at San Francisco.

The requirements of handling a large crowd, and the decision to design exhibits as far as possible for individual participation on the part of visitors, occasioned the development of a new principle for exhibit showmanship. This principle, which has controlled the display of the New York exhibits, can be briefly described as that of "a show within a show". An exhibit and its participants are arranged as a show for the much larger number who do not participate. It can be illustrated by the long distance demonstration. In an earlier form, this demonstration proved very attractive at Chicago and at Dallas. It will be enlarged and extended at New York. (Incidentally, a similar exhibit will appear at San Francisco.) At one end of a large room in New York there is a huge map of the United States, with switchboard lights marking the location of some 3500 important cities and towns. On either side of the map are booths from which, one at a time, the participants place their demonstration calls. In front of the map are tables with head receivers, where visitors can listen in and hear both sides of the conversation. Receivers are provided for a couple of hundred visitors. On the average, they listen for about five minutes, so that about 30,000 different listeners can be accommodated during a day. The actual participants in demonstrations will run about one every five minutes.

For each call the route is traced on a map by a line of lights. The crowd listening at head receivers in front of the map, the glass telephone booths for those who participate, the scheduling desk and the pages who guide the participants, the mechanism for selecting participants with its surrounding crowd—all these together form an interesting scene, the purport of which can easily be grasped by observers who do not participate. There will, therefore, be provided over the rear of this room a large balcony or mezzanine. Along this visitors can walk and look down upon the scene just described, in much the same way as visitors to the gallery of the New York Stock Exchange look down upon its milling brokers. Escalators and stairways, connecting the balcony with the main floor, allow those who wish to join in the participation to do so; but there will always be a large group which prefers only to look on. To call attention to the promptness with which long distance telephone connections are made, there are provided beside the map luminous clock mechanisms which indicate for each telephone call as it is made the time it takes. These timing devices show first the relatively small time it takes for the calling subscriber to pass his call to the operator; then the similarly small time until the distant subscriber's bell is rung; next the wait until the called subscriber answers; and finally, what is frequently the largest part, the time to get the particular person who is called.

With this balcony arrangement, those who are taking part in the exhibit become a show for an even larger number of visitors. The balcony also is adapted to those who wish to travel fast. In addition, it will permit handling effectively about twice the crowd that could otherwise be handled and it will insure that each person who goes past the exhibit area is given some idea of what it all means. This principle, of course, follows the well-recognized psychology of the amusement park, where the crowd watching participants sliding down shoots or tumbling around on turning tables gets its amusement vicariously rather than by participation. Apparently, however, it has not generally been applied before to a world's fair exhibit, perhaps because few of the exhibits have been participating.

At New York, five of the six Bell System exhibits will be participating; and the sixth is to be a scientific novelty, the details of which are not yet ready to be announced. All the exhibits are essentially acoustic and each requires an acoustically treated room which is sheltered acoustically from adjacent rooms. Functionally, therefore, the exhibit building takes the general form of a series of six small theatres, with their foyers contiguous and, following the line of the foyers, a continuous balcony.

This principle of a show within a show will be particularly valuable in the case of the hearing test, where the participants pass through a glass-enclosed sound-proof room into inner rooms with special telephone booths for the individual tests. The tests are given through telephone receivers by a phonograph mechanism. This exhibit, therefore, would be almost meaningless and certainly uninteresting to those who do not participate if it were not for the possibilities introduced by the balcony. Over the booths, level with the balcony, and so visible alike from the balcony and from the main floor, there will be what is in effect a small stage. This is equipped with microphone and public address system; and on it a demonstrator will explain what is going on in the booths. She will go through the motions of taking the test herself, but what she hears in her head receiver will be made audible through the loudspeaker to all those in that area. A test card like the ones the participants use will be shown on a large screen beside the stage, and it will be filled out appropriately as the loudspeaker reproduces the test. Because of the varying distances at which visitors will be from the loudspeaker, reproduction of the test will not give a measure of a visitor's hearing; but it will show him how hearing can be tested under the proper conditions in the sound-proof booths. It has, however, an added advantage in that those who are going to participate will have heard the explanation and listened to a sample test before going into the booths. This will make the hearing test almost foolproof and will increase very much the number of participants who can be handled per day. According to present estimates 14,000 individuals a day will be able to test their hearing.

The showmanship principle, for which the balcony is utilized, will be particularly effective in another acoustic exhibit, already referred to but not yet ready to be announced. This exhibit, which has the advantage of being participating and at the same time presenting a scientific novelty, is in effect an extension of the famous "Oscar show" in Chicago. It is designed for a very large number of observers and also for individual participation by seven or eight hundred persons a day. It requires a space of several thousand square feet and will be shown only at the New York fair.

At New York, in addition, there will be provided a "Hall of Telephone Pioneers." This is a continuation of the exhibit area of the building and is formed by a widening of the balcony. At its center there will be the voice mirror which proved attractive at Dallas. It will permit several thousand visitors a day to hear how their voices sound to others when they telephone. Around the walls of this room will be static exhibits of equipment, historical and modern, of scientific or engineering significance to all interested in the progress of the communication arts. Adjacent to this hall is a small private room to serve as headquarters for Pioneers and as their meeting place.

The Bell System building at New York was functionally designed by Voorhees, Gmelin and Walker to house the exhibits which are being executed by the Bell Laboratories. The building stands on a triangular plot. Following the ideas of the architects, this site has been landscaped by Vitale and Geifert, and exterior panels and sculpture designed by Carl Milles, Hildreth Meiere and Edward Trumbull. Within the building the display of exhibits and the decorations are being carried out under the direction of Henry Dreyfuss. Acoustic treatment was engineered by Electrical Research Products Incorporated. Construction was undertaken by Vermilya-Brown Co. Inc., successors to Marc Eidlitz and Sons, acting as general contractors. When the building has been completed and its exhibits installed, the operation and management will be turned over to the New York Telephone Company, which will undertake that responsibility through its Long Island Area under the general supervision of its Vice President Carl Whitmore and the direct charge of Thomas W. Williams.

The San Francisco exhibit occupies one corner of the Palace of Electricity and Communication. This is one of the large high buildings erected by the Exposition, space in which is rented to various exhibitors for the construction of booths or small buildings. Neighboring exhibits in this Palace are those of General Electric, Westinghouse, Pacific Gas, Western Union, General Cable, International Business Machines and others. The plot occupied by the Bell System is by a few hundred square feet the largest in the building. It fronts on the main aisle, opposite space rented by General Electric. On this aisle there are two entrances to the Bell System structure; but it also has the peculiar advantage, so far as concerns flow of traffic, of its own entrance from the outside court which adjoins the Palace. The exhibit structure is being built by Lindgren and Swinerton, Inc., of San Francisco, who constructed the Montgomery Street headquarters building of the Pacific Telephone and Telegraph Company. After the installation of equipment, which is being built in Bell Telephone Laboratories, operation and management of the exhibit will be handled by the Northern California Area of the Pacific Company under the general supervision of Vice President M. R. Sullivan and the direct charge of L. N. Roberts.

John Mills

Notes on Recent Occurrences

PRESIDENT GIFFORD IS ELECTED HEAD OF THE TELEPHONE PIONEERS

PRESIDENT WALTER S. GIFFORD of the American Telephone and Telegraph Company was elected President of the Telephone Pioneers of America for the year 1939, at the seventeenth annual meeting of the General Assembly of that organization, which was held in Toronto, Canada, on September 30 and October 1, 1938.

DR. JEWETT TO RECEIVE JOHN FRITZ GOLD MEDAL

FRANK B. JEWETT, Vice President of the American Telephone and Telegraph Company and President of the Bell Telephone Laboratories, has been awarded the John Fritz Gold Medal, highest of American engineering honors, for 1939, for "vision and leadership in science, and for notable achievement in the furtherance of industrial research and development in communication." The award is made by a board composed of representatives of the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, and American Institute of Electrical Engineers.

Among other distinguished scientists who have been recipients of the John Fritz Medal have been Alexander Graham Bell, John J. Carty, former Chief Engineer and later Vice President in charge of Development and Research of the American Telephone and Telegraph Company, Lord Kelvin, Guglielmo Marconi, and Thomas A. Edison.

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