

TELEPHONE ENGINEERS FACE GREAT PROBLEMS

50,000,000 People In United States Now Have Access to This Modern Convenience--Story of Progress.

Boston, Nov. 16.—When a person says "hello" in Boston and another hears and echoes the word in Chicago or New Orleans, the process, simple as it seems to the modern man of business, has involved several hundred other people, each with a specially trained intelligence. The greatest marvel of the modern telephone is not that telephony is possible but that the thousand and one details of operating can be looked after so successfully. To accomplish all this enormous task, to keep the lines open, and the apparatus in order, and to meet the endless problems that arise in the installation of new services, the last two decades have seen the development of an entirely new profession into which hundreds of young Americans have entered, that of the telephone engineer.

The complexity of all work that has to do with electricity and the rapidity with which the use of the mysterious and seemingly miraculous current has become part and parcel of modern industrial and municipal life has made a thorough preliminary training the first necessity to the young man who enters electrical engineering. At the Massachusetts Institute of Technology, for example, there were two graduates in electrical engineering in 1884, while today there are some 200 young men studying this one general subject and among them at least one in every six is especially interested in telephony. Yet these students, of course, represent only a fraction of the number of future telephone engineers now training at the various schools and colleges that have followed the Institute's example in establishing courses in what is perhaps the most important of the modern "commercial professions."

The basis of the telephone engineer's training is such a knowledge of the highest mathematics as will enable him to make the endless computations necessary to the production of any plan, whether for a small induction of coil or for the wires of a transcontinental system. He must know the length and breadth of theoretical electricity; he must understand the general phenomena and laws of sound, especially as they relate to speech and hearing; and of course he must be expertly familiar with the various details of telephonic communication and the installation and management of great systems.

There are now something like 50,000,000 people in the United States who have access to a telephone and from their own locality they can talk over two-thirds of this country. But telephone development, although involving a problem of constantly increasing difficulty, has proceeded along the lines of least resistance; the first exchanges have been established in the larger cities and towns because here the demand was most imperative. The linking together of these centres of population and the saturation of the intermediate country districts by means of telephone connections has been gradually going on at the same time with the steady improvement of the service offered by the great controlling Bell company; so two distinct sets of problems have required simultaneous solution.

The telephone receiver used today with all its increased efficiency is practically as simple as the one Alexander Graham Bell exhibited at the Centennial exhibition in Philadelphia in 1876; but in the transmitter that stands on the 20th-century man's desk or hangs on the wall in his house a wonderful improvement has been made and in the development of the present well-nigh perfect mechanism millions of instruments have been thrown away to make room for better ones.

Today the current is sent out on a wire of copper instead of a wire of iron and is brought back on a duplicate copper wire instead of finding its way through the earth, which is generally charged with other electric currents. A wonderful economy of space has been secured by enclosing the insulated copper wires in cables, whether the lines are intended for overhead or underground structures, and the extent to which this economy has been carried appears in the fact that it is usual to have 400 pairs of wires in one lead-enclosed cable. The hanging of thousands of miles of wire year after year is comparatively easy to understand, but in the exchange—the clearing house where the copper nerves reaching thousands of different points are under control—a multitude of in-

tricate and absorbing problems has been worked out.

As telephony has progressed and the use of telephones increased manyfold the cost of the instruments themselves has decreased, but the investment required for the "central" plant has grown tremendously larger. Few people realize that the switchboard through which their daily communications are made costs many hundred thousand dollars, or even, in a city like New York, several millions. They do not realize that it is a very elaborate piece of mechanism made up of millions of small mechanical parts all of which must be adjusted with the most painstaking exactness, nor that in talking 1,500 miles, say from Boston to Kansas City, they are given the exclusive use of property which has cost probably half a million and the assistance of 25 operators, and that no one else can use for the time being the 3,000 miles of wire which if melted into ingot would weigh over 600 tons.

All the work of the engineer and mechanic which is at the immediate service of anybody anywhere merely for the ringing of a bell, costs enormously. The hundreds of millions of poles must be frequently renewed at great expense and the switchboards costing fortunes are hardly installed before they must be remodeled to include some new invention or thrown on the scrap heap to make way for a more perfect and efficient system. No price is too high to pay for the best possible service and the best possible service is

demanding quite as vigorously by the Bell company which has already covered so large an area with its wires and which leases its apparatus rather than sell it so as to make sure that it shall be properly maintained and kept up to the standard, as by the customer. Competing companies organized on the theory that wires and equipment would be unaffected by storms or accident, that a switchboard once installed would become a permanent source of revenue, have often come to grief because they have not correctly gauged the requirements of the telephone using public or the expense of maintaining and developing a satisfactory system.

The problem of charges in itself is one which has been worked out only by slow degrees. When telephones were in an experimental stage a flat charge for the use of an instrument was made, but as the business has increased such a charge has come to appear almost as unfair and impracticable as if a flat charge were made by a milkman for all his customers without regard to the quantity of milk delivered.

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DINNER.
Consomme, Broiled Steak, Fried Bananas, Mashed Potatoes, Carrots, Huckleberry Pie, Coffee.
SUPPER.
Chicken Fried in Cream, Tea, Biscuit, Salad, Chocolate Cake, Tea.

CHICKEN FRIED IN CREAM.
Put a pint of rich cream in a frying pan over a moderate fire till it begins to color; dip the different parts of the chicken in flour, season with a teaspoon of salt, fry in the cream on each side till it is a delicate brown. When done put it on a hot platter, pour another half pint of cream into the pan, let it boil one minute, add a saltspoonful of salt, a dash of pepper, then pour it over the chicken. Serve garnished with sprigs of parsley and a dish of puffed potato slices.

A. & C. R. R. TIME CARD.

EFFECTIVE SEPT. 4, 1904.

Leave	PORTLAND	Arrive
8:00 a.m.	Portland Union depot for Astoria	11:10 a.m.
7:00 p.m.	depot for Astoria	9:40 p.m.
Leave	ASTORIA	Arrive
7:45 a.m.	for Portland and way points	11:30 a.m.
6:10 p.m.		10:30 p.m.

SEASIDE DIVISION

Leave	ASTORIA	Arrive
11:35 a.m.	for Seaside Direct	5:20 p.m.
Leave	ASTORIA	Arrive
8:15 a.m.	for Warrenton, Stevens, Hammond, Ft. Stevens, Seaside	10:45 a.m.
5:50 p.m.		7:40 a.m.
Leave	SEASIDE	Arrive
4:30 p.m.	for Astoria Direct	12:30 p.m.
Leave	SEASIDE	Arrive
6:15 a.m.	for Warrenton Ft. Stevens, Hammond, Astoria	9:25 a.m.
9:30 a.m.		7:20 p.m.

Additional train leaves Astoria daily at 11:30 a. m. for all points on Ft. Stevens branch, arriving Ft. Stevens 12:30 p. m., returning, leaves Ft. Stevens at 2:00 p. m., arriving Astoria 2:45 p. m.
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Atlantic Express 8:15 p. m. via Huntington	Salt Lake, Denver, Ft. Worth, Omaha, Kansas City, St. Louis, Chicago and the East	7:15 a.m.
St. Paul Fast Mail 8:15 p. m. via Spokane	Walla Walla, Lewiston, Spokane, Minneapolis, St. Paul, Duluth, Milwaukee, Chicago, and East	8:00 p.m.

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