Canadian Society of Civil Engineers.

ESTABLISHED 1887.

To be read in November.

TRANSACTIONS.

Paper 8.

THE TELEPHONE.

(By F. N. Gisborne, M. Can. Soc. C. E., F.R.S.C., &c., &c.)

Many and bitter have been the writings and discussions as to the *Original Inventor* of the Telephone.

The earliest *record*, vide copy of the "Jahresbericht" of 1861, in the British Museum, proves that Philip Reis, of Berlin, had then experimented, with the avowed object of *transmitting speech* by electricity, and that musical sounds had been conveyed by his apparatus. Moreover, his original instruments now reproduce speech, when the electrodes are moistened with a drop of water, or oil.

Fifteen years later, 1876, Professor Elisha Gray, while endeavoring *to transmit speech*, invented his *harmonic telegraph*; and Graham Bell, who was in search of a *harmonic telegraph* (vide his original United States Patent of 1876), discovered the simple and beautiful method of *transmitting speech*, which has since bestowed upon him fame and fortune.

Two years later, 1878, Professor Hughes gratuitously gave to science and the world, his microphone; and based upon such discovery, viz., the varying resistance of carbon electrodes under more or less pressure, Thomas A. Edison invented and improved telephonic transmitters; and now the combined inventions of Bell, Edison, Gower, Blake and others constitute the commercial value of those Bell Telephone Company's acquired patents which have been upheld by the law courts of the United States and Europe with such liberality of scope as greatly to astonish the scientists of the world.

Innumerable attempts have consequently been made to transmit speech *without infringing* upon original patents, and to such efforts are we, in great measure, indebted for the researches of and results obtained by electricians of note; for although admirably effective under favorable environment, the telephone is still susceptible of material improvement, and already we have mathematically correct formulæ and laws as a guide for experimenters in the practical transmission of sound waves by electrical impulses.

The diverse theories advanced by prominent electricians, at a late meeting of the Society of Telegraph Engineers and Electricians, London, is my apology for preparing the present paper for discussion, and I may at once state, that the following requirements are *essential* to the satisfactory transmission of speech.

1st. That articulation shall be clear and natural in tone.

2nd. That the apparatus shall be free from inductive or extraneous sounds.

3rd. That increased electrical energy for long-distance transmission of speech and loudness of sound is desirable.

4th. That a material reduction in the number of wires or circuits, at present required for a Telephonic Exchange, is the essential element for economy of maintenance.

At the meeting already referred to, Professor Sylvanus Thompson stated:—That all diaphrams and springs have distinctive tones, thus those of low fundamental pitch impart a *boomy* sound in reproduced speech, while higher keyed ones, yield a metallic or *tinny* sound.

That the transmission of electric impulses from sound waves are not dependent upon the varying resistances of the electrodes under pressure; but are occasioned by the millions of minute electrical discharges between the molecules which fly to and fro, between the adjustible electrodes, from higher to lower potential, as they approach or recede under the varying forces of sound waves; and that the effectiveness of transmitters was improved, as their electrodes rise in temperature, either by applied heat or from the passing of the electric currents.

This statement was in part endorsed by Mr. Stroch (formerly assistant to Sir Chas. Wheatstone), who remarked, that he did not believe in the effectiveness of *applied* heat; but that when the current first passes through the electrodes, their minute points offer so much resistance, that heat is produced and they burn off, so that the surface contacts become larger and the instruments convey speech; but when too