



DEVOTED TO TEMPERANCE, SCIENCE, EDUCATION, AND AGRICULTURE.

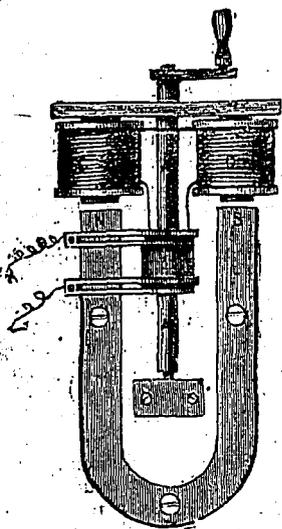
VOLUME XV., No. 4.

MONTREAL & NEW YORK, FEBRUARY 16, 1880.

SEMI-MONTHLY, 30 CTS. per An., Post-Paid.

### ELECTRIC SPEECH.

Who has not tried the experiment of gently tapping the end of a long log while another with his ear against the other end listens to the sound? or who has not heard the blow on a telegraph pole made by some one a long distance off, the sound being carried by the wires? or who has not made the dangerous experiment of putting his ear



MAGNETO-ELECTRIC MACHINE.

on the rails of a railway to hear the advancing train miles away, or which may be much nearer than was anticipated? or, who has not made a telephone by taking two tin cans, such as oysters or vegetables are packed in, carefully removing both ends and tightly stretching a smooth piece of bladder at bottom of each and connecting centres of membranes by a piece of good string, catgut, or, best of all, copper wire? By the last contrivance conversation, in an ordinary tone can be carried on across a line two or three hundred feet long. These experiments all are evidences of the fact that the vibrations of sound can be quickly and forcibly conducted by many common substances such as wood and the metals.

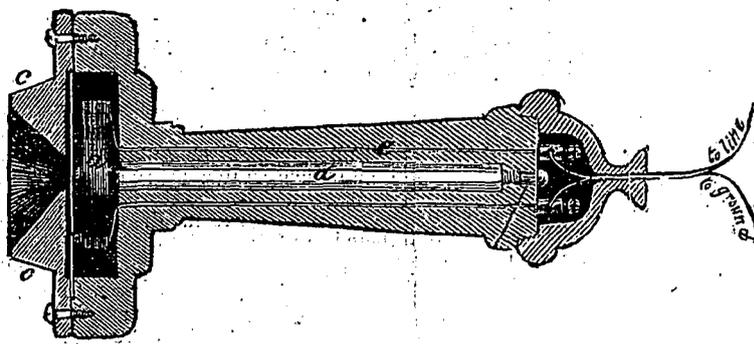
Somewhat similar in its action, although very different in principle, is the telephone which, like many other triumphs of ingenuity, seems to have been floating about for many years in the minds of experimentors as a possibility soon to be realized, and several independent and original efforts were made in different parts of the world to transmit vocal and musical sounds over long stretches of wire by means of electricity. Before the year 1876 none of these records were practically successful, but during it the telephones of Bell, Gray, Edison and Dolbear were given to the world, each a distinct and ingenious solution of the problem which had engaged electricians—how sounds might be conveyed to long distances through the medium of an electric current.

The instrument of the four above named, which we select for explanation, will be that invented by Andrew Graham Bell, as the one perhaps most easily understood.

In the accompanying cut of Bell's tele-

phone, *c* is the mouthpiece, at the bottom of which is *b*, a thin disc of soft iron, vibrating in correspondence with the voice; more agitated in loud talking than in whispering, and more by rapid utterance than slow.

The next point to be made clear is that a magnet varies in strength when a piece of iron in contact with it varies in closeness of connection. Take a common horseshoe magnet and suspend from it by their points as many sewing needles as it can hold up, then take a small piece of iron such as is usually sold with a magnet (called an armature), wrap it up in one fold of fine tissue paper, and place it on the side of the magnet. You will find that some of the needles will fall off. This is because the armature has magnetism excited within it at the expense of the magnet, which, therefore, has less power of supporting other objects. We shall see this more plainly still if we remove the tissue paper from the armature and slide it quietly down the magnet's side; a greater number of needles than before will fall off. In the construction of the telephone the little iron disc, *b*, vibrated by the voice, is attached to a strong steel magnet of cylindrical form, *d*; they are prevented from actually touching by a thin coating of varnish on the disc; as the disc moves back and forth in sympathy with the voice of a speaker, it is pressed toward and drawn away from the magnet, causing its strength to vary with every articulation and tone.



SECTION OF BELL'S PORTABLE TELEPHONE.

The next step to be taken in making the telephone's action intelligible is to know that when a magnet has wrapped about it a coil of fine wire, properly covered with silk, any variation in the magnet's strength excites an electric current in the surrounding wire. In the common medical battery where the turning a crank generates the shocks of electricity given to a patient, this can be very conveniently seen. In such an apparatus *N S* is a powerful steel magnet; before it revolve the two soft iron cores *C* and *D*; as they approach *N S* they become more and more magnetic and as they are drawn away their attracting force decreases. Parallel with these changes is the excitation of an electric current in the coils surrounding *C* and *D*, which rises and falls in strength exactly as the magnetism of the cores does.

Referring again to the cut of the telephone, we find *a*, a coil of wire wound around the end of *d*, the magnet; as *d* varies in strength by the vibrations of *b*, the soft-iron disc, it excites waves of electricity in *a*, the coil which is sympathetic with the spoken voice. These minute and delicate currents are carried to the other end of the line of communication through a wire as in ordinary telegraphy; this wire is joined to one end of joined to the other end of the coil, and is *a*, the coil, by *e*, while the bottom wire, *f*, is connected through the gas or waterpipes with the ground. The latter expedient is resorted to in all telegraphs, and makes it unnecessary to employ the two wires which were at first used on the lines; it is found that the earth is so good a conductor as to serve admirably instead of a second wire.

The currents constituting the message are received on an instrument exactly like the transmitting one; the waves of electricity as they pass around *d*, the magnet, affect its strength proportionately to their number power, and order; the disc attached is in consequence vibrated, and distinctly, though feebly, yields the words given to the companion instrument, which may be miles and miles away.

The wonder of this invention consists in its carrying recognizably the very accent and peculiarities of the tone of one's voice, while its tremors have been transformed from purely mechanical motion into magnetism,

such as that described at the beginning of this article. Another evidence of the same import is that the speed of transmission is electrical, far transcending in rapidity the movement of sound-waves in metallic wires.

### SABBATH RAILWAY TRAVELLING.

BY PRESIDENT EDWARDS.

1. *It is a gross invasion of the rights of the people.*—The people have a right to the stillness and quiet of the Sabbath. The rumbling and screaming, the tumult and bustle, noise and confusion of the trains, as they run through a village, and often in the time of public worship, are gross and outrageous violations of that right.

2. *It is exceedingly injurious to the men who are employed in it.*—It tends to blunt their moral susceptibilities, to degrade them in their own eyes and in the eyes of their fellow-men, and to debase their whole character. It tends to lessen their conviction of moral responsibility, to render them reckless, and thus to increase the danger of all who travel under their care. It tends, also, if they have families, greatly to injure their children, and increase their exposure to evil, crime and infamy. Perhaps no men in the land need the rest of the Sabbath like the engine-drivers and other railway employes. Is there not a cry from all the railway men, "Give us our Sunday?"

3. *It tends to demoralize the public mind, to weaken the efficacy of law, and thus to endanger the purity and permanency of all our institutions;* while it keeps many away from the house of God, and thus lessens the efficacy of the means of grace. This no man, or body of men, for the sake of increasing the value of railway stocks and dividends, aiding and abetting others in breaking the Sabbath, or for any other secular purpose, have a moral right to do. And while they do it, it is wholly without right, in opposition to the moral law, and in violation of one of the great principles by which every man in the community is bound to be governed.

4. *The Sabbath day was not made for secular business nor was it given to men for that purpose.*—Of course it does not belong to them. If they take it, they take what is not theirs. That is not honest. Honesty is contentment with what belongs to a man. An honest man, who is acquainted with his rights, will not take what is not his. The Sabbath day for secular business is not his. So to take it for that purpose is not honest.

5. *Property gained by the open violation of divine laws is not apt to wear well.*—It does not seem to produce a good influence on the minds of the possessors. And if it goes down to their children, and they pursue a similar course, it seems to be followed with a curse downwards.

And should men wisely regard their own highest interests for this world, and the interests of their children, they would not consent to gain any more property, or retain it any longer than they could by obeying divine laws.—*British Workman.*