closing the circuit once more, causing a renewed activity in the electro-magnet, and consequently a repetition of the stroke on the bell. So does the hammer vibrate back and forth as long as the button is pressed.

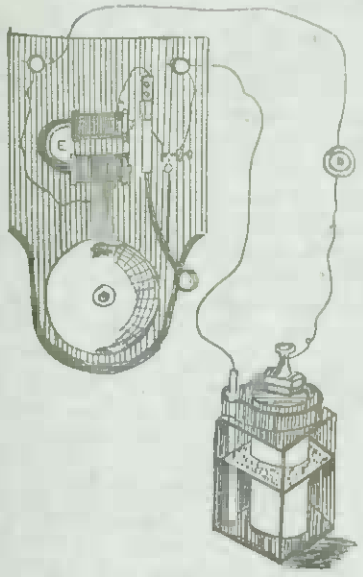

Fig. 7. Electric Bell.

A most extensive and an invaluable application of the electro-magnet is made in the telegraph. The essential instruments are a key and a sounder. The former is a simple device for closing or opening the circuit at pleasure, and the latter is simply an electro-magnet so provided that the attraction of the armature produces a click, which is understood by the operator according to an arbitrary system of signals now almost universally adopted. The rapid opening and closing of the circuit produces a succession of these sounds. When not in use the key at either station is kept closed. A line has been constructed from one side of this room to the other. (Fig. 8.) One station we may call "Salt Lake," and the other "Ogden."

These gentlemen seated at the operating tables, have kindly consented to receive and transmit such messages as may be presented by the audience. The line is open to all without charge. [A number of messages were received and sent in full view of the audience, and at the close of the lecture they were delivered to the addressees.]

Wonderful indeed, is it not, that the mere opening and closing of a key at one station will cause a corresponding motion of a sounder armature, perhaps hundreds of miles away? If the line be long, however, a relay will have to be introduced, the action of which is shown in the blackboard drawing here made. (Fig. 8.) B represents the main battery, K the key at either station; 1 and 2 are the relay magnets, so arranged that when they become active through the passage of the current, the circuits of the local batteries (b) are closed, and the sounders (s) make the report. Instead of a return wire as we use in the room line, connections may be made with the earth at each station.

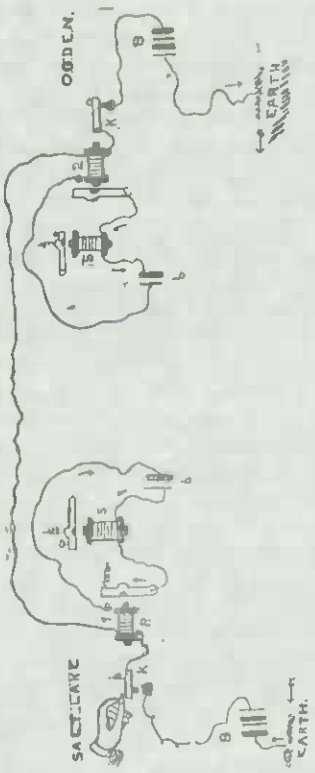

Fig. 8. Telegraphic Line.

Another effect of the electric current is its chemical action in decomposing compounds through which it may be passed. Here is a glass vessel containing water. (Fig. 9.) A pair of wires pass into the vessel from the battery. These wires terminate in platinum electrodes, over each of which a glass tube filled with water is inverted. Now I close the circuit, and you see bubbles of gas rising in each tube, but in one (--) about twice as fast as in the other (+).

Fig. 9. Electrolysis of Water.

If we allow this operation to continue for a considerable time, and then test the contents of the tubes, we shall find the one (--) to contain hydrogen, and the other (+) oxygen; and of these elements in fact the water was originally composed, and in the proportions here shown, that is two parts hydrogen to one part oxygen. But we may as easily decompose other substances beside water. Here is a solution of silver salt; I suspend from the negative (--) electrode a bunch of brass buttons; and from the positive (+) pole a plate of silver. After a time we will remove the buttons from the solution, and we shall doubtlessly find them uniformly silver coated. [These buttons were beautifully covered with silver, and were distributed among the audience as interesting mementoes of the occasion.]

This principle is also made use of in the process of electrotyping; an electrolytic deposit of copper being made on the surface of a waxen impression, which "shell" is then strengthened by a backing of type metal. Here is such a mould ready prepared; also a shell as taken from the mould, after the deposit had been perfected, and a completed electrotype.

A useful application of electricity and one from which much is expected in the future, is in the production of motion. Here is an efficient motor; the principle of its construction we can scarcely undertake to explain in detail, owing to the lateness of the hour; but we can all see it in operation. It has been attached to an ordinary sewing machine, and when the current is passed, the machine is driven at a very rapid speed. Electricity has already been successfully employed in the running of cars, and far more efficient applications are confidently expected

Suddenly changing to another phase of our subject, I bring before you here a little instrument (Fig. 10), known as an induction coil.

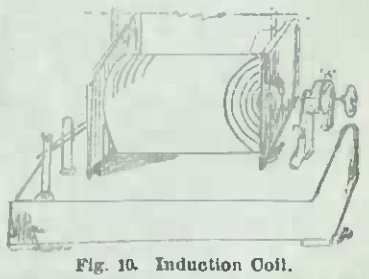

Fig. 10. Induction Coil.

It consists in fact of two coils of wire, one within known as the primary coil, directly connected with the battery, and an outer coil having no electrical connection with the other or with the battery, and known as the secondary coil. Whenever a current is started or stopped in the primary, a current is mys-