RITCHIE'S TELAUTOGRAPH.

Compared with the numerous attempts, many of them of exceeding ingenuity, which have been made to construct an instrument capable of reproducing simultaneously a true facsimile of the handwriting of a distant operator, the new form of the telautograph appears to us to constitute an immense step in advance.

The principle is practical, the same as that of Prof. Elisha Gray's original instrument, but the mode of carrying it into effect has been greatly improved. For the facts here given we are indebted to The Electrician and The Electrical Review, of London.

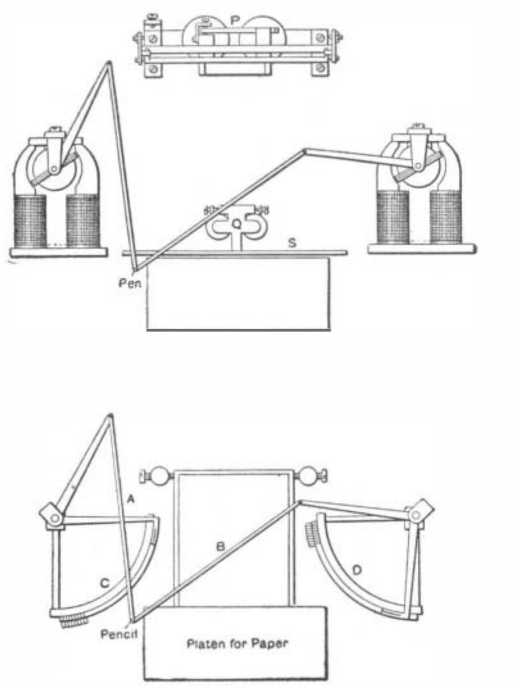

Fig. 1.—PRINCIPLE OF THE TELAUTOGRAPH.

Fig. 1 shows the principle on which the instrument is based and Fig. 2 is a diagram of the connections. The pen is fixed at the extremities of two links, *A* and *B*, which are fixed to the arms of two otherwise independent rheostats, *C* and *D*. Each of these is connected through the battery to one of the two lines and has a total resistance of 7,000 ohms, divided into 496 steps. One of these rheostats is shown by the side of the instrument in Fig. 3. Thus currents, varying in magnitude with the position of the pencil, are sent along the two lines which connect the sending and receiving instruments. The receiving part of the instrument consists of two large D'Arsonval galvanometer movements, with strong controlling springs to insure constancy. The spindles on which the moving coils are fixed are connected to a link motion corresponding to that of the transmitter part of the instrument, and move a pen along a similar piece of paper.

Having indicated the general principle on which the instrument is based, we now come to its constructive details. As is seen in Fig. 2, a battery is placed at each end of the line, these two batteries being normally in opposition. Before starting to write, the operator takes up the pencil, seen in the general view of the instrument, and, with the point of it, pushes back a lever at the left of the lower or transmitter part. This works a mechanical grip, which clutches the paper and moves it forward about ¾ inch, and at the same time operates a switch reversing the home battery, cuts off the receiving part of the home instrument, and connects up the transmitting portion. A further movement of this lever momentarily opens up the circuit of the home battery, the reason for which will be explained presently. The paper is 5 inches wide, and a length of about 2 inches is exposed at one time. During the motions of the pencil on the paper, currents varying in strength are sent along the lines, *F* and *G*, returning in each case by the earth.

The lower part of Fig. 2 represents the transmitting part of the home station, and the upper part the receiving part of the distant station, but the complete instrument in each case is made up of a transmitter and a receiver. *H* and *K* are the coils of the D'Arsonval galvanometer movements, these movements being also seen distinctly in Fig. 3. The coils have about 600 turns of silk-covered wire impregnated with shellac varnish, and only the coil revolves, the cylindrical piece of iron at its center being fixed. The magnets are electro-magnets excited by the local battery. An interesting feature of the instrument is that, instead of extreme delicacy being attempted in the construction of these movements, the reverse is the case. Twenty-four-volt secondary batteries are employed at each end of the line, and the rheostat naturally forms the greater part of the resistance in the circuit, so that fairly strong currents, telegraphically speaking, flow through the coils. Added to this that the magnets of the D'Arsonval system are highly magnetized, and it is seen that considerable mechanical forces come into play, so that the controlling spring attached to the moving coil is strong, and, as a matter of fact, so strong that the spindle of the moving coil is merely held between centers, jewels being unnecessary. Thus the motion of the coil is decisive and dead-beat, and, moreover, adjustment is easy and the whole mechanism is substantial.

After traversing the moving coil on its way to the distant battery, the current passes on either side through relays, *E'* and *E*. These relays are so adjusted that the weakest current (sent when the pencil is at the top left-hand corner of the paper) just suffices to cause their armatures to be attracted. When the current is momentarily interrupted by moving the paper-shifting and starting lever, the relay, *E'*, drops back. This causes the current normally flowing through the paper-shifting magnets, *P*, to be momentarily interrupted, and the release and re-attraction of the armature of *P* actuates the grip which moves on the paper. The whole frame rocks backward and forward when the current through the coils is interrupted and re-made. The relay, *E*, is for the purpose of signaling. A press-key on one side of the transmitter (not shown in the diagram, Fig. 2) on being depressed breaks line, *F*, and puts line, *G*, to earth. This causes the relay, *E'*, to release its armature and the relay, *E*, to make a contact at *O*, so that the local circuit of the bell, *N*, is closed and the bell rings. It should be mentioned that to avoid a multiplicity of lines in Fig. 2 all the wires leading to the battery are not shown, but some are broken off and + or − marked against them.

We now come to the ingenious device by means of which no characters are written on the paper at the distant station unless the pencil is actually pressing on the paper at the transmitting end. Motions of the pencil are transmitted to the pen, but the latter does not touch the paper until the pencil does. Normally the "pen-lifting" magnet, *Q*, is excited by the local circuit, the armature of the relay, *R*, being against the left-hand stop. This magnet, *Q*, raises the pen from the paper by slightly moving the cross-bar, *S*, in a horizontal direction away from the vertical paper. When, however, the pencil presses upon the platen on

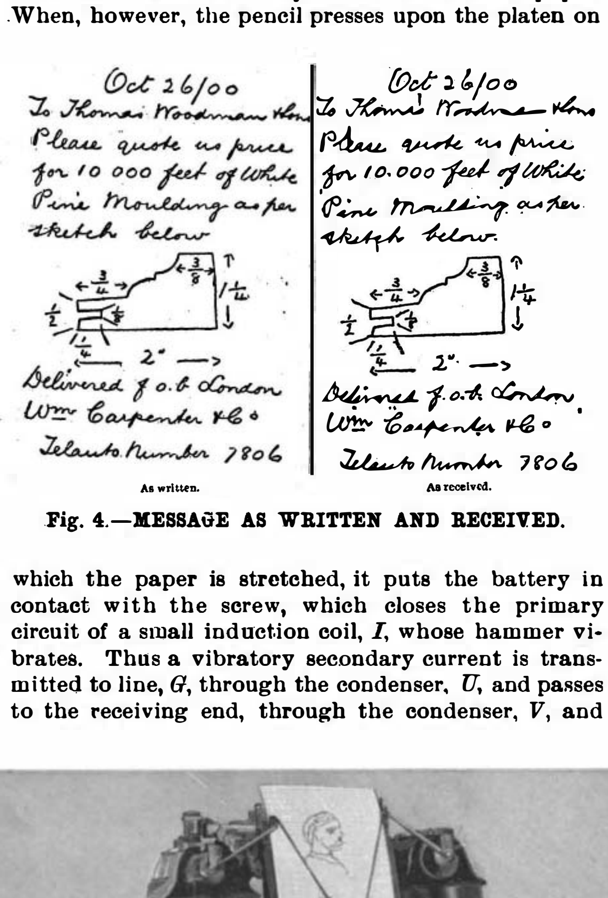

Fig. 4.—MESSAGE AS WRITTEN AND RECEIVED.

which the paper is stretched, it puts the battery in contact with the screw, which closes the primary circuit of a small induction coil, *I*, whose hammer vibrates. Thus a vibratory secondary current is transmitted to line, *G*, through the condenser, *U*, and passes to the receiving end, through the condenser, *V*, and energizes the relay, *R*. This breaks the local circuit of the magnet, *Q*, and allows the pen to fall back on the paper. The vibratory current returns by the line, *F*, and not by earth, so that it does not affect neighboring telephone circuits. The circuit, *KEE'H*, has

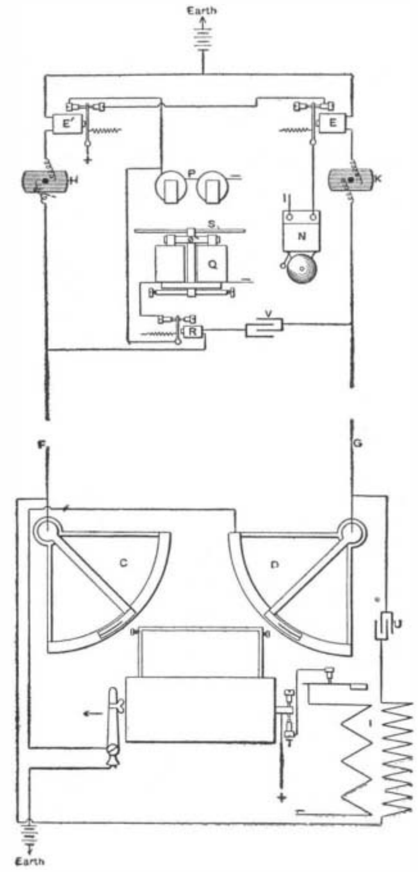

Fig. 2.—DIAGRAM OF CONNECTIONS.

fairly high self-induction, and the relays, *E'* and *E*, are not influenced. It is also noticed that the local current reaches *Q*, through the secondary contacts of the relay, *E'*, as well as of the relay, *R*, so that when the apparatus is not in use and no current is flowing through *E*, no current is being wasted in the pen-lifting magnet. The same applies to the magnet, *P*.

On finishing his message, and before laying down his pencil, the operator must press down, with the point of the pencil, a small plunger key on the left of the instrument, to reverse the home battery so that it opposes the distant one, and to connect up the receiver to line instead of the transmitter. This switch is not shown in the diagram. The action of depressing this plunger also opens a local bell circuit, which is, moreover, opened at another contact so long as the operator's arm is resting on the desk. If, therefore, he retires from the instrument without switching off by depressing the plunger key, the bell circuit is closed, and the bell rings until the omission has been remedied.

A telephone is employed in connection with the instrument. When the telephone is on its hook, the writing telegraph is connected to the lines in the manner already detailed, and on removing the telephone the writing telegraph is disconnected and the ordinary telephone connections substituted. The telephone is seen to the left in Fig. 3.

As already mentioned, a 24-volt secondary battery is employed at each end, and with this the instrument is found to work well on a line up to 300 ohms resistance. The resistance of each of the moving coils is about 185 ohms, and of the relays only about 20 ohms each.

An interesting detail is the pen employed. This resembles a tiny pipe-bowl, from which a thin glass tube conveys the ink to the paper. Each time the paper is moved on by pushing over the paper-shifting lever, and the circuit is thereby broken, the pen returns automatically to the ink-pot on the "isobath" principle. Writing and sketches are reproduced with wonderful distinctness and legibility by the apparatus, as shown in Fig. 4, and, although the hand-writing is somewhat distorted, its character does not disappear.

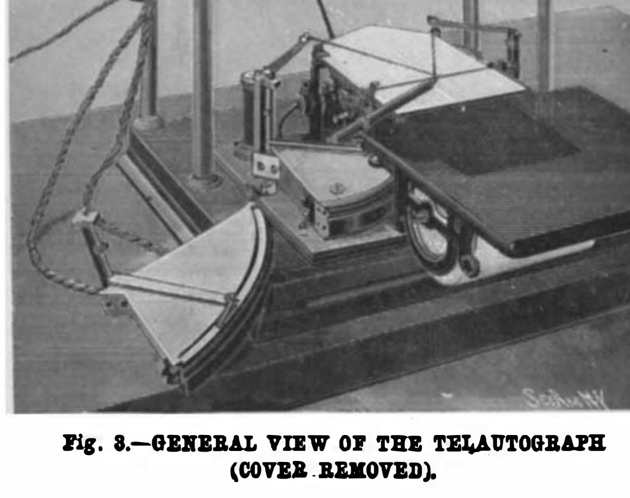

Fig. 3.—GENERAL VIEW OF THE TELAUTOGRAPH (COVER REMOVED).

THE American peanut crop averages about 5,000,000 bushels a year, and 22 pounds of the nuts make a bushel. About $10,000,000 worth of peanuts yearly are consumed, either in their natural form or in candy. The shucks furnish good food for pigs, and the peanut vine forms a first-class fodder for mules. Vast quantities of peanuts are shipped each year to Great Britain and the Continent from both Africa and Asia, where they are converted into "pure Lucca olive oil." A bushel of peanut shells will afford about a gallon of oil, and the meal is used for feeding horses, and is also baked into a variety of bread which has a large sale in Germany and France.