## A NEW FORM OF TELAUTOGRAPH.

BY DR. ROBERT GRIMSHAW.

For more than half a century attempts have been made to produce handwriting at a distance; for instance, Bakewell's apparatus of 1842, Caselli's "Pantelegraph" of 1856, Gray's of 1888, Amstutz's of 1893, and Ritchie's and Cerebotani's of later date; while much more recently both Prof. Korn and Herr Karl Grzanna (whom the Germans persist in calling "Gruhn," the name of his former assistant) have been active in this field. As far back as 1904 Grzanna published an account of an apparatus for producing written characters at a distance; and Korn brought out his first selenium cell apparatus in 1906.

Grzanna's apparatus (based on the German patent of the Dresdener Klein) as at present constructed consists essentially of the parts here illustrated. The principle of its action is the resolution of every desired stroke of handwriting into a horizontal and a vertical component on the surface on which it is made, and its exact reproduction in the form of the resultant of such components, on the receiving surface. The Cowper apparatus shown at the Paris Exposition of 1878 did the same thing, using a capillary ink tube to form the letters. But in Grzanna's apparatus mirrors are used at the receiving end which throw a beam of light on a sensitive tape. As one mirror swings up and down in the vertical plane, the other in the horizontal from right to left, in the same way as the analyzed movement of the writing, or drawing, point, the resultant of these two mirror movements corresponds to the path of the pencil, at the sender.

Referring to Fig. 1, which represents the principle of the sender, *t* is the writing point jointed to a lever arm *a*, which is easily movable in all directions in the plane of the writing. The other end of this lever is attached to an arbor *p*, which is also movable horizontally in the line *AB*, so that the pencil can write freely. A stationary electric resistance is indicated at *r*, and a movable resistance, *s*, is connected with the lever arm *a* by the link shown in the illustration. These two resistances are electrically connected with a battery of eight dry cells. A small current collector, *b*, is attached to the movable rod, but is electrically insulated therefrom. At *c* is a stationary current-collector. These two collectors are electrically connected with the line wires *d* and *e* respectively. One portion of the battery current flows through the collector into each line conductor; the amount varying with the position of the pencil *t*. At each point of the writing surface there are two different but definite current strengths, so that one can say that the movements of the writing operation are converted into changes of current strength. The current returns either through the earth or through a third conductor. At the receiving station it enters the apparatus seen in Fig. 2.

In this there is a small electric lamp *L*, that casts its light through a bent tube, with a prism, *p*, and a lens, *I*, on a small concave mirror, *h*, swinging on a horizontal axis; and from this to a second concave mirror, *s*, which swings about a vertical axis. From this latter mirror the rays are reflected to a roll of photographically sensitive paper, *F*. The horizontal axis of the first mirror, *h*, is surrounded by a coil of copper wire in electric connection with the wire *d* from the sending station; the vertical axis of the mirror *s* being in like manner surrounded by a coil, *g*, in electric connection with the other wire, *e*. Current in these coils causes vibration of the mirrors, by acting on magnets attached to their axes.

The invisible photographic writing or drawing on the sensitive paper is automatically developed and fixed. After the message is received, the sensitive paper *D* is drawn off the roll *Ph*, between the pressure rolls and under a yellow glass pane *G*, which shuts off the developing chamber of the apparatus. After developing the paper containing the now legible writing or picture passes out between two more pressure rolls. The lower front rolls are rotated by means of worm-wheels in connection with a worm shaft driven by a small motor, *M*, the latter, as well as the lamp, *L*, being served with current from a small battery, *B*. The mechanism is so arranged that after the message is written, the under rolls are rotated until sufficient of the sensitive paper is drawn along toward *D*, under the developer-reservoir *En*. From this latter, two rubber tubes lead toward two glass strips, lying at an angle to each other on the paper above and thus forming a trough with a small slit below. Through the latter the developing liquid is evenly distributed over the paper *D*. The flow of liquid from *En* is automatically regulated, and when no paper is ready to be developed, the rubber tubes are closed by the pressure of an iron plate. At the proper moment an electromagnet relieves the pressure on the tubes and thus allows the developing liquid to flow. The development takes about ten seconds.

**Grzanna's telautograph in use.**

The apparatus itself can be driven by a dry battery or by an accumulator; about 12 volts being sufficient. Each apparatus is arranged as both receiver and sender. The German post office department has tested the system on the following lines: Berlin-Potsdam, 30 kilometers; Dresden-Meissen, 27 kilometers; Dresden-suburban line, 4 kilometers; and Dresden-Berlin, 200 kilometers.

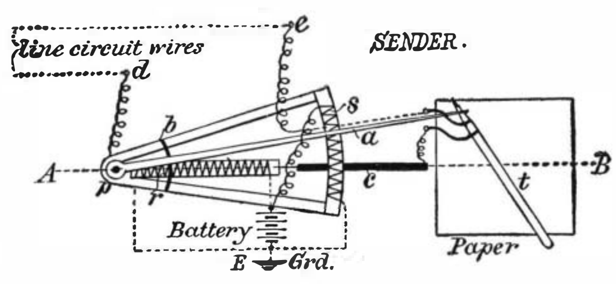



**Fig. 1.—Details of the sending apparatus.**

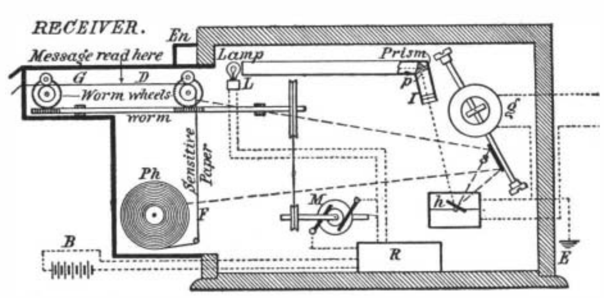
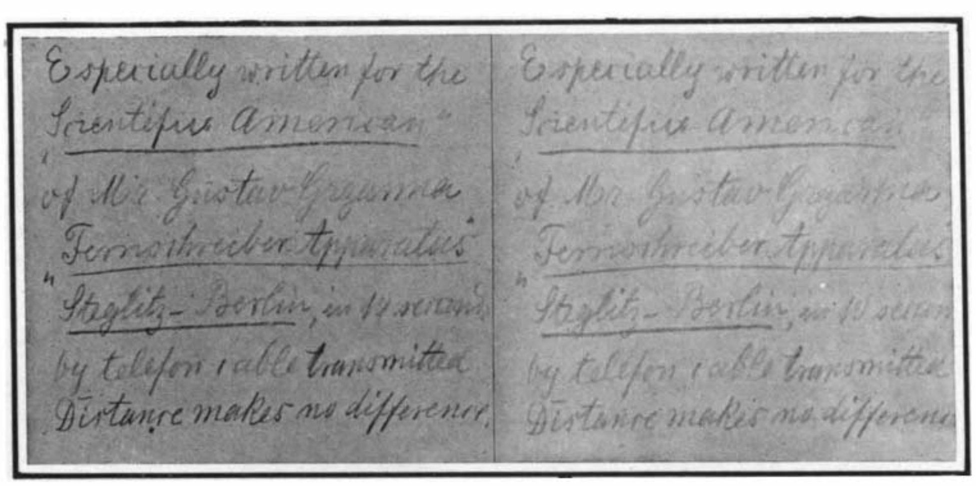



**Fig. 2.—Arrangement of the mechanism at the receiving end.**




Written by hand. Reproduced by the receiver.

**A sample of the work done by Grzanna's telautograph.**

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The remains of a Tyrannosaurus Rex, forty feet long and twenty-two feet in height, have been found in the Bad Lands, south of Glasgow, Mont., by Barnum Brown, of New York, connected with the American Museum of Natural History. The relic has been shipped to New York. It took sixteen teams to haul the fossil to the railroad. The skull alone weighs 4,000 pounds. The SCIENTIFIC AMERICAN hopes to publish an illustrated description of this "King of Lizards."

## The Cullinan Diamond Cut.

The famous Cullinan diamond, the cutting of which was recently described in the columns of the SCIENTIFIC AMERICAN, has been successfully divided into eleven stones. When first discovered, and even before it was cut, the stone was valued at about $1,000,000, and about that amount was paid for it by the Transvaal government. Fred Wells, the superintendent of the Premier Diamond Company, found the Cullinan diamond in January of 1905. The diamond was a white elephant in its way. Too big and too precious to find a purchaser, the problem of disposing of it perplexed the company not a little. Finally it was decided to present the stone to King Edward, who has intrusted an Amsterdam firm with the splitting and polishing of the gem.

The London Times states that in the original state the Cullinan diamond weighed 3,253¾ English karats, or over 1 1-3 pounds avoirdupois. It is now divided as follows: (1) a pendeloque or drop brilliant, weighing 516½ karats, dimensions, 2.322 inches long and 1.791 inches broad; (2) a square brilliant, weighing 309 3-18 karats, 1.771 inches long by 1.594 broad; (3) a pendeloque, weighing 92 karats; (4) a square brilliant, 62 karats; (5) a heart-shaped brilliant, 18⅜ karats; (6) a marquise brilliant, 11¼ karats; (7) a marquise brilliant, 8 9-16 karats; (8) a square brilliant, 6⅝ karats; (9) a pendeloque, 4 9-32 karats; (10) ninety-six brilliants, weighing 7⅜ karats, and (11) a quantity of unpolished "ends," weighing 9 karats.

The first and second of these stones are by far the largest in existence. Even the second is much bigger than the largest previously known brilliant, viz., the Jubilee, weighing 239 karats, while beside either of them so famous a jewel as the Kohinoor sinks into comparative insignificance, since its weight, 102¾ karats, is little more than one-third of that of the smaller, or one-fifth that of the larger. Moreover, the stones are not more distinguished for size than for quality. All of them, from the biggest to the smallest, are absolutely without flaw and of the finest extra blue-white color existing.

As regards the two largest, an innovation was made in the manner of cutting. Normally a brilliant has fifty-eight facets. In view, however, of the immense size of the two largest Cullinan brilliants, it was determined to have an increased number, and to give the first seventy-four facets and the second sixty-six. This decision has been abundantly vindicated by the results, for the stones exhibit the most marvelous brilliancy that diamonds can show. This fact is all the more remarkable and satisfactory because very large brilliants are apt to be somewhat dull and deficient in fire.

## Mechanical Stoking.

Many attempts at mechanical stoking have been made in locomotive design, but for different reasons they must still be considered experimental. These attempts have been answers to a crying need for better results than have been obtained from hand firing. Any devices which tend to improve the results of the present system of locomotive firing should, therefore, be well tried out. One of the greatest evils in connection with hand firing is the necessity for the opening of the firebox door, thus admitting large volumes of cold air. In fireboxes which are arranged with baffle plates to protect the tube sheet, cold air from the fire door is not so destructive, but in those which do not furnish this protection, the damage is very great, both to the steaming capacity of the boiler and to the life of the sheets and tube ends. When the firebox door of a hard-working locomotive is opened by hand for the admission of each fire, the aggregate amount of time in which the outside air has free play through the opening is probably as much as twenty-five per cent of that consumed by the trip. There is in use on some roads a device which should be applied to all locomotives of the heavier types, at least. This device is simply an air door opener and closer. It consists of an air cylinder, the piston rod of which is connected to a lever on the fire door. Air is admitted to the cylinder by a valve operated by the fireman's foot; this drives the piston outward and opens the door. The return is effected by a spring as soon as the air is exhausted. The exhaust takes place automatically when the foot of the fireman releases the valves. The advantage in the use of this device lies in the fact that the time the door must be kept open is reduced. The fireman has the scoop full of coal ready to be discharged immediately the door is opened, and the closing is effected just as quickly.—Railway and Engineering Review.