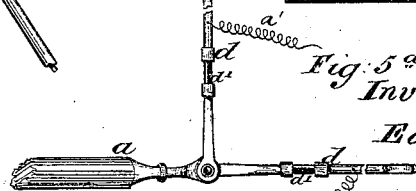
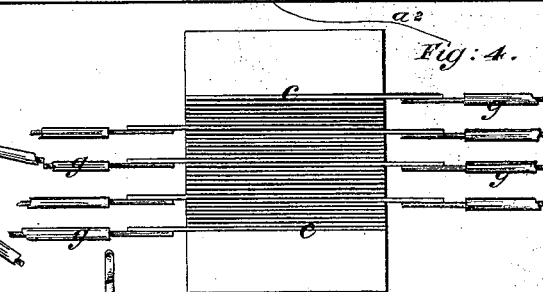
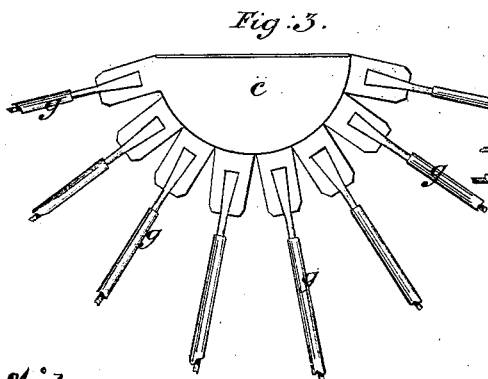
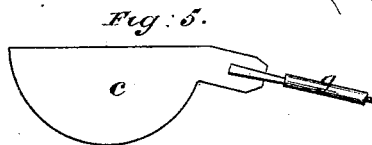
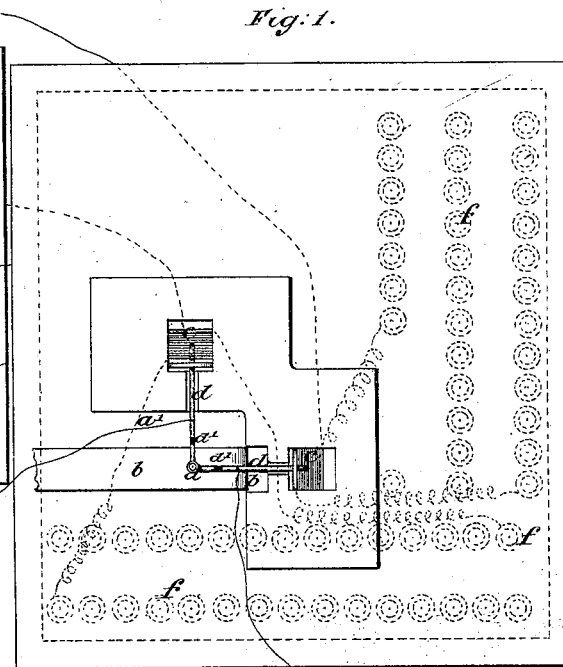
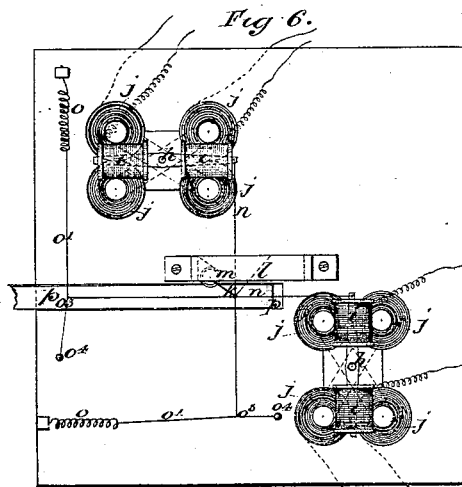
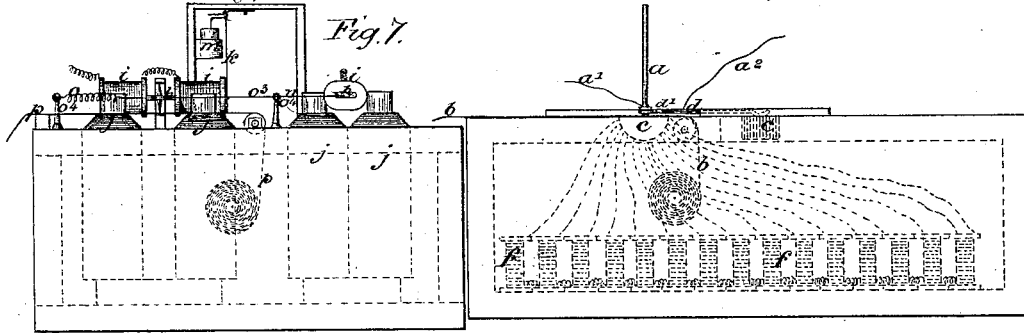


E. A. COWPER.
Autographic Telegraphs.
No. 217,588. Patented July 15, 1879.



Witnesses:

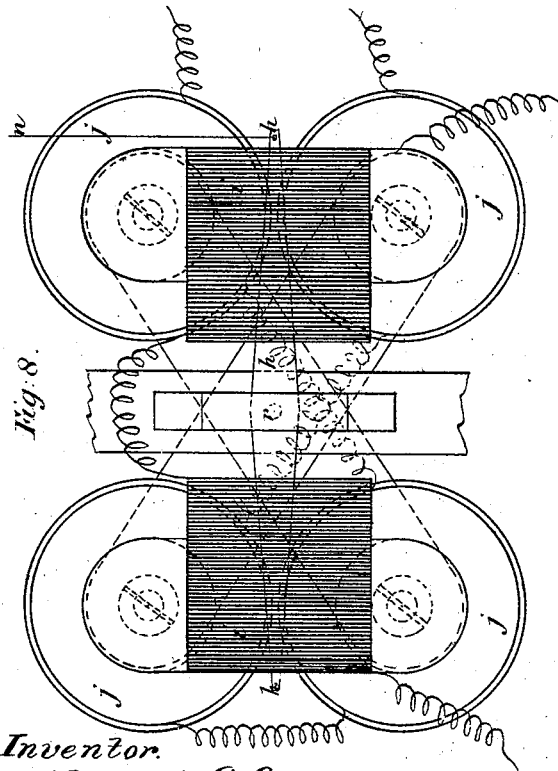
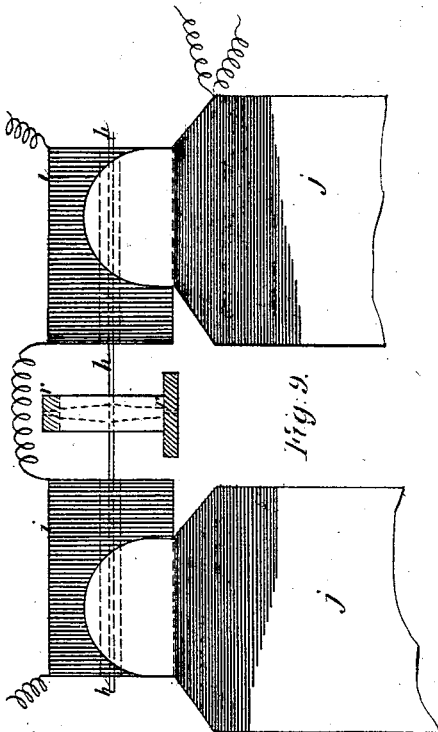
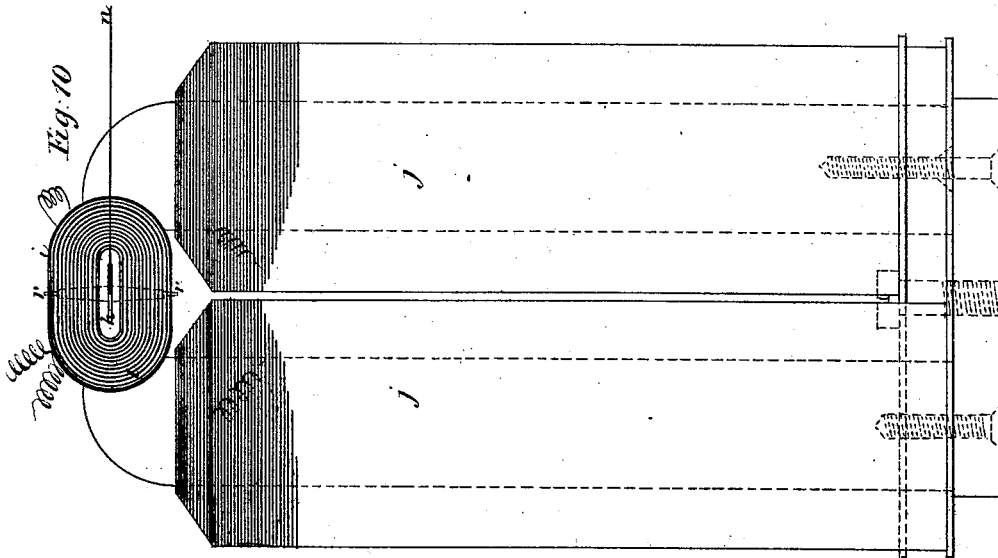
Gas. E. Hutchinson.
J. A. Rutherford.

Inventor,

Edward A. Cowper.

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UNITED STATES PATENT OFFICE.

EDWARD A. COWPER, OF WESTMINSTER, COUNTY OF MIDDLESEX, ENGLAND.

IMPROVEMENT IN AUTOGRAPHIC TELEGRAPHS.

Specification forming part of Letters Patent No. **217,588**, dated July 15, 1879; application filed May 3, 1879; patented in England, June 15, 1878.

To all whom it may concern:

Be it known that I, EDWARD ALFRED COWPER, of No. 6 Great George street, Westminster, county of Middlesex, England, have invented an Improved Electric Telegraph; and do hereby declare that the following description, taken in connection with the accompanying drawings, hereinafter referred to, forms a full and exact specification of the same, wherein I have set forth the nature and principles of my said improvement, by which my invention may be distinguished from others of a similar class, together with such parts as I claim and desire to secure by Letters Patent—that is to say:

My invention relates to a system of telegraphing and apparatus for carrying it into effect, according to which I produce at one station a copy, or an approximate copy, of matter written or traced at another station.

The principle on which my system is founded is that of compounding the movements of a point in two directions, the one at right angles, or at some other desired inclination, to the other, the actual movement of the point being the resultant of the two movements.

In order to apply this principle to telegraphy I employ at the one station a sending-instrument, in which a pen or other style is moved so as to write or trace letters, figures, or other symbols on a moving paper or other surface; and at the other station I employ likewise an ink-tube, brush, or other tracer presenting little resistance, so as to trace on a moving paper or other surface letters, figures, or other symbols similar, or approximately similar, to those traced at the sending-station.

I make the movements of the tracer at the receiving-station accord, or nearly accord, with those at the sending-station in the following manner: The sending-tracer moves two contact-makers, the one in a line at right angles, or other desired inclination, to the line of the other. Each of these contact-makers moves over a set of stepped or graduated conductors, so as to send into line currents of greater or less force, or subject to less or greater resistance, according to the extent of the movement. By the one contact-maker currents are

sent into the one of two lines which connect the sender to the receiver, and by the other contact-maker currents are sent into the other of these two lines. At the receiving-station the tracer is moved in two directions at right angles, or other desired inclination, to one another by means of a pair of polarized armatures, coils mounted in a magnetic field, or other known instruments that move in obedience to electric currents. The one of these instruments is actuated by the currents sent into the one line, and the other instrument is actuated by the currents sent into the other line. According as these currents vary in their strength or in the resistance opposed to them as determined by the movements of the sending-tracer, so the excursions made by the receiving-tracer in the two directions are varied, and thus the marks made by it are caused to resemble, or approximately resemble, those made by the sending-tracer.

In operating according to my invention the pen or other style is held in the hand of the operator writing, who writes upon a strip of paper that is caused to travel steadily under his pen, so that there is no occasion for him to move his hand along on the paper, as is usual in writing. This paper slip, however, only serves to enable the operator writing to see what he writes, as the paper is of no further use except as a record of what has been written.

The pen or other style is connected by two light connecting-rods (or it may be by threads, if springs are added to keep the threads always tight) to the contact apparatus for sending the currents of the required strengths. One connecting-rod is attached to one contact-maker, which slides over a number of thin metal plates, thus making contact with the one or two it may at the time rest on. The thin metal plates are all insulated the one from the other, but are parallel to each other and very near together. They are all in connection with the line-wire, though through very different resistances. Thus No. 1 is in direct connection with the line-wire. No. 2 is in connection with No. 1, but through a considerable length of fine wire or resistance-coil. No. 3, again, is in connection with No. 2, but

through another length of fine wire or resistance-coil, and so on through the whole series of thin metal plates, so that when the contact-maker, which is in connection with the battery, slides on the plates it connects the battery with the one or two only that it rests on, and so connects the line-wire with the battery through all the resistances interposed between plate No. 1 and the plate or plates the contact-maker rests on at the time, thus sending a current of any given strength into the line-wire for transmission to the receiving-instrument at the other end of the line. Thus it is evident that the strength of the current depends upon the position of the pen or style at the moment while writing; and as the other connecting-rod from the pen or style is provided with a similar contact-maker sliding over another set of thin metal plates at right angles, or nearly so, to the first, and connected in the same manner with another line-wire, it is clear that the two motions of the pen, up and down and right and left, will convey two currents through the two line-wires, varying in strength according to the varying position of the pen with which the operator is writing.

It is well known that to produce any curved line it is only necessary to vary the amount of the motions of up and down and right and left, and therefore it is only necessary at the receiving end of the line to utilize the varying currents, and cause them to reproduce the same amount of motion that originally caused them to be sent of their relative strengths, in order to produce fac-simile of the hand-writing of the operator sending the message. In such an arrangement it is not absolutely necessary that the electric writings should be exactly of the same size as that written by the operator, as it may be arranged to be larger or smaller, though, of course, small electric writing requires less motion in the parts of the receiving-instrument than large, and therefore the instrument would be somewhat quicker in action.

The receiving-instrument is arranged to produce the two motions at right angles, or other angle, to each other by the action of the varying currents from the two line-wires. The half of the instrument for producing the varying amounts of motion in one direction is arranged with a light soft-iron plate or bar, either suspended, as in a galvanometer, or mounted on very delicate bearings or supports, so as to turn very freely. This light bar is surrounded for a considerable portion of its length, at each end, with a fixed coil of fine insulated wire, at such a distance from it as just to allow of its vibration as far as required. Such coil is in connection with one of the line-wires, so that the light bar of soft iron is thus made into an electro-magnet without being burdened with the weight of the coils of wire, which would, to some extent, hinder the rapidity of action.

On the outside of the coils stationary magnets are placed, by the attraction and repul-

sion of which the motions of the light bar are effected, and these magnets may be either permanent steel magnets or electro-magnets maintained by their own battery independent altogether of the line-wire.

The varying motion of the light bar of soft iron is taken up by a light rigid or flexible connection to the writing-pen or style, which may be of any known construction or material used for such purposes; but I prefer to use a common siphon-pen, or such a one as described in the specification of a patent granted to William Clark 19th September, 1859, No. 2,132, which has a little reservoir of ink to supply it, the tube being so small that the ink will not run out of it, though it will come out freely when the point touches the paper and moves on it, or when the paper moves under the siphon-pen. The long strip of paper is moved slowly along under the pen at about the same rate as a person moves his hand across a sheet of paper while writing.

The currents sent through the line-wire by the sending-instrument vary in strength or power, and therefore cause the light bar of soft iron to move with varying power by its attraction to the stationary magnets; and in order to cause it to take its proper position according to each variation in power a varying resistance is opposed to it, such as a spring, which requires more power to compress it the more it is compressed, so that the action of the soft-iron bar, combined with that of a precisely similar bar actuated by the second line-wire, will cause the position of the pen in the receiving-instrument to follow the position of the pen in the hand of the operator at the sending-instrument, and thus form the letters. The total strength of the spring or varying resistance can be regulated at will, so that the letters formed by the pen shall be of the same proportionate height and width as the letters written by the operator at the sending-instrument.

One convenient way of applying the varying resistance to the light bar of soft iron is by placing a very light spring to pull at the end of the bar in the direction of its length, but allowing of the motion of the bar, which will thus cause the spring to act with more and more leverage as it moves more out of line with the spring. When so arranged there is required another spring to keep the connection with the pen tight, if such connection is flexible, so that the pen may go backward as well as forward over the paper, as the light bar of soft iron moves either one way or the other; but the spring or variable resistance may be made to act both to give the increasing resistance and the power to draw back the pen as well if the spring is made to pull by a flexible or jointed connection at a fixed point, the line of such pull being parallel, or nearly so, to the light bar of soft iron, while another rigid or flexible connection from the end of the bar to the connection to the spring has the pen attached to it at about the middle of

its length, which arrangement will give the same result as the two springs before described.

Another form of receiving-instrument that may conveniently be used to give the motion required to the tracer in one direction is that of one or a pair of permanent steel magnets or needles capable of being attracted by a stationary electro magnet or magnets either in one direction or the other, or constantly in one direction, with a varying force, according to the strength of the current passed through the wire of the electro magnet or magnets from the line-wire.

The motion is communicated to the tracer by a rigid or flexible connecting-rod, to allow of the motion of the tracer in the other direction at right angles or other angle to the first, such second motion being obtained by a similar receiving-instrument, so that the two in combination may reproduce the motions of the sending-tracer, owing to its sending currents of varying strength through the two line-wires to the receiving-instruments.

Another form of receiving-instrument (though not so conveniently made of the same power as the above) is constructed with coils of insulated wire around the vibrating steel magnets or needles in place of the electro-magnets as above, on the principle of two common indicators or galvanometers, the tracer being actuated in the two directions, as before.

Another form is made by reversing the arrangement of the fixed and moving parts, and letting the coils move and the steel magnets be fixed, (or using electro-magnets as the fixed magnets.)

Another slight modification consists in using soft-iron keepers in place of steel magnets in either of the three above cases; but they are not so good for the purpose in consequence of less power being obtained; or two pairs of magnets and armatures, such as described in the specification to Clark's patent, No. 2,134 of 1859, may be arranged to work at right angles and actuate the pen.

Referring to the drawings, (in all cases the same letters referring to the same parts,) Figure 1 shows a plan of sending-instrument. Fig. 2 is an elevation.

a is the pen or style, which is held in the hand of the operator and carries two wires, *a*¹ *a*², in connection with two batteries. *b* is the traveling slip of paper, (upon which the message to be sent is written,) driven by clock-work or other mechanism at a uniform speed. *c c* are the two sets of thin metal plates forming the contact apparatus. *d d* are the light connecting-rods, the ends of which form the contact-makers, sliding over the sets of contact-plates *c c*. *f f* are the sets of resistance-coils, which are connected to the contact-plates, there being one coil for each plate, except the first plate of each set, which is connected directly to the line-wire.

Fig. 3 is an elevation, on an enlarged scale, of the thin metal plates forming the contact apparatus. Fig. 4 is a plan of plates, and

Fig. 5 is an elevation of a single plate. Each plate has an insulated wire, *g*, soldered into it to form the connection with its resistance-coils, and these wires may be arranged radially, as shown, or in any other such manner that they will not interfere with each other. The plates are insulated from one another by means of paper or other suitable non-conducting material.

Fig. 5^a shows an enlarged view of the sending style or tracer *a*, with the contact-makers *d* connected thereto, the latter being insulated from the style by a piece of insulating material at *d'*, beyond which the contact-maker is connected to the one circuit-wire, *a*¹ or *a*².

Fig. 6 is a plan of the receiving-instrument. Fig. 7 is an elevation. *h h* are the light soft-iron movable plates or bars suspended in delicate bearings. *i i* are the fixed coils surrounding the bars *h h*, in which the said bars are free to vibrate, and through which the varying currents from the line-wires are sent. *j j* are the four constant electro-magnets or permanent magnets, between the poles of which the soft bars *h h* and their surrounding coils *i i* are placed. *k* is a siphon-pen suspended by a spring and set-screw, or other convenient means of adjustment, from the bridge *l*, and having its shorter end dipping into the ink-reservoir *m*. *n n* are the light connecting rods or threads by which the motions of the bars *h h* are transmitted to the siphon-pen *k*. *o o* are the fine springs which supply the necessary resistance to the pen against the pull of the magnets by means of the threads *o*¹ *o*² *o*³, the latter of which is attached to the fixed post *o*⁴. *p* is the traveling slip of paper upon which the message is written by the siphon-pen. It is driven, by clock-work or other suitable mechanical means, at a uniform relative speed to the paper in the sending-instrument.

Fig. 8 shows a plan of part of the receiving-instrument on a larger scale; Fig. 9, a side view of the same, and Fig. 10 an end view. *h* is the light soft-iron movable plate or bar turning freely in the bearings *r r*, (if desired, the bar may be suspended by threads in place of these bearings;) *i i*, the fixed coils surrounding them, and *j j* the constant electro-magnets, for which permanent magnets may be substituted, if desired.

It will be seen that the permanent magnets, being arranged in diagonal positions, as shown, can be adjusted relatively to the needle *h*.

Having thus described the nature of my invention and in what manner the same is to be performed, I wish it to be understood that I do not limit myself to the arrangement herein described for carrying the same into effect, as it will be readily understood that the before-described method of operating may be carried out in various ways; but

I claim—

1. The method of effecting at a receiving-station the reproduction of characters written or marked at a sending-station, by means of electric currents varied in force by the move-

ments of the sending style or tracer, so as to produce correspondingly-varied movements of the receiving style or tracer.

2. The method of effecting at a receiving-station the reproduction of characters written or marked at a sending-station, by causing the sending style or tracer to transmit two distinct currents of varying strength through different line-wires, so as to produce two motions in different directions at an angle to each other in the receiving style or tracer, substantially as herein described.

3. In an electric-telegraph apparatus, a sending style or tracer having contact-pieces, the movements of which cause resistances to be included or excluded from the electric circuits, whereby the strength of the currents is varied according to the position of the sending style or tracer, substantially as specified.

4. In an electric-telegraph apparatus, a receiving style or pen connected to movable armatures, coils, magnets, or their equivalents, actuated by variations in the currents transmitted from the receiving-instrument, where-

by the motion imparted by them to the receiving style or pen causes said receiving style or pen to reproduce the characters marked by the sending style or pen, substantially as specified.

5. In electric-telegraph sending apparatus, the combination of a sending style or tracer, *a*, with contact-pieces *d* and insulated contact-plates *c*, connected to resistance-coils *f*, arranged and operating substantially as herein described.

6. In electric-telegraph receiving apparatus, the combination of a receiving style or tracer, *k*, with movable armatures *h*, coils *i*, through which varying currents are sent, and magnets *j*, arranged and operating substantially as herein described.

In testimony whereof I, the said EDWARD ALFRED COWPER, have hereunto set my hand, in the presence of the two subscribing witnesses this 16th day of April, A. D. 1879.

EDWARD ALFRED COWPER.

Witnesses:

CHARLES DENTON ABEL,
ARTHUR I. B. SMITH.