(No Model.)

6 Sheets—Sheet 1.

E. GRAY.

TELAUTOGRAPH.

No. 522,892. Patented July 10, 1894.

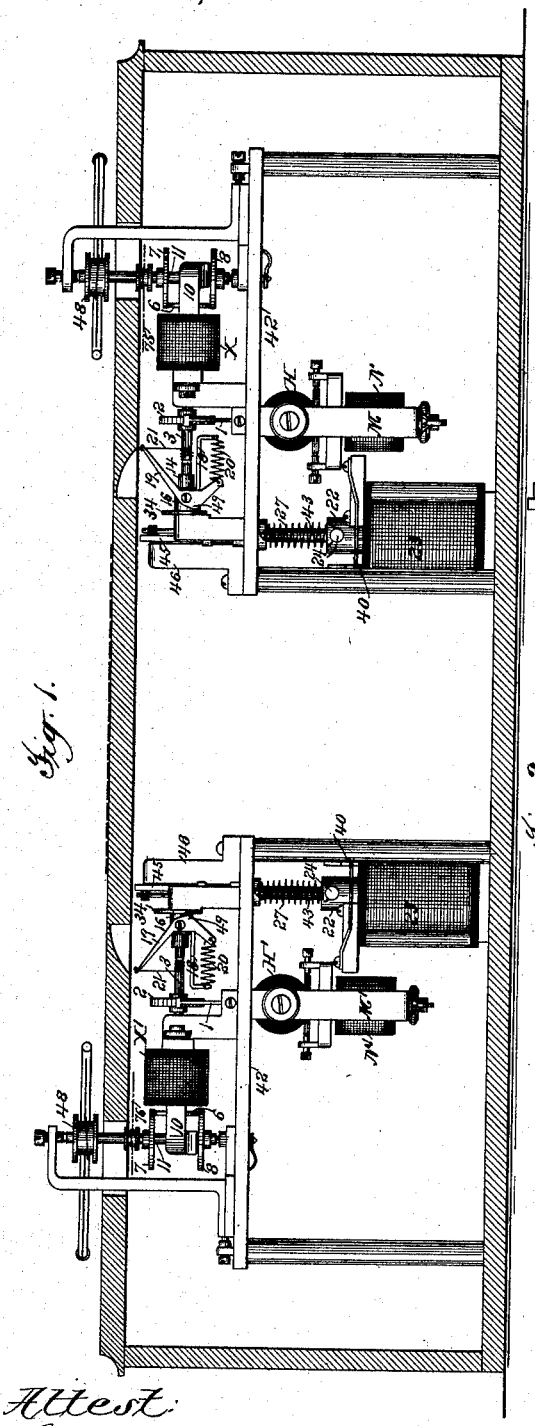

Fig. 1.

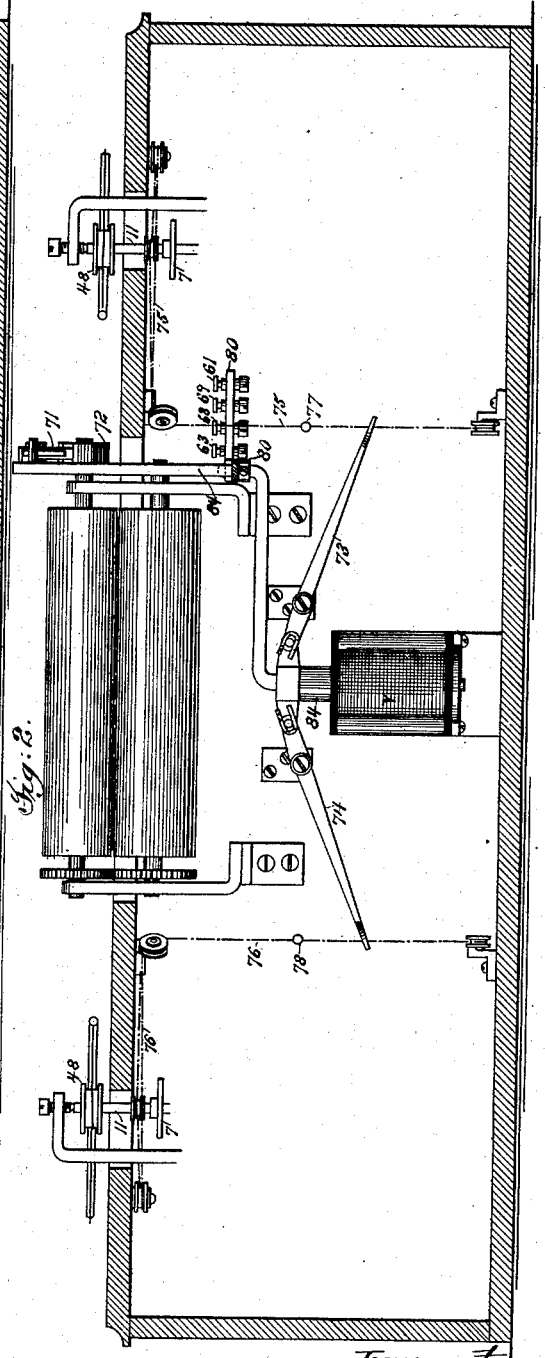

Fig. 2.

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(No Model.)

6 Sheets—Sheet 2.

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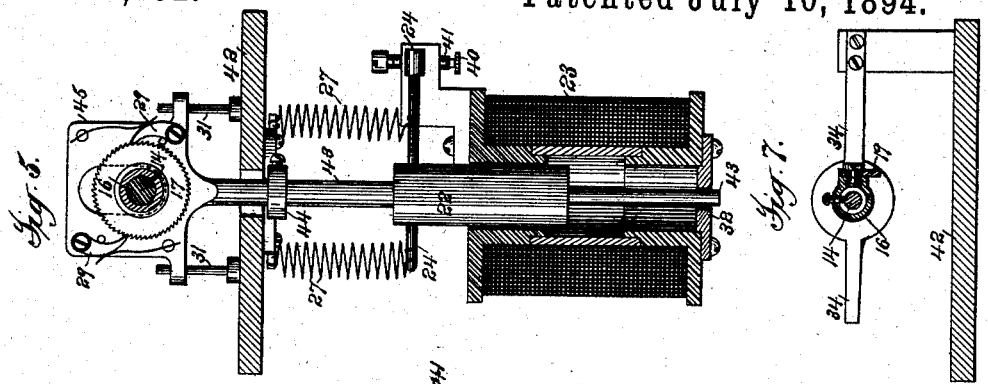
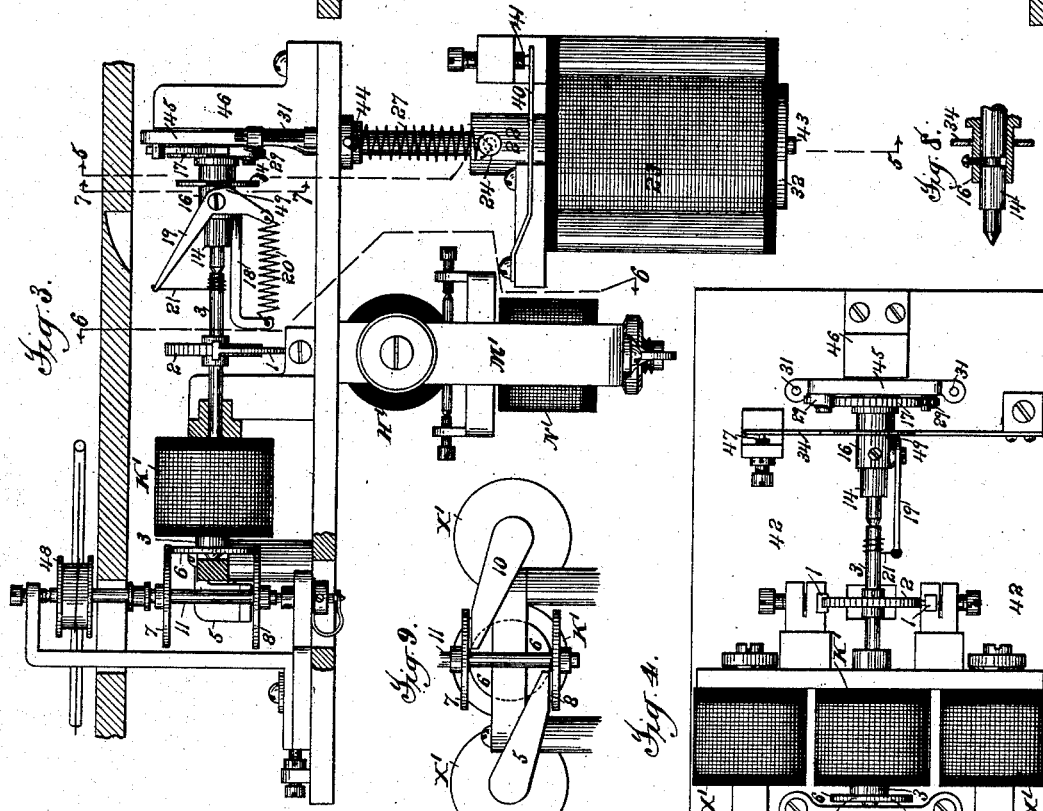
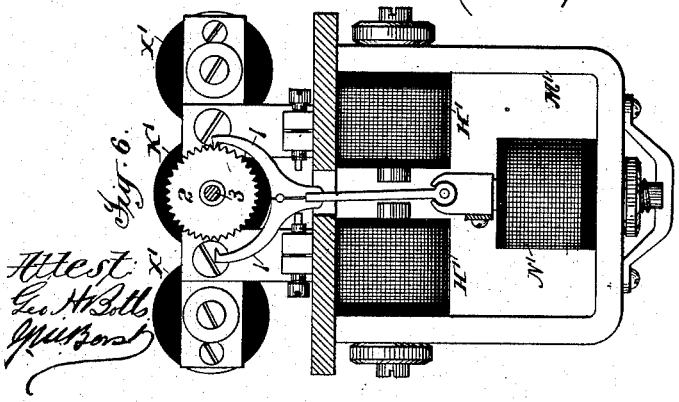
TELAUTOGRAPH.

No. 522,892. Patented July 10, 1894.







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(No Model.) 6 Sheets—Sheet 3.

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TELAUTOGRAPH.

No. 522,892. Patented July 10, 1894.

Fig. 10.

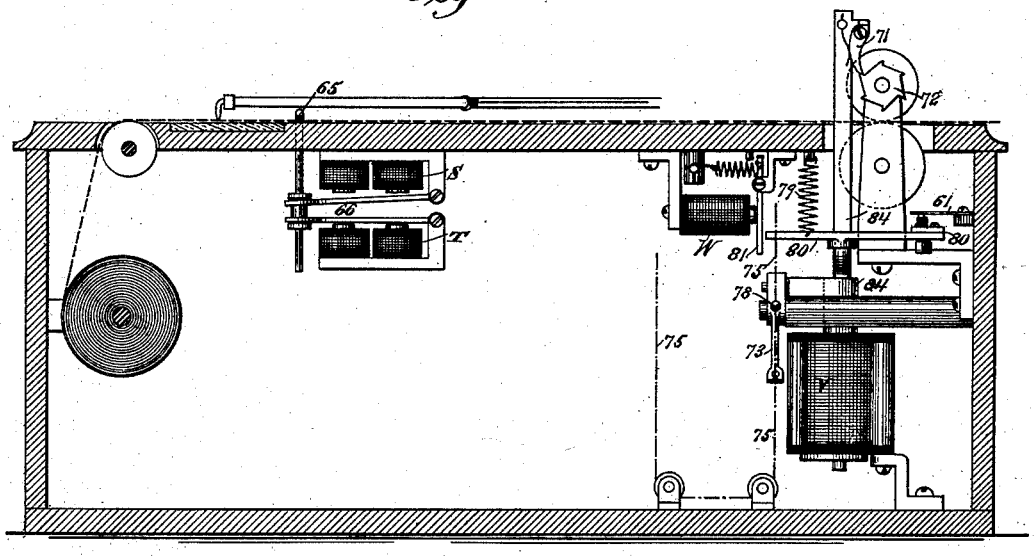
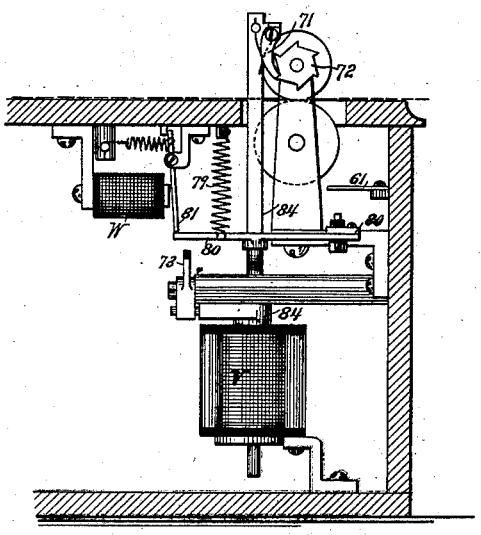


Fig. 11.



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(No Model.) 6 Sheets—Sheet 4.

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TELAUTOGRAPH.

No. 522,892. Patented July 10, 1894.

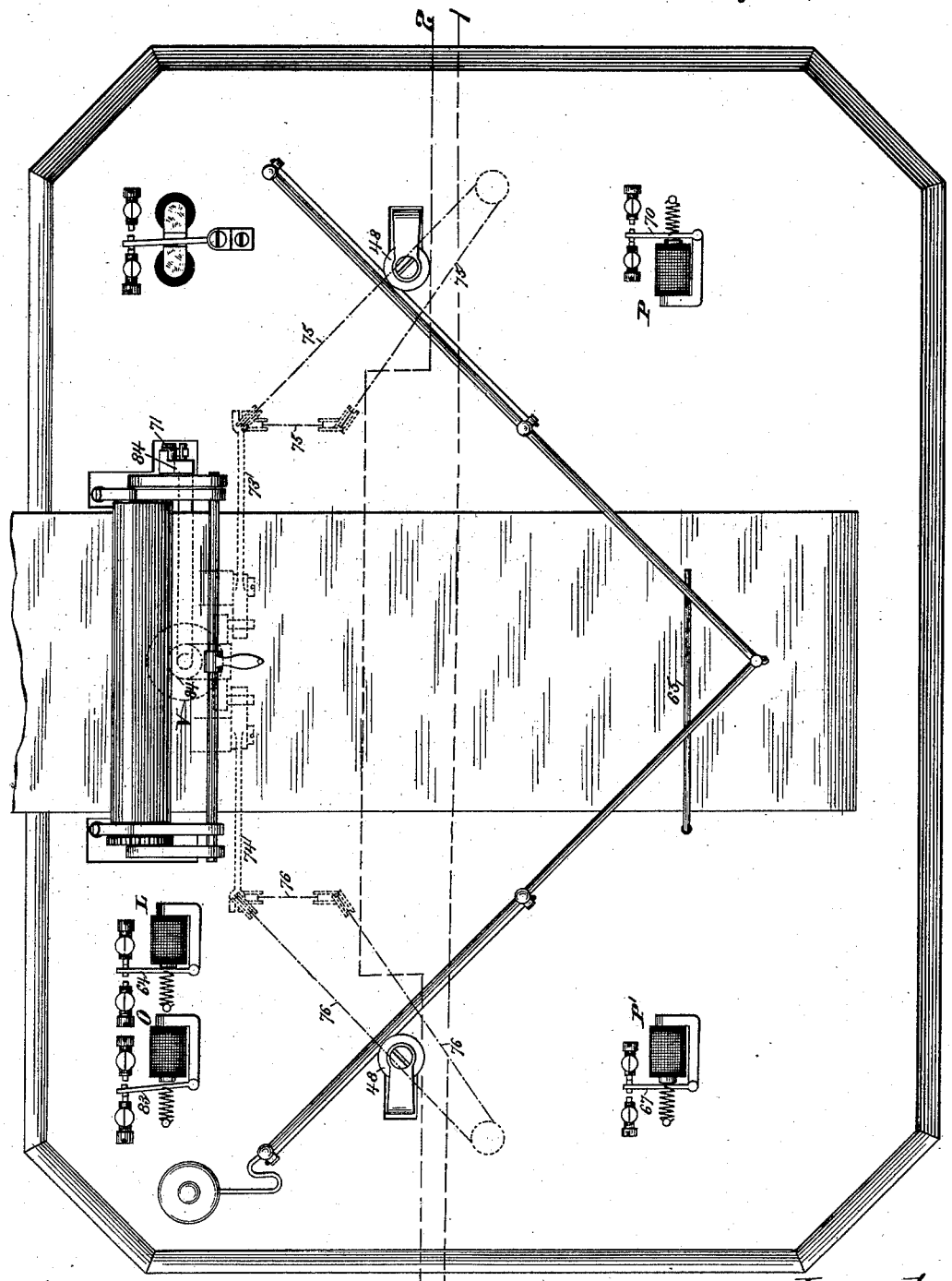

Fig. 12.

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(No Model.) 6 Sheets—Sheet 5.

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TELAUTOGRAPH.

No. 522,892. Patented July 10, 1894.

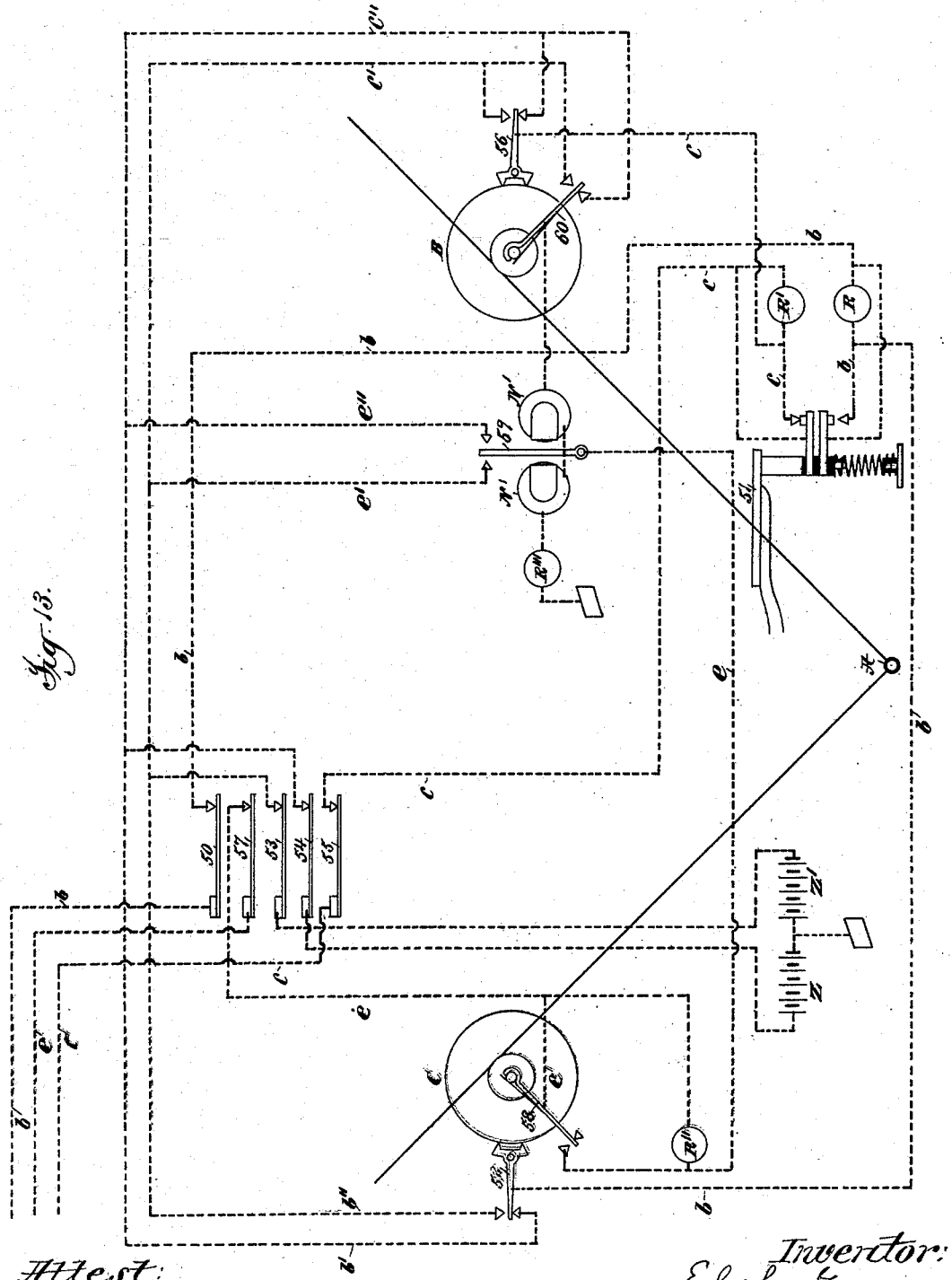

Fig. 13.

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(No Model.)

6 Sheets—Sheet 6.

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TELAUTOGRAPH.

No. 522,892. Patented July 10, 1894.

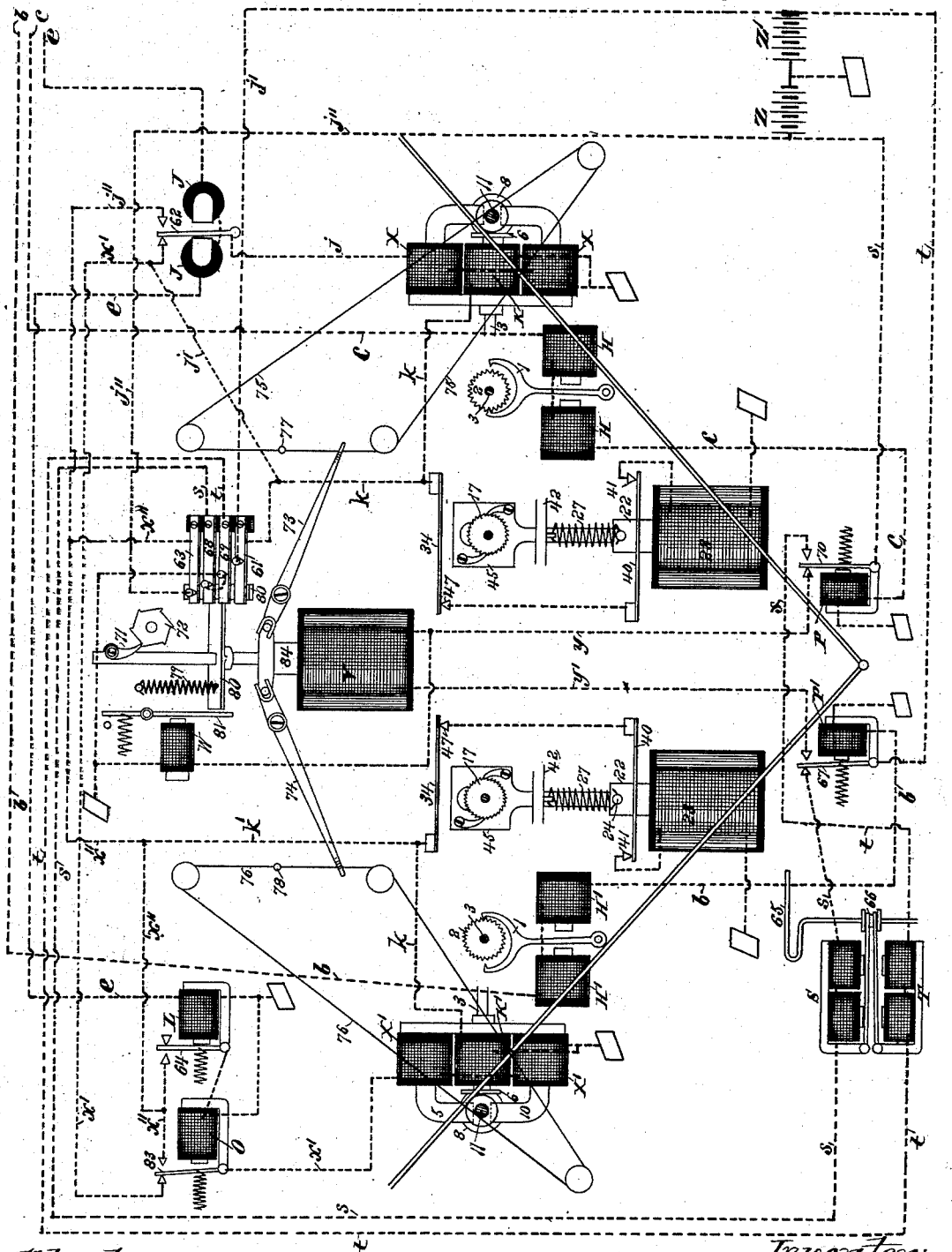

Fig. 14.

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UNITED STATES PATENT OFFICE.

ELISHA GRAY, OF HIGHLAND PARK, ILLINOIS.

TELAUTOGRAPH.

SPECIFICATION forming part of Letters Patent No. 522,892, dated July 10, 1894.

Application filed March 8, 1893. Serial No. 465,110. (No model.)

To all whom it may concern:

Be it known that I, ELISHA GRAY, a citizen of the United States, residing at Highland Park, county of Lake, and State of Illinois, have invented certain new and useful Improvements in Telautographs, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to writing telegraphs of that class in which the act of writing a message at the sending station operates to reproduce it at the receiving station, forms of which are shown in my prior patents, Nos. 386,814, 386,815 and 461,472.

It is found in autotelegraphy that the mechanism for driving the receiving pen should be such that the power operating upon it shall be constant and shall also be capable of acting with great quickness when called into action. It should be constant for the reason that the mechanism connected with the receiving pen is of a very delicate nature. More especially is this true of the reversing mechanism; particularly of that sort which has been found most effective, in which the power is transmitted to the receiving pen through frictional contact between parts of the reversing mechanism. It is also important where the application of the power to the receiving pen is regulated step by step by an escapement or its equivalent, as in the mechanism shown, that the power should be constant in order that the action of the escapement may be regular and that the receiving pen may not at any time be forced beyond proper restraint of the escapement. Quickness of action is important in order to secure rapidity of transmission. If a train of gearing has to be set in motion upon which the movement of the receiving pen depends, time is inevitably lost. I have found that the most rapid action is secured by driving the receiving pen by means of a spring. If, however, an ordinary spring or weight motor be used, having stored up sufficient power to last for a reasonable length of time, its force will not be constant and it is open to the disadvantage first above mentioned.

It is the object of the present invention to obtain a means for storing, as near as practicable to the point of application to the receiving pen, of the force to drive it, in such a way that the force shall be practically instantaneous in its action; and to this end my invention consists in providing a spring between the motor or other source of power and the receiving pen, which spring shall be put under tension by the motor, the tension of the spring driving the receiving pen. Thus the most instantaneous action possible is attained. To provide for the constancy of the force of the spring I provide a motor or other source of power which is controlled in its application to the spring by the tension of the spring itself; so that when the spring reaches the desired degree of tension the further action of the motor upon the spring is suspended until the tension of the spring falls below the normal amount of tension, when the motor acts to again increase the same. Thus the force of the spring is maintained substantially constant. It is obvious that the motor or source of power may be of any desired construction or form whatsoever, it being only necessary that it should furnish the power needed to place the spring under tension, and that its operating connection upon the spring should be controlled by the degree of tension of the spring itself. It is also obvious that the form or mode of action of the spring is immaterial, it being only necessary that it be placed under tension for the purpose of thereby imparting motion.

In the construction shown and described herein, the form of mechanism for furnishing the power is an electric motor, and the means for interrupting the application of this power when the tension of the transmitting spring is sufficient, consists of a make and break in the motor circuit by means of which the motor circuit is opened when the desired degree of tension is attained.

My invention further consists in part of a new and much simplified motor, and an improved reversing mechanism, for the receiving pen. It further consists in a new organization whereby a single wire may be employed for effecting the reversal of the receiving pen instead of the two wires heretofore used for this purpose.

My invention further consists in certain other features and details of construction hereinafter described and shown in the draw-

ings annexed hereto, and specifically pointed out in the claims.

Figure 1 is a vertical section of a receiving instrument embodying my invention, being a vertical section on the line 1—1 of Fig. 12. Fig. 2 is also a vertical section of the instrument on about the line 2—2 of Fig. 12. Fig. 3 is an elevation on an enlarged scale of the motor and reversing mechanism. Fig. 4 is a plan view of the same. Fig. 5 is a sectional view on the line 5—5 of Fig. 3. Fig. 6 is a sectional view on the line 6—6 of Fig. 3. Fig. 7 is a section on the line 7—7 of Fig. 3. Fig. 8 is a longitudinal section of the right hand axial portion of Fig. 3. Fig. 9 is an end view of the pole pieces of the reversing mechanism. Fig. 10 is a vertical transverse section of the instrument showing the paper shifting and pen raising magnets. Fig. 11 is another view of the paper shifting magnets and connected devices. Fig. 12 is a plan view of the receiving instrument. Figs. 13 and 14 are respectively diagrams of the transmitting and receiving instruments and circuit connections.

The improvements in the receiving instrument will first be described.

The magnet H′ is the usual escapement magnet with which connects one of the main line wires over which the pulsations are sent from one of the interrupters of the transmitter, the coils of this magnet H′ being mounted upon the free ends of the horse-shoe magnet M′, the polarity of which is maintained by a coil N′. The escapement pallets 1 are of usual construction, being carried by a pivoted soft iron extension of magnet M′ and control the escapement wheel 2 on the shaft 3. This shaft is for the most part of brass, but its left hand portion, as shown in Fig. 3, is of soft iron, forming a core for the magnet K′, and carrying on its left hand end a disk or ring 6 of soft iron connected with that portion of the shaft which forms the core of the magnet K′. Motion is given to this escapement shaft by means of a motor of peculiar construction, consisting of a plunger 22 reciprocating in an ordinary axial magnet 23. This magnet is in a normally closed local circuit which passes through spring 40 and pin 41, Fig. 4. The plunger 22 carries a cross-bar 24 passing through its top and connected by two springs 27 with the frame piece 42. In its reciprocating movement the plunger descends until the cross bar 24 depresses the spring 40, breaking the circuit of the magnet 23, which passes through spring 40 and contact stop 41, and permitting the plunger to rise under the pull of the springs 27 until the circuit is again made. This reciprocation continues as long as the circuit of the magnet 23 remains closed, except as broken, as above stated, at short intervals, by the spring 40. The rod 43 to which the plunger is attached is guided at its lower end by plate 32. At its upper end it carries a cross-head 45 guided in its vertical movement by the pins 31 and carrying the two spring-pressed pawls 29. These pawls engage with a fine toothed wheel 17 mounted on a hollow shaft 16 free to rotate upon a pin 14 fastened at one end to the fixed abutment 46. The shaft 16 is feathered to the pin 14, whereby longitudinal movement of the shaft on the pin is prevented. The pin 14 passes through an opening in the cross-head 45 which is of such shape as to permit the cross-head to reciprocate vertically notwithstanding the presence of the pin. The opposite end of the pin 14 is cone-shaped and upon it is journaled one end of the shaft 3. To the sleeve 16 is pivoted an angular lever 19 one end of which has attached to it a cord 21, the other end of the cord being fixed upon the shaft 3. The projection 18 is also fixed upon the sleeve 16 and the end of this projection is connected with the lower end of the lever 19 by the spring 20 which serves to keep the cord 21 taut. This spring 20 is the spring through the tension of which the power of the motor is transmitted to the receiving pen. To the rear of the lever 19 is placed a spring circuit maker and breaker 34 (shown in side view in Fig. 7) which is at one end attached to an abutment and at the other bears against a contact point 47 (see Fig. 4). This circuit maker and breaker serves to control the operative connection of the motor with the spring 20, so that when the tension of said spring has reached the normal degree, the motor will cease to operate upon it, being stopped by the interruption of the circuit, as hereinafter more fully described. Placed tangentially with regard to disk 6 are two other soft iron plates, here shown in the form of disks, 7 and 8, mounted upon the vertical shaft 11 which carries the pen drum 48 from which the receiving pen is moved. These disks are maintained in a condition of opposite polarity by proximity to the two poles 5 and 10 of the reversing magnet X′. The shaft 11 has a slight vertical movement. The polarity of the disk 6 being maintained as either positive or negative, let us say, for example, positive, then when the disk 7 is negative, it will be attracted to the disk 6 and held against it; and the disk 7 and consequently the pen drum will be revolved in one direction. When a reversal in the direction of writing occurs and the disk 8 consequently becomes negative, the latter disk will be attracted by the disk 6 and move with it, giving an opposite rotation to the shaft 11 and pen drum and reversing the movement of the receiving pen. The triangular lever 19, its spring, and its cord, in this manner constitute a regulator of the power transmitted from the plunger and axial magnet to the escape wheel.

The operation of this part of the mechanism is as follows:—As the plunger 22 reciprocates the two pawls 29 simultaneously push and pull upon the periphery of the wheel 17 and force it to revolve, carrying with it the shaft 16, winding up the cord 21 upon the shaft 3 and stretching the spring 20. When the last named spring has been stretched to

the point for which the apparatus is set a projection 49 on the lever 19 impinges upon the circuit making and breaking spring 34 moving it away from contact 47, thus breaking the circuit of the axial magnet 23, which passes through the spring 34 and contact 47. Further rotation of the shaft 16 is thus suspended and the shaft 3 is driven under the tension of the spring 20 until the lever 19 has moved sufficiently to permit the circuit of magnet 23 to be again closed, when the action of the latter magnet is resumed. The power transmitted to the shaft 3 can thus never exceed the tension upon the spring 20; and as this spring, lever 19 and cord 21 always remain in approximately the same position owing to the immediate winding action of the axial magnet at the moment when their position initiates a change, the lever, cord and spring constitute together a delicate regulator for the power transmitted to the escape wheel shaft. Furthermore only substantially the amount of power required for use is developed by the axial magnet and considerable saving of power as well as ease and smoothness of action is secured.

It will of course be understood that the improvements in the receiver which have just been described may be employed with any desired arrangement of circuits and with any number of line wires.

Referring now to Figs. 13 and 14 the circuit connections will be described. A is the transmitting pen, which, as in my other patents, is intended to represent a pencil, pen, or other marking instrument, or even a handle without a marking point, all these being included for convenience under the term "pen." This pen is connected by two cords, as shown in my said former patents, with two interrupters B, C, which may be of any construction adapted to cause pulsations of the current, that shown being a form in which pulsations successively of opposite polarity are sent to line. The main line *b*, coming from the distant station, passes at the transmitter to a circuit making and breaking spring 50 and thence to the writing platen 51 where a branch with a resistance R is provided so that in the depressed position of the writing platen, that is during the operation of writing, the current of *b* shall have open to it a path around the resistance, but when the platen is in its elevated position the current will pass through the resistance, substantially as described in my said former patents. The circuit *b* then passes to the circuit making and breaking lever 52 of the construction shown in my former patent, No. 491,346, and thence through one or the other of wires *b' b''* and springs 53 54 to battery *z* or *z'* and ground. Main line *c* comes from the distant station, follows a similar course, passing through circuit making and breaking spring 55 to the writing platen where it is provided with paths through and around resistance R' and thence to interrupter B and circuit making and breaking lever 56 and thence by wire *c'* or *c''* and spring 53 or 54 to battery *z* or *z'*. In this organization of connections but one circuit is employed for reversing both sides of the receiving instrument. Thus main line wire *e* coming to the transmitter passes through circuit making and breaking spring 57 to the circuit changing arm 58 frictionally mounted on the shaft of the interrupter C with an alternative path through the resistance R'', thence to the armature 59 of the polar relay N' and thence by one of the wires *e' e''* and springs 53, 54, to battery *z* or *z'* and earth. The frictional circuit reversing arm 60, these arms 58 and 60 being constructed and mounted as described in my said patents, Nos. 461,472 and 491,346, is provided with two contact points each of which is connected with one of the wires *c' c''*. The arm 60 is itself connected with ground through magnet N'. In this circuit is interposed a resistance R''' for the purpose of adjusting the strength of the battery as much as may be requisite in order to obtain delicate action.

The usual paper shifting switch will be employed, this switch consisting of a lever so arranged as to send a full current over both circuits *b* and *c* when desired by the transmitting operator. As this switch is of any ordinary construction, such as for instance shown in my said patent, No. 461,472, it is not thought necessary to illustrate it here. So also a switch of any ordinary construction, such as for instance as shown in my prior patents, for shifting the main line wire from the transmitting to a receiving instrument at the same station, and vice versa may be employed if desired. This also it is considered unnecessary to illustrate in this application.

It will be seen that as the transmitting pen is moved in the operation of writing and the interrupters B and C are caused to rotate, a series of pulsations of successively opposite polarity will be sent through each of the main lines *b* and *c* and that upon reversal in direction of movement of the transmitting pen with reference to the interrupter B the polarity of the current traversing the magnet N will be changed, resulting in a reversal in the polarity of the current traversing the main line *e* and that upon a reversal in the direction of movement of the transmitting pen with reference to the interrupter C the current traversing the main line *e* will be changed in strength, to wit, if the motion of the transmitting pen is changed from a direction from interrupter C to a direction toward interrupter C, the resistance R'' will be let into the circuit *e* and the strength of the current thereon will be reduced, while if reversal be in the opposite direction the current will be correspondingly increased.

The operation occurring at the transmitter being now explained, reference will be had to the circuit connections of the receiver, Fig. 14. Main line wire *b* enters the receiver and passes to magnet H' and the relay P' which

assists in the raising and lowering of the receiving pen and the shifting of the paper, as will be hereinafter described. The pulsations, successively positive and negative, traversing the line *b* cause the escapement pallets to vibrate and the shaft 3 is thus permitted to rotate under tension of the cord 21 driving the receiving pen in a given direction. Likewise the main line *c* passes at the receiver through a corresponding magnet H on the other side of the machine and magnet P, this main line with connected parts performing on the other side of the receiver functions essentially similar to those described with reference to main line *b* and which therefore need not be again stated.

Main line *e* enters the receiver and passes directly to polar relay J, thence to Morse relay L and thence to ground. The armature 62 of the magnet J is in a local circuit passing by wire *j* through the coils of magnet X and to ground, and in the other direction through one of the contact stops of armature 62, and wire *j'* or *j''*. The wire *j'* connects directly with circuit making and breaking spring 61 and thence with negative battery Z' and ground. The wire *j''* connects directly with circuit making and breaking spring 63 and thence to positive battery Z and ground. A positive or negative current will thus be directed at all times through reversing magnet X, the polarity of this current depending upon which one of its contact stops armature lever 62 rests against. A branch, by wire *k*, from this circuit, passes through magnet K to earth, thus maintaining a constant negative current through it. As the current is reversed through the coils of magnet X by the movement of armature 62, the rotation of the receiving pen drum on this side of the instrument will be correspondingly reversed in direction.

On the left hand side of the instrument a circuit is made from the earth through the coils of magnet X', wire *x'*, armature 83, wire *x'*, wire *j'* and spring 61, to negative battery Z' and ground, and by an alternative path through wire *x''* to spring 63, and thence by wire *j''* to positive battery Z and ground.

The circuit of magnet O is made from earth through the armature 64 of magnet L and the wires *x''* and *j''* to the positive battery Z.

When a current of increased strength traverses the main line *e*, the armature of magnet L is drawn to its front stop, thus breaking the circuit of magnet O causing it to release its armature and permitting a negative current from battery Z' to pass over wires *j'* and *x'* and armature 83 through the coils of magnet X'.

When a current of reduced strength comes over main line *e*, the armature of magnet L is released, completing the circuit of magnet O; magnet O draws up its armature, breaking the circuit of X' through *x'*, and a positive current from battery Z now traverses the coils of X' through wires *j''* and *x''* and spring 63. The polarity of the poles of the magnet X' is thus reversed upon each change of strength in the main line, reversing circuit *e*. The polarity of the magnet K' is maintained constant by a current passing from battery Z through wire *j''*, *x''* and *k''* and coils of K' to earth. Reversal in direction of movement of the receiving pen drum on this side of the instrument therefore follows each change in the strength of the reversing current coming over line wire *e*.

The magnet O is provided in order to bridge the gap in the current caused by reversal in polarity of the current *e*. It will be seen that at the moment of reversal of polarity there will be no current on line and consequently the armature 64 will tend to drop back, which might result in false reversal on this side of the receiver. The magnet O and its armature and armature spring, however, are so adjusted that this magnet does not act to draw up its armature in the brief time during which the armature 64 rests on its back stop, at the moment of reversal in polarity of the current on *e*. By this arrangement it is made possible to perform the function heretofore requiring two reversing line wires, by a single wire. The pen raising and paper shifting are effected in this organization in the following manner: The magnets S and T are respectively the pen raising and pen lowering magnets, carrying the pen rest 65 supported by their common pivoted armature 66. The circuit of magnet S passes from battery Z' by wire *s*, armature 67 of magnet P', springs 68 and 69 to ground. Circuit of magnet T passes from battery Z through armature 70, wire *t*, circuit making and breaking spring 69 to ground. Upon depression of the writing platen at the transmitting station, the resistance R is cut out of circuit *b* and the resistance R' is cut into circuit *c*. Consequently the armature of the Morse relay P' is drawn up and the armature of P is released, and thus the circuit *t* is closed and the circuit *s* is broken. The magnet T now acts and lowers the receiving pen to the paper. When the receiving platen at the transmitting station is allowed to rise this operation is reversed and the receiving pen is elevated from the paper.

When, for the purpose of shifting the paper, the two circuits *b*, *c* are simultaneously made of full strength, both the magnets P and P' draw their armatures and a circuit is made from the positive battery Z through armature 70, wires *y* and *y'*, paper shifting magnet V, armature 67 of magnet P', to the negative pole of battery Z'. This actuates the magnet V, which is as shown herein an axial magnet, but may be of other construction, causes it to draw down its plunger armature and through the agency of pawl 71 and ratchet wheel 72 to feed the paper. The plunger is returned to its normal position by the spring 79 attached to the cross piece 80.

At the same time the paper is fed unison is secured as follows: To the head of the

plunger are loosely attached two pivoted levers 73, 74 forked at their outer ends and embracing two endless cords 75, 76 each provided with a ball or other stop 77, 78 adapted to engage with the fork, and attached to one of the pen drum shafts. As the plunger 84 of the paper shifting magnet is drawn down the outer ends of the levers 73, 74 engage with the balls 77, 78, move the endless cords and carry the respective pen drum shafts to the unison position. The springs 61, 63, 68 and 69 are so placed with reference to the contact points with which they make connection that they are not in contact with them except when pressed upward by the piece 80 attached to the armature of magnet V. This will be the case when the instrument is in operation; but in order to hold the batteries at the receiver out of circuit when there is no current on line, I provide a locking magnet W, which magnet is in circuit with armature 70 of magnet P. Its circuit will therefore be normally closed when the instrument is in operation, but when the main line batteries are thrown off by the hanging up of the transmitting pen, the circuit of W will be broken. The lower end of the armature of magnet W when in its protracted position projects beyond the end of the piece 80 and locks it from rising to a position in which it may press the circuit making and breaking spring into connection with their respective contact points. When, therefore, the armature of magnet V is drawn down for the purpose of shifting the paper the magnet W will be energized and will hold its armature out of the path of the piece 80; but if, after shifting the paper, the transmitting operator proceeds to hang up his pen and take the current entirely off the line, armature 70 will drop back, breaking the circuit of magnet W, and permitting its armature 81 to drop forward and lock the piece 80 against rising far enough to reach the circuit making and breaking springs 61, 63, 68, 69. When the transmitting pen is again taken down and the current is thrown upon the lines the circuit of magnet P will again be made, since the transmitting platen is on its upper contact point, and magnet W being energized will withdraw its locking armature 81, permitting the circuits to be again closed.

Under the term "motor" and "power mechanism" as herein used I intend to include every form of device whether electrical or not from which power may be derived.

I have herein shown a construction in which two motors are used for each half of the instrument. Of course, it is to be understood that a construction in which a single motor should furnish power for both parts of the instrument is within the contemplation of this patent.

It will be understood that the arrangement of circuits and line wires herein described may be applied to an instrument having any sort of a transmitting interrupter and any sort of a receiving mechanism, and is not limited to the particular form of instrument, either transmitter or receiver, herein shown.

Although pulsations of successively reverse polarity are described as sent to line in this application, I do not limit myself to such pulsations but may employ those of successively like polarity. The pulsations may be sent by means of a pole changer as well as by the use of batteries of like polarity, if preferred; or in any manner and from any source of electricity desired.

In some cases it may be preferred to write the message in a single line extending along a narrow strip of paper, as suggested in my Patents Nos. 386,814 and 386,815, and in such case it will only be necessary to arrange the mechanism for shifting the paper in the direction of a line of writing, instead of perpendicular thereto. The receiving pen may in some cases consist of a simple pencil or tracer and the ink-supplying apparatus be dispensed with.

As stated in my said prior Letters Patent No. 386,814 the movements necessary to produce the messages instead of being imparted to the receiving pen may be wholly or in part imparted to the paper. It is therefore to be understood that when the movement of the receiving pen is referred to, this also includes the equivalent movement of the paper.

It is obvious that one of the pawls 29 may be omitted, if desired, the mechanism with such omission working in the same manner as already described, except that the plunger gives rotation to the shaft only while moving in one direction instead of in both, as in the construction shown. It is, therefore, to be understood that a single pawl is the equivalent of the two pawls shown in the drawings.

What I claim is—

1. The method of transmitting and recording a character by the movements of a transmitting pen and a receiving pen, by transmuting the movements of a transmitting pen into electric pulsations, sending to line in the reversing circuit a current of changed strength upon reversal of the transmitting pen in one of two crosswise directions of motion, and a current of changed polarity upon reversal in the other of the two crosswise directions of motion of the transmitting pen, thereby reversing the movement of the receiving pen in said two directions respectively, substantially as set forth.

2. In a telautographic system the method of reversing the direction of movement, in two directions crosswise of each other, of a receiving pen, to follow corresponding reversals in the direction of movement of the transmitting pen, which consists in causing the strength of the reversing current to change upon reversal in direction of motion of the transmitting pen in one of said two directions, and in causing a change of polarity in said

current upon reversal in direction of motion of the transmitting pen in the other of said two directions, substantially as set forth.

3. In a telautographic system the combination of a transmitting instrument, a receiving instrument, means for causing reversals in two crosswise directions of movement of the receiving pen to cause corresponding reversals in the direction of movement of the transmitting pen, consisting of a main line wire and electrical connections for sending a current of changed strength upon reversal in one of the said two directions, and mechanism for sending a current of changed polarity upon reversal in the other of said two directions, said changes effecting corresponding reversals in the movements of the receiving pen, substantially as set forth.

4. In a telautographic system, the combination of a transmitting instrument, a receiving instrument, two line wires for effecting two series of electrical pulsations, whereby motions in two directions crosswise of each other are imparted from the transmitting pen to the receiving pen, and reversing mechanism consisting of a single line wire provided with electrical connections and mechanism for sending thereon a current of changed strength upon reversal of direction of motion of the transmitting pen in one of said two crosswise directions and for sending a current of changed polarity upon a reversal of the direction of motion of the transmitting pen in the other of said two crosswise directions, said changes operating to reverse the movement of the receiving pen in said two crosswise directions respectively, substantially as set forth.

5. In a telautographic system, the combination of a transmitting pen, two electric circuits, means for sending electric pulsations over said circuits to cause the receiving pen to move in accordance with the movements of the transmitting pen, means for producing changes in said circuits, to raise and lower the receiving pen and to shift the paper at the receiving station, a reversing circuit, means for causing a change of strength in the current on the reversing circuit upon reversal in direction of motion of the transmitting pen in one of its two crosswise directions of movement, means for causing a change of polarity in the current traversing the reversing circuit upon a change in the direction of motion of the transmitting pen in the other of its two crosswise directions of movement, said changes operating to reverse the movement of the receiving pen in said two crosswise directions respectively, substantially as set forth.

6. In a telautographic system, the combination of a transmitting pen, two electric circuits, devices operated through said pen and producing a series of pulsations in each of said circuits, one for each of the two crosswise directions of movement of the transmitting pen, a receiving pen caused to move through said two series of pulsations in two crosswise directions, corresponding to the two crosswise directions of the transmitting pen, means for causing a temporary change in the current of said main circuits, for raising and lowering the receiving pen, a third circuit, means for causing a change of strength in the current traversing the same upon a reversal in the movement of the transmitting pen in one of said two crosswise directions, means for changing the polarity of the current traversing said reversing current upon a reversal of the transmitting pen in the other of said two crosswise directions of movement, the receiving pen being correspondingly reversed in its movement by the said changes in the reversing current, substantially as set forth.

7. The combination of a telautographic receiving pen, power mechanism for driving the same, a spring placed under tension by the power mechanism through which spring the power is transmitted to the receiving pen, and a circuit maker and breaker for suspending the operation of the power mechanism upon the spring when the latter has been placed under sufficient tension, substantially as set forth.

8. The combination of a telautographic receiving pen, power mechanism for driving the same, a spring placed under tension by the power mechanism, through which spring the power is transmitted to the receiving pen for driving it in two directions, and a reversing mechanism between the spring and the receiving pen, substantially as set forth.

9. The combination of a telautographic receiving pen, power mechanism for driving the same, a spring placed under tension by the power mechanism, through which spring the power is transmitted to the receiving pen, a reversing mechanism between the spring and receiving pen, and means for disconnecting the power mechanism from the spring when sufficient tension of the spring has been secured, substantially as set forth.

10. The combination of a receiving pen, a spring under tension for driving it in two directions, means for maintaining a constant tension of the spring, a reversing mechanism, and a receiving pen, substantially as set forth.

11. The combination of a telautographic receiving pen, a magnet, a reciprocating armature therefor, pawls carried by the armature, a shaft, a ratchet wheel mounted thereon with which the pawls engage to rotate the shaft in one direction, and a spring put under tension by the rotation of said shaft and which operates through said tension to drive the receiving pen, substantially as set forth.

12. The combination of a telautographic receiving pen, a magnet, a reciprocating armature therefor, pawls carried by said armature, shaft, a ratchet wheel mounted thereon with which said pawls engage to rotate the shaft in one direction as the armature reciprocates,

a spring put under tension by the rotation of said shaft and which operates by reason of said tension to drive the receiving pen, and a circuit breaker in the circuit of said magnet and arranged to be opened when the spring has received sufficient tension, substantially as set forth.

13. The combination of a telautographic receiving pen, a shaft or sleeve from which the said pen is driven, means for rotating said shaft, and a spring put under tension by the rotation of the shaft and serving by means of its tension to drive the receiving pen, substantially as set forth.

14. The combination of a telautographic receiving pen, a shaft, power mechanism for causing said shaft to rotate, a spring put under tension by means of the rotation of said shaft and serving because of its tension to drive the receiving pen, and means for disconnecting the power mechanism from the shaft when sufficient tension of the spring has been secured.

15. The combination of a telautographic receiving pen, power mechanism for driving the same, part of the connections between the power mechanism and the receiving pen consisting of a spring under tension, whereby the power exerted upon the receiving pen cannot exceed the tension of said spring, substantially as set forth.

16. The combination of a receiving pen, a shaft, a power mechanism for rotating the same, a lever carried by the shaft and connected with a spring and means for changing the position of the lever as the shaft rotates and thereby putting the spring under tension, the tension of the spring serving to give movement to the receiving pen, substantially as set forth.

17. As a regulator for limiting the power transmitted from a power mechanism to a telautographic receiving pen, a pivoted lever, a spring and a cord connected therewith, the spring being put under tension by the winding of the cord under the influence of the power mechanism and the tension being applied to the driving of the receiving pen substantially as set forth.

18. The combination of a telautographic receiving pen, a shaft, power mechanism for rotating the shaft, a magnetizable disk or ring mounted upon the shaft, two magnetizable plates connected with the receiving pen and adapted to be attracted, and moved in opposite directions, by the said magnetizable ring or disk, and means for causing the magnetic engagement of the ring or disk on the shaft with the said two plates alternately, thereby causing the alternate movement of the receiving pen in opposite directions, substantially as set forth.

19. The combination of a telautographic receiving pen, a shaft, power mechanism for rotating the shaft, a magnetizable disk or ring mounted upon the shaft, two magnetizable disks connected with the receiving pen and alternately attracted by said magnetizable ring or disk, and means for causing the magnetic engagement of the ring or disk on the shaft with the said other two disks alternately, thereby causing the alternate movement of the receiving pen in opposite directions, substantially as set forth.

20. A reversing mechanism for a telautographic receiver, consisting of a shaft, power mechanism for rotating the shaft, a magnetizable disk or ring mounted upon the shaft, two magnetizable plates connected with the receiving pen and adapted to be attracted and moved in opposite directions by the said magnetizable ring or disk, magnet coils for giving to each of the said magnetizable plates alternately a polarity opposite to that of the ring or disk of the shaft, so that the latter may attract the former, and electrical connections whereby upon change of direction in movement of the transmitting pen the polarity of the said two plates will be respectively changed so as to cause a reversal in direction of movement of the receiving pen, substantially as set forth.

21. A reversing mechanism for a telautographic receiver, consisting of a shaft, power mechanism for rotating the shaft, a magnetizable disk mounted upon the shaft, and two plates of magnetizable material connected with the receiving pen and alternately attracted by said magnetizable disk, magnet coils for giving to each of the said magnetizable plates alternately a polarity opposite to that of the disk on the shaft, so that the latter may attract the former, and electrical connections whereby upon change of direction of movement of the transmitting pen, the polarity of the said two plates will be respectively changed so as to cause a reversal in direction of movement of the receiving pen, substantially as set forth.

22. In a telautographic apparatus, a unison device consisting of a magnet at the receiving station, electrical connections with the transmitting station whereby the same can be operated at the will of the transmitting operator, and mechanism connecting the armature of said magnet and the receiving pen, whereby when the said armature is caused to move the receiving pen is moved thereby to unison position, substantially as set forth.

23. In a telautographic apparatus a unison mechanism consisting of a magnet, electrical connections with the transmitting station whereby the magnet may be operated at the will of the transmitting operator, and mechanism connecting the armature of said magnet with each of the two pen drums of the receiving pen, whereby when the said magnet is caused to operate the receiving pen is drawn to the position of unison, substantially as set forth.

24. In a telautograph, the combination of a paper shifting magnet and connections whereby it may be operated from the transmitting station, and mechanical connections between the armature of the paper shifting magnet

and the receiving pen, whereby the receiving pen is brought to unison with the transmitting pen upon the shifting of the paper, substantially as set forth.

25. In a telautograph, the combination of circuit makers and breakers controlling local batteries at the receiver, mechanism for locking said makers and breakers in an open position, and a magnet controlling said mechanism to lock said circuits open when the transmitting pen is out of use, substantially as set forth.

26. The combination of a telautographic receiving pen, power mechanism for driving the same, a spring placed under tension by the power mechanism, through which spring the power is transmitted to the receiving pen, an escapement for regulating the application of the power of the spring to the receiving pen, and means for disconnecting the power mechanism from the spring when the tension of the latter is normal, substantially as set forth.

27. The combination of a spring, a motor or other source of power for maintaining the tension of the spring and means for suspending the operation of the motor upon the spring when the tension of the latter is normal, and a receiving pen connected with and driven by the power of the spring, substantially as set forth.

28. The combination of a spring, of power mechanism for giving tension thereto, means for suspending the operation of the power mechanism upon the spring when its tension reaches the normal amount, means for re-establishing the operation of the power mechanism upon the spring when the tension of the spring falls below its normal amount, and a receiving pen driven by the power of the spring, substantially as set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ELISHA GRAY.

Witnesses:
W. L. RE QUO,
THOS. A. WHEELWRIGHT.