No. 668,890.

Patented Feb. 26, 1901.

G. S. TIFFANY.

TELAUTOGRAPH.

(Application filed Oct. 19, 1900.)

(No Model.)

4 Sheets—Sheet 1.

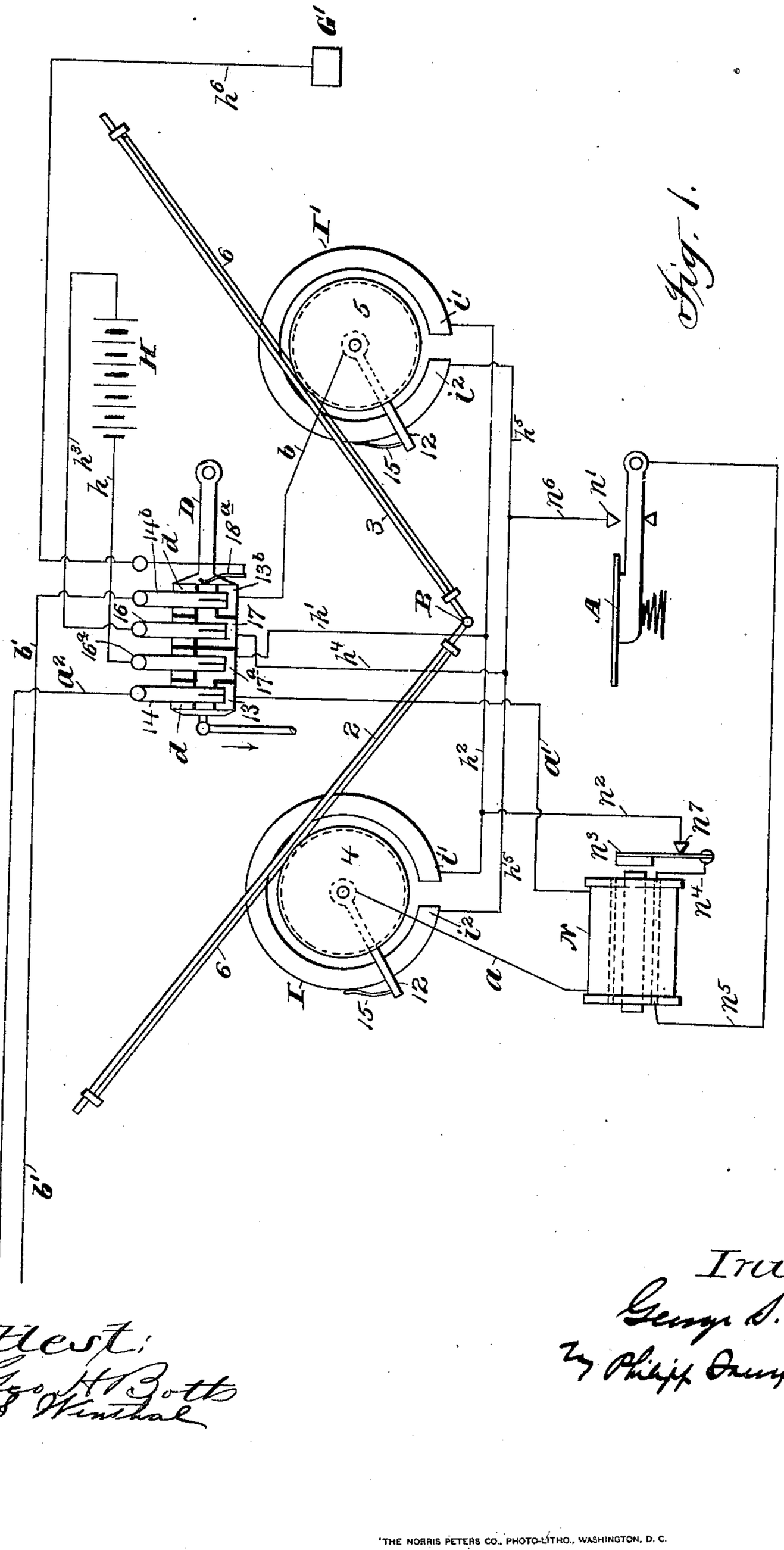

Fig. 1.

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4 Sheets—Sheet 2.

Fig. 2.

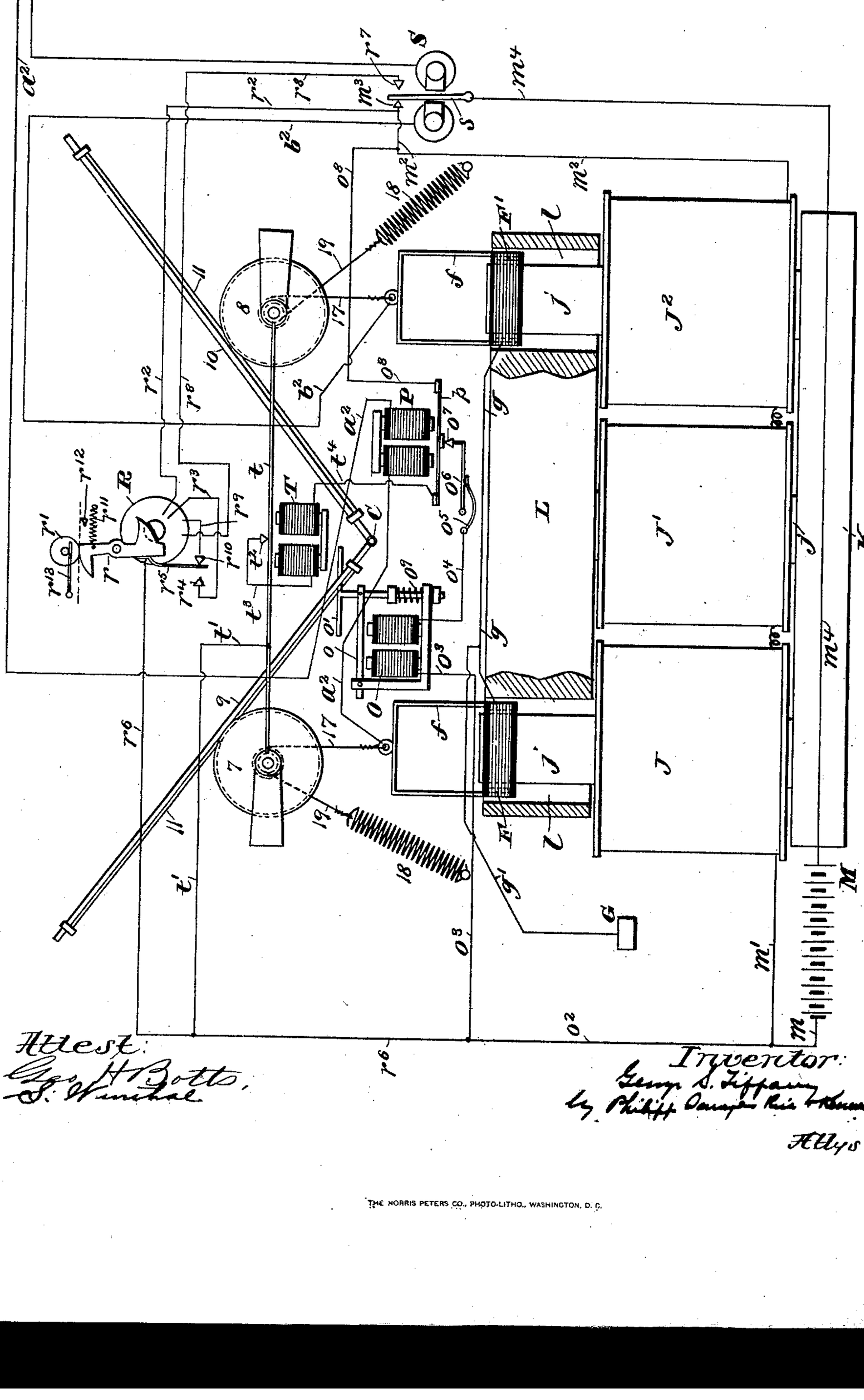

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Fig. 3.

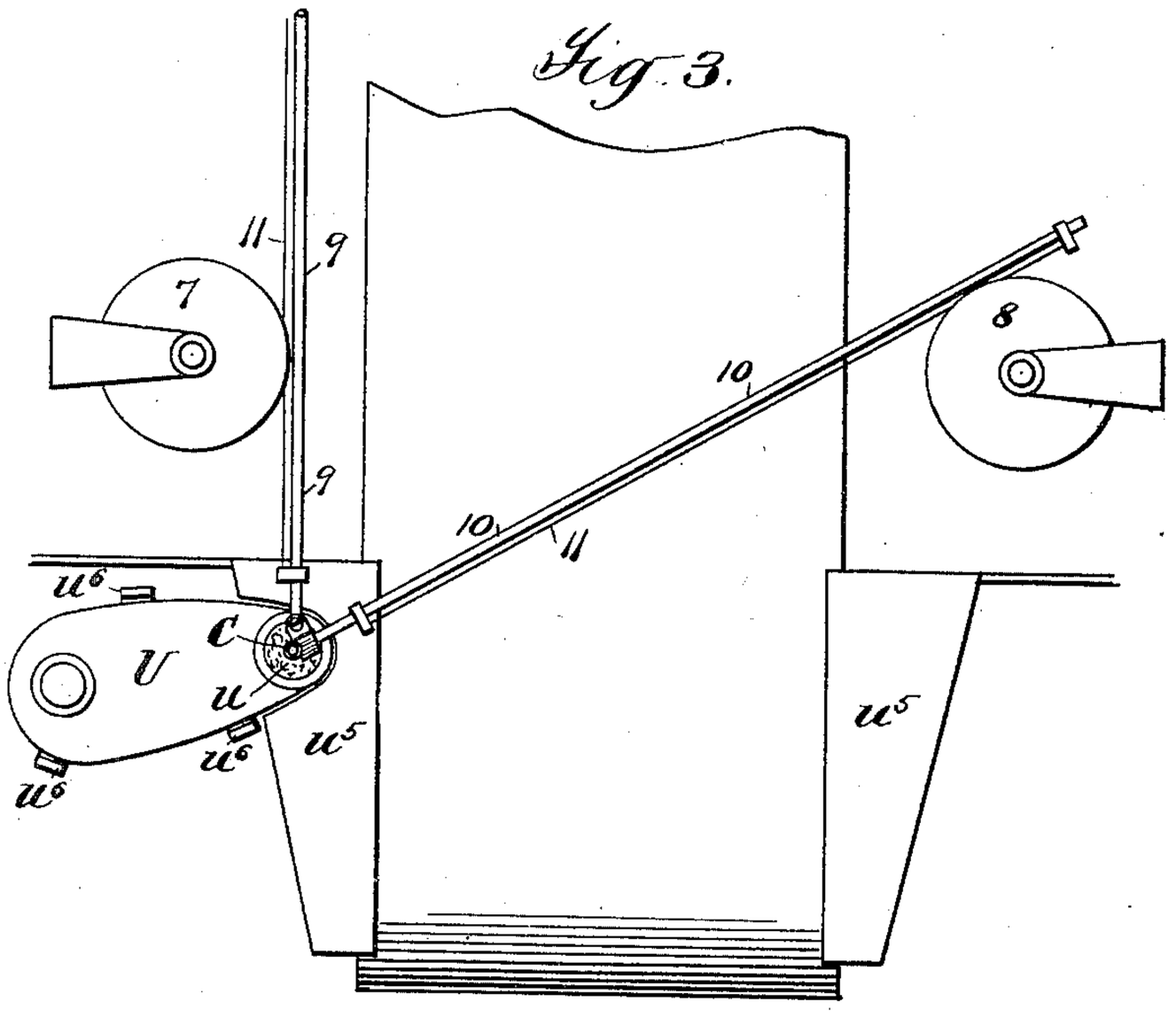


Fig. 4.

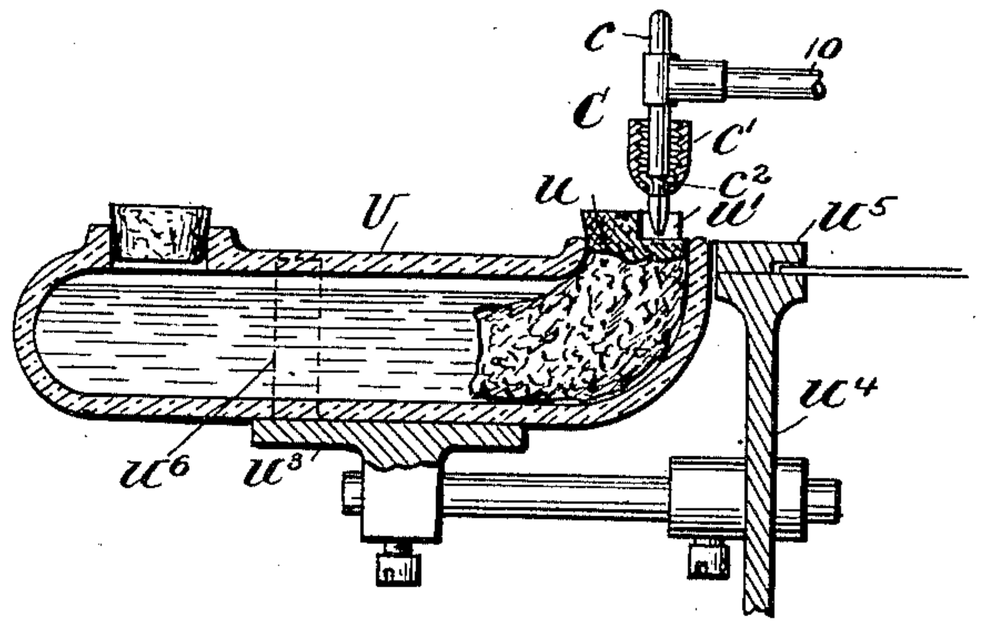
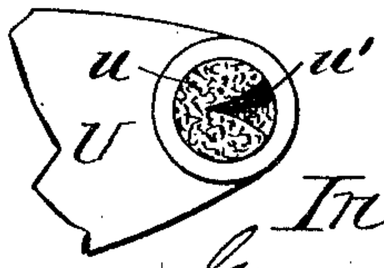


Fig. 5.



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No. 668,890. Patented Feb. 26, 1901.

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TELAUTOGRAPH.

(Application filed Oct. 19, 1900.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 6.

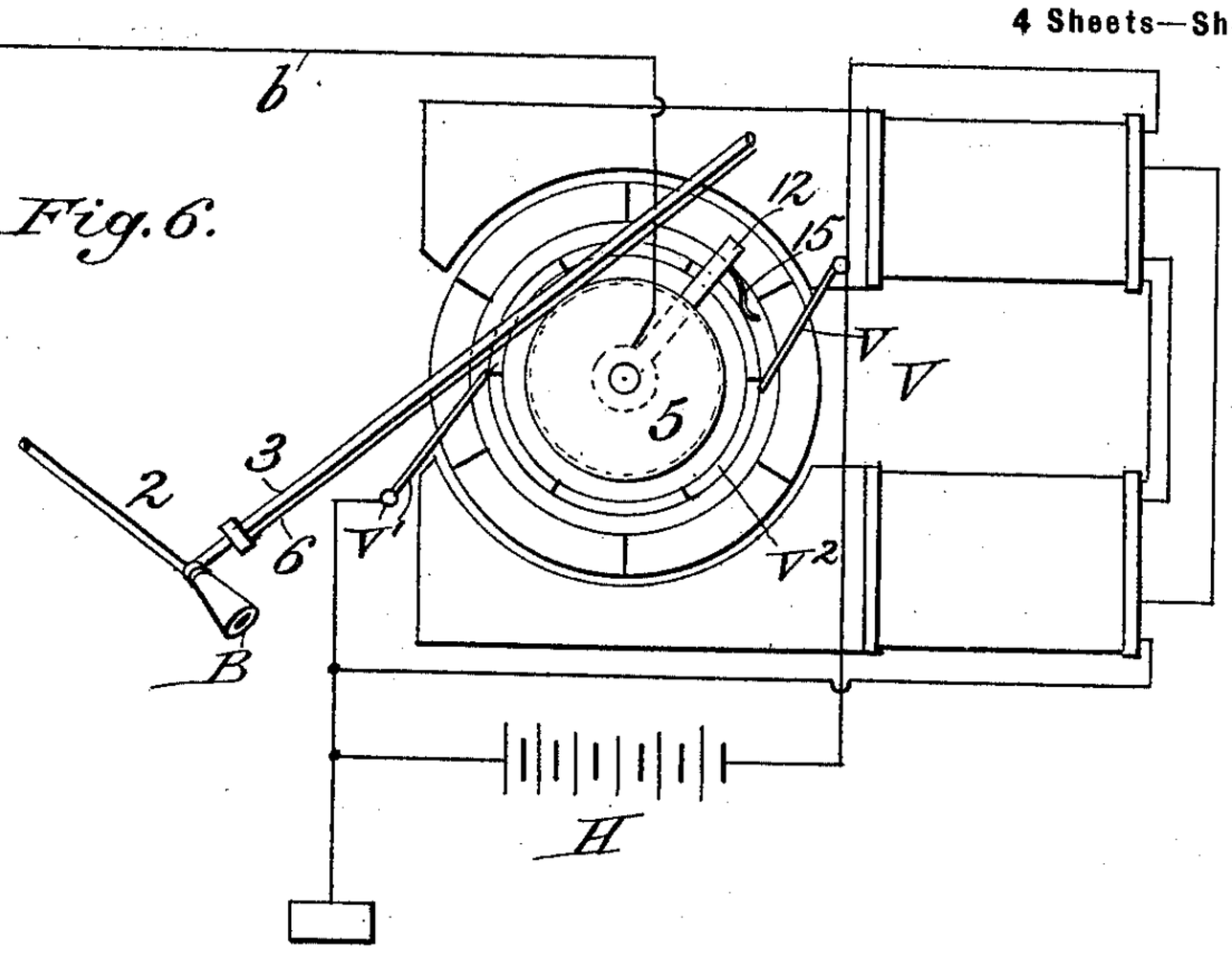


Fig. 7.

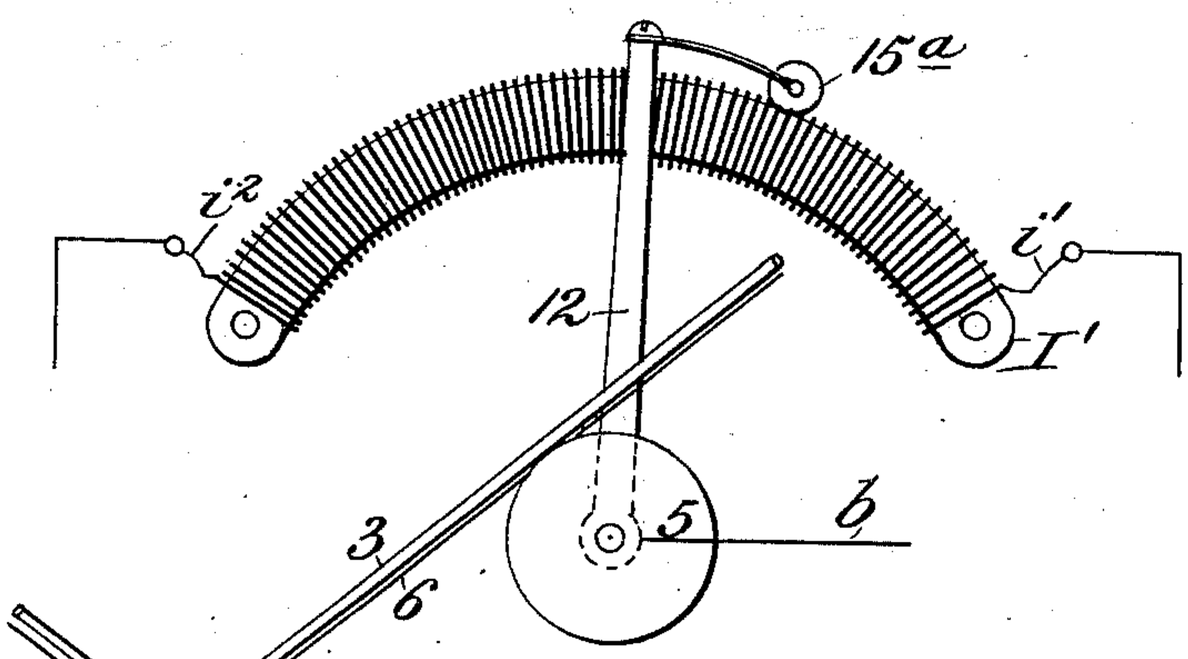
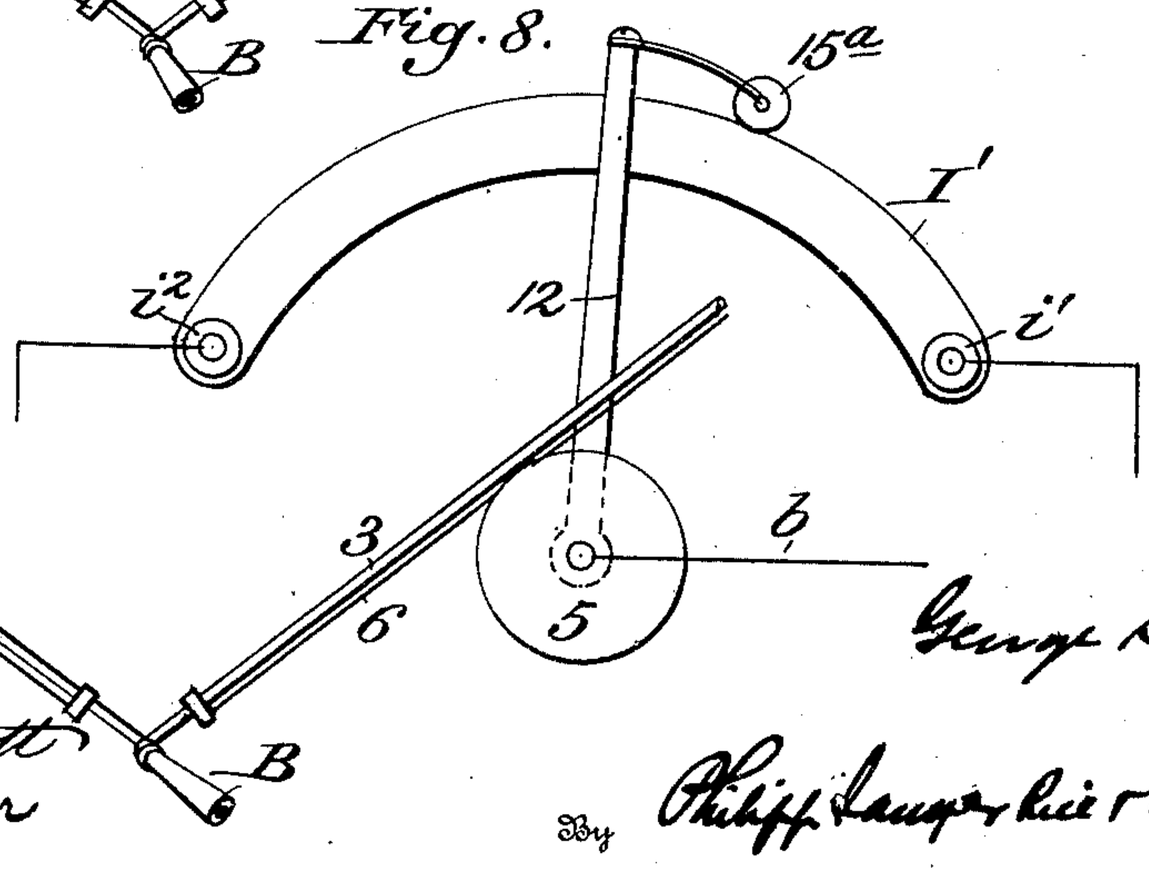


Fig. 8.



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TELAUTOGRAPH.

SPECIFICATION forming part of Letters Patent No. 668,890, dated February 26, 1901.

Application filed October 19, 1900. Serial No. 33,590. (No model.)

To all whom it may concern:

Be it known that I, GEORGE S. TIFFANY, a citizen of the United States, residing at Evanston, county of Cook, 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 improvements in telautographic apparatus, and particularly to telautographic apparatus of that class in which the movements of the receiving-pen in unison with the transmitting-tracer are effected by variations in the strength of the current sent to line from the transmitting instrument to the receiving instrument, such variations in current strength being in turn effected by and corresponding to the movements of the transmitting-tracer.

One feature of the present invention relates to means controlled by the transmitting-tracer for varying the strength of the currents sent to line, the means provided for this purpose by the present invention, broadly considered, being adapted for use in connection with any suitable devices at the receiving instrument operable by such variations in current strength and in turn controlling the movements of the receiving-pen.

Another feature of the invention relates to devices at the receiving instrument for controlling the movements of the receiving-pen and which are in turn controlled in their movements by variations in the strength of the currents sent to line from the transmitter, the devices provided for this purpose by the present invention, broadly considered, being adapted for use in connection with any suitable means controlled by the transmitting-tracer for producing the necessary variations in current strength on line.

Although, as just indicated, these two features of the present invention are capable of use independently of each other, the combination of the two results in the production of a telautographic apparatus having the important advantages of great simplicity and speed as well as other advantages, and such combination therefore constitutes another feature of the invention. These several features are also independent of any particular form of transmitting and receiving apparatus, and it is therefore to be understood that the present invention, broadly considered, is not to be limited to the particular form of apparatus in connection with which these features are shown in the drawings.

In the accompanying drawings, Figure 1 illustrates, partly in diagram, the transmitting instrument, with means for varying the strength of the currents sent over the main-line circuits. Fig. 2 illustrates in like manner the receiving instrument, with means for controlling the movements of the receiving-pen in accordance with variations in current strength. Fig. 3 is a diagrammatic view illustrating particularly means whereby the receiving-pen may be supplied with ink when moved to its unison-point. Figs. 4 and 5 are details of the inking means employed; and Figs. 6, 7, and 8 are detail views illustrating different forms of devices whereby the strength of the currents sent to line may be varied.

Referring to said drawings, A represents the writing-platen, and B the transmitting-tracer, which is carried by a pair of hinged arms 2 3, connected to drums 4 5 by cords 6, wound around said drums and secured at their ends to said arms, so that as the transmitting-tracer B is moved in writing and caused to assume different positions along the writing-surface the drums 4 5 are correspondingly rotated. As the drums 4 5 are thus rotated currents of varying strength are sent over line to the receiving instrument, which cause a pair of drums 7 8 at the receiving instrument to rotate in unison with the drums 4 5, all as hereinafter more fully described, and as thus rotated to in turn cause the receiving-pen C (which is carried by arms 9 10, connected to drums 7 8 by cords 11, as in the case of the transmitting-tracer,) to move in unison with the transmitting-tracer and to reproduce at the receiving instrument the writing produced or traced by the transmitting-tracer at the transmitting-station.

The main-line circuits from the transmitting instrument to the receiving instrument will now be described.

With the master-switch D in closing position, as shown, the circuit from the left-hand side of the transmitting instrument consists of wire *a*, leading from an arm 12, rotating with the drum 4, to the secondary winding of an induction-coil N, (introduced into this circuit for a purpose hereinafter explained;) wire *a'*, leading from said coil to contact-plate 13 on master-switch D, contact-brush 14 resting on said plate; wire a^2, leading to a rectilinearly-movable coil F on the left-hand side of the receiving instrument, and wires *g g'*, leading thence to ground at G. The circuit from the right-hand side of the transmitting instrument consists of wire *b*, leading from arm 12, rotating with drum 5, to contact-plate 13^b of master-switch D, contact-brush 14^b; wire *b'*, leading to a polarized relay S on the right-hand side of the receiving instrument; wire b^2, leading from said relay to a rectilinearly-movable coil F', (corresponding to coil F on the left-hand side,) and wires *g g'*, leading from said coil to earth at G.

Current is supplied to the main-line circuits just described from two local circuits at the transmitting-station, which are independent of the main-line circuits and which include a source of electric energy, as a battery H, and two preferably arc-shaped plates I I', through which current is supplied to the left and right hand main-line circuits, respectively, from said independent circuits. These arc-shaped plates I I' are mounted below the drums 4 5, so as to be engaged by contacts, as brushes 15, carried by the rotating arms 12, through which brushes and arms currents are shunted into the main circuits, which vary in strength according to the positions of said brushes 15 between the ends of said plates I I', as will presently appear. These independent current-supplying circuits will now be described. With the master-switch D in the position in which it is shown in Fig. 1 the negative pole of the battery H is connected by wire *h*, contact-brush 16^a, contact-plate 17^a on the master-switch, and wires h' h^2 to the terminals i' of the arc-shaped plates I I', while the positive pole of the battery H is connected by wire h^3, contact-brush 16, contact-plate 17 on the master-switch D, and wires h^4 h^5 to the opposite terminals i^2 of the arc-shaped plates I I'. The positive pole of the battery H is grounded at G' when master-switch D is in the position shown by wire h^6, connected to contact-spring 18^a, contacting with plate 17, brush 16, and wire h^3, so that with the parts in the positions shown in Fig. 1 a current is passing through each of these independent circuits from the negative pole of battery H and through the plates I I', the brushes 15, and rotating arms 12 to the main-line circuits leading to the receiving instrument. The strength of the currents delivered from these independent circuits to the main-line circuits will, as before stated, depend upon the position of the brushes 15 relatively to the terminals i' i^2 of the plates I I', since the nearer these brushes are to the terminals i' of said plates the greater the voltage between the brushes 15 and the opposite terminals i^2 of said plates or ground, and vice versa; or, in other words, if we assume the voltage of the battery H to be thirty volts and a brush 15 to be one-third the distance from the terminal i^2 of a plate I or I' the difference of potential between the brush 15 and ground will be approximately ten volts, and if the brush be midway between the two terminals i' i^2 the difference of potential between the brush and ground will be approximately fifteen volts. From this construction it results that as the arms 12 are rotated with the drums 4 5 by the movement of the transmitting-tracer the brushes 15 are caused to assume different positions relatively to the terminals i' i^2 of the plates I I' and to shunt into the main-line circuits currents which vary in strength in accordance with the positions thus assumed by the brushes, the strength of such currents increasing as the brushes 15 approach the terminals i' of said plates and decreasing as they approach the terminals i^2 thereof.

The members—namely, the plates I I' and contacts 15—through which currents are supplied from the independent circuits to the main-line circuits may be of any material suitable for the purpose; but I prefer that the members I I' should be of some high-resistance material—such, for example, as carbon—as if such members were of low resistance they might soon be destroyed by the heat of the current passing through them from the battery H.

The devices provided at the receiving instrument for controlling the movements of the receiving-pen and which are in turn controlled in the extent of their movements in accordance with the strength of the currents shunted into the main-line circuits from the independent circuits at the transmitting instrument consist of the movable coils F F', before referred to, and three electromagnets J J' J^2, providing suitable magnetic fields for the movement of said coils. These coils, while they might be mounted to move in other rectilinear directions without departing from the present invention, broadly considered, are preferably mounted so as to move vertically, as shown, relatively to the core and poles of their magnets, vertical movement of the coils being preferred, because thereby the connections between them and the receiving-pen are much simplified and the friction of the moving parts is very much reduced. The magnets J J' J^2 rest upon a heel-iron K, with a pole-piece L secured to the top of the core *j* of the central magnet J', said pole-piece L being provided near its ends with openings *l*, inclosing the cores *j* of the end magnets J J^2 and providing space around said cores for the movement vertically of the coils F F', consisting of wire wound, preferably, upon a

thin metallic tube (preferably copper) secured to a frame *f* and fitting loosely over the cores *j*, so as to slide freely thereon, the openings *l* also being of sufficient size to permit such free movement. It will be observed from this construction that each of the coils F F′ surrounds one polar extremity of its magnet J or J^2 and is in turn inclosed or embraced by the pole-piece of opposite polarity—namely, the pole-piece L. The coils F F′ are suspended from the pivoted drums 7 8 or the shafts thereof, as shown, by means of cords 17, secured at their lower ends to the frame *f* and wound around said pen-arm drums or their shafts, so that as the coils F F′ are moved downwardly they tend to rotate the pen-arm drums 7 8 in one direction against the tension of springs 18, connected by cords 19 to the pen-arm drums or the shafts thereof and which tend to rotate said drums in the opposite direction. The electromagnets J J′ J^2 are excited separately from the coils F F′ by the following circuit: wires *m m′*, leading from the negative pole of a local battery M, coils of magnets J J′ J^2, wire m^2, contact m^3, armature *s* of relay S, and wire m^4 to the positive pole of battery M.

The operation of the apparatus as thus far described is as follows: Assuming the master-switch D to be in the position in which it is shown in Fig. 1 and the transmitting-tracer and receiving-pen to be in writing position upon the paper, as the transmitting-tracer is moved by the operator in writing the drums 4 5 are rotated, through the connections described, in one direction or the other and to an extent dependent upon the direction and extent of movement of the transmitting-tracer and its arms 2 3. As the drums 4 5 are thus rotated the arms 12, rotating therewith, will move their brushes 15 over the peripheries of the arc-shaped plates I I′, thus causing said brushes to assume different positions relatively to the two terminals *i* i^2 of said plates. As the brushes 15 are thus moved over the peripheries of the plates I I′ currents of varying strength are shunted into the main-line circuits from the left-hand side of the transmitter, through wire *a*, secondary winding of induction-coil N, wire *a′*, plate 13, contact-brush 14, wire a^2, relay P, wire a^2, coil F, and wires *g g′*, to ground and from the right-hand side of the transmitter, through wire *b*, plate 13^b, contact-brush 14^b, wire *b′*, relay S, wire b^2, coil F′, and wires *g g′*, to ground. As such currents are sent over the main-line circuits they will in passing through the coils F F′ cause the latter to assume different positions vertically in their magnetic fields in accordance with the strength of the currents, and thus effect rotation of the pen-arm drums 7 8 and movement of the receiving-pen C in unison with the drums 4 5 and the transmitting-tracer, respectively, it being understood that when currents of increased strength are shunted into the main-line circuits by the movement of the brushes 15 toward the terminals *i′* of the plates I I′ the coils F F′ will be drawn downwardly, and thus through their cords 17 rotate the pen-arm drums 7 8, and that when currents of decreased strength are shunted into the main-line circuits by the movement of the brushes 15 toward the terminals i^2 of the plates I I′ the pull of the coils F F′ upon the pen-arm drums 7 8 will be relaxed and such pen-arm drums then rotated in the opposite direction and the coils F F′ moved upwardly in their magnetic fields by the springs 18. In this operation it will be observed that the magnets J J^2 act by attraction to move the coils F F′ to actuate the receiving-pen; but the operation of the magnets might be reversed without departing from the invention—that is to say, these magnets might act repulsively upon these coils to so move them.

In the drawings there is illustrated a pen-lifting mechanism and circuits for operating the same, controlled from the transmitting instrument, which will now be briefly described, although this mechanism is not claimed in this application, as it forms the subject-matter of a separate application filed by me October 19, 1900, Serial No. 33,589. This pen-lifting mechanism consists of a magnet O, the armature *o* of which is provided with a pen-supporting arm *o′*, which when the armature *o* is released by the magnet O engages pen-arm 9 and moves the receiving-pen C from the paper. The magnet O is energized from a local circuit consisting of wires *m* o^2 o^3, leading from the negative pole of battery M, wire o^4, spring o^5, pivoted arm o^6, contact o^7, the armature *p* of a relay P, which is in series with the main-line wire a^2, wire o^8, leading from the armature *p* to wire m^2 and contact m^3, armature *s* of relay S, and wire m^4 to the positive pole of battery M. The condition of this local circuit, and through it the condition of the magnet O, is controlled so as to effect the movement of the receiving-pen to and from the writing-surface by the transmitting-platen A in the following manner: During the writing operation and while the platen A is in the depressed position, in which it is shown in Fig. 1, the relay P, being energized by the main-line circuit a^2, will attract its armature *p*. The pivoted arm o^6 of the local circuit of the magnet O, however, will follow the armature *p*, being held in contact therewith by the spring o^5, thus maintaining the local circuit of the magnet O closed. With this local circuit closed the magnet O is energized, attracting its armature *o* and moving the pen-supporting arm *o′* out of supporting position, with the result that the receiving-pen C is moved into contact with the writing-surface. When the transmitting-tracer is raised from the writing-platen A, the latter rises and engages a contact *n′*, and thus closes a local circuit from the negative pole of the battery H through wire *h*, contact-brush 16^a, plate 17^a, wires *h′* h^2 n^2, vibrator n^3, wire n^4, primary winding of induction-coil N, wire n^5 to the writing-

platen, and thence by wires n^6 h^5 h^4, contact-plate 17, contact-brush 16, and wire h^3 to the positive pole of battery H. As this circuit is thus closed the vibrator n^3 is attracted by coil N, so as to be moved away from contact n^7 of wire n^2, thus breaking this local circuit, when the vibrator n^3 moves away from the coil N and again engages contact n^7, reëstablishing the circuit, and so on so long as the platen A remains in its raised position. Vibratory currents are thus induced upon the left-hand main-line wire a^2 and through relay P by the induction-coil N, thus vibrating the armature p of said relay. The rate of vibration of the armature p of relay P is greater than that of which the pivoted arm o^6 is capable, so that the current through the local circuit of magnet O is repeatedly interrupted during the vibration of armature p, with the result that the average strength of current through magnet O is diminished to such an extent as to cause said magnet to release its armature o. As the armature o is thus released the pen-supporting arm o' is moved by a spring o^9 into supporting position, thus raising the receiving-pen from the paper. These vibratory currents through the relay P continue as long as the transmitting-tracer is out of contact with the platen A and the latter remains in its raised position. As soon, however, as the transmitting-tracer is returned to engagement with the platen A the latter is depressed out of engagement with contact n', when the branch circuit through the vibrator n^3 will be broken and the vibratory currents through the relay P cease, thus reclosing the local circuit from the battery M through magnet O by the engagement of the pivoted arm o^6 with the armature p of relay P, the magnet O then attracting its armature o and withdrawing arm o' from supporting position, when the receiving-pen will move into contact with the paper.

After the writing operation is completed or when it is desired to shift the paper at the receiving end the master-switch D will be moved in the direction indicated by the arrow in Fig. 1, so as to bring four insulated plates d, borne by the switch, into engagement with the brushes 14 14^b 16 16^a 18^a, thus opening the main-line circuits. Before the switch D reaches this position, however, the main-line wires b' and a^2 will be momentarily connected to the positive and negative poles, respectively, of the battery H through contact-plates 17 and 17^a, respectively, thus reversing in polarity the current over right-line wire b' to what it was during the writing operation, with the result that the armature s of relay S will be biased away from contact m^3 and against a contact r^7, thus opening the local circuits described in the receiver and closing the paper-shifting circuit at the receiving end, as hereinafter described. When the main-line circuits a^2 and b' are thus opened by the master-switch D, the coils F F′ are deenergized and then moved upwardly through their magnetic fields by the springs 18, which also rotate the pen-arm drums 7 8 and through the pen-arms 9 10 move the receiving-pen to its unison-point. Means are shown herein for inking the receiving-pen when it is thus moved to its unison-point, which means, however, is not claimed herein, as it forms part of the subject-matter of the application hereinbefore referred to, filed by me October 19, 1900, Serial No. 33,589. The means shown for so inking the receiving-pen at its unison-point consists of an ink-well U, provided with suitable absorbent material u, preferably sponge-rubber, projecting from the ink-well in proper position for engagement with the receiving-pen as the latter arrives at its unison-point. Any suitable form of receiving-pen may be used in connection with this inking device; but I prefer to use the one shown, which, however, forms of itself no part of my invention and is merely selected for the purposes of illustration as one form of pen which may be used in connection with the inking device shown. This pen consists of a stem c, secured to the pen-arms 9 10 in any suitable manner and inclosed by a cup c', the lower end of which is split, held in position upon the stem, above the lower end thereof, by engagement with a groove c^2, formed in said stem. The lower end of said stem, which forms the pen-point, is split or grooved longitudinally, as shown in Fig. 4, and the interior surface of the cup c' is threaded, as shown, so that upon inserting the lower end of the pen in a supply of ink or in absorbent material filled with ink said pen will supply itself with ink by capillary attraction, or, if desired, the pen may be inked by filling the cup c' from the top. Where sponge-rubber or similar absorbent material is employed the portion thereof projecting from the ink-well will preferably be provided with a recess, as u', for receiving the pen as it comes to its unison-point, so that the pen may embed itself in or be embraced by the absorbent material and more freely supplied with ink. The ink-well U may be supported at the unison-point in any suitable manner. As shown, it is so supported upon a bracket u^3, secured to the frame u^4 of the transmitting instrument, with the ink-supplying opening of the ink-well located in a recess in one of the paper-guides u^5, the bracket u^3 being provided with projections u^6 for retaining the ink-well U in proper position.

Any suitable form of paper-shifting mechanism may be employed at the receiving instrument for shifting the paper after the completion of a line of writing or at other desired times. A convenient form of mechanism for this purpose and one which is commonly used in telautographs is illustrated in Fig. 2 and will now be briefly described. This paper-shifting mechanism consists of a magnet R, rocking-armature r therefor, and a vertically-movable roll r', which coacts with the upper end of the armature r when the

latter is attracted by the magnet R to grip the paper and move it forward. The magnet R is energized for the purpose of attracting its armature r and feeding the paper by a local circuit controlled by the armature s of relay S, consisting of wire m^4 from the positive pole of battery M, armature s, contact m^3, wire r^2 to the inside of the inner winding of magnet R, this magnet having two windings of a like direction of winding, and wire r^3 from the outer terminal of the inner winding of said magnet to contact r^4, spring-arm r^5, wires r^6, o^2, and m to the negative pole of the battery M. The armature r is shown in the position it assumes after having shifted the paper, with its spring-arm r^5 out of engagement with the contact r^4. Before the movement of the armature r to this position the spring arm r^5 is in engagement with said contact r^4, thus closing the circuit described from the battery M, so that when the master-switch D at the transmitting-station is moved to the position in which it is shown in Fig. 1 a negative current is sent over line-wire b', as before described, through the relay S, thus biasing the armature s of said relay against contact m^3 and completing the local paper-shifting circuit just described. The magnet R being thus energized will attract the armature r, rocking it into the position in which it is shown in Fig. 2, the roller r', which is of iron, being attracted by the armature, so as to grip the paper between it and said armature. As the armature r is moved to this position its spring-arm r^5 is moved out of engagement with contact r^4, thus breaking the local circuit described from battery M, this movement of spring-arm r^5 away from contact r^4 taking place at about the end of the shifting movement of the armature r. The armature r is held in this position against the core of magnet R by residual magnetism during the writing operation and so long as the master-switch D remains in the position in which it is shown in Fig. 1. When, however, the master-switch D at the transmitting-station is moved in the direction indicated by the arrow, as before described, to open the main-line circuits a^2 b', a reverse current is sent over the line b' through relay-magnet S by the momentary engagement of contact-plate 17 with contact-brush 14^b, thus biasing the armature s against contact r^7, when the following circuit will be established between the battery M and paper-shifting magnet R: wire m^4 from the positive pole of said battery to armature s, contact r^7, wire r^8 to the outer terminal of the outside winding of magnet R, which is of comparatively high resistance, wire r^9 from inside of the outer winding, contact r^{10}, spring-arm r^5, and thence by wires r^6, o^2, and m to the negative pole of battery M. Upon the formation of this circuit current will pass through the outer winding of the paper-shifting magnet R in the opposite direction to that heretofore described for energizing the magnet R to shift the paper, which will tend to magnetize the core of magnet R of reverse polarity, thus cutting out the residual magnetism and allowing a spring r^{11} to rock the armature r from the position in which it is shown and against a back-stop r^{12} and in position for again shifting the paper when the main-line circuit b' is again closed and the armature s biased against contact m^3. Immediately upon the discharge of the core of magnet R the roller r' is released and raised by its spring r^{13}, thus releasing the paper.

In order to secure accurate movement of the receiving-pen in a telautographic apparatus in unison with the transmitting-tracer, it is necessary that the devices provided at the receiving instrument for controlling the movement of the receiving-pen should move with as little friction as possible, and I have discovered that the friction between these moving parts can be very materially reduced if such moving parts be subjected to vibration during the writing operation. In Fig. 2 of the drawings I have shown means for so vibrating these moving parts controlled from the transmitting instrument, which means, however, are not claimed herein, as they form part of the subject-matter of the application hereinbefore referred to, filed by me October 19, 1900, Serial No. 33,589. Briefly described, the means shown for this purpose in the present case consist of a light resilient rod t, of suitable material, connecting the bearings of the pen-arm drums 7 8 and which is kept in a constant state of vibration during the writing operation and while the armature s of the relay S is against the contact m^3 by means of a magnet T, connected to the negative pole of battery M by wires m o^2 r^6 t', rod t, contact t^2, and wire t^3 and to the positive pole of said battery by wire m^4, armature s of relay S, contact m^3, wires m^2 o^8, armature p of relay P, and wire t^4, leading from said armature to the magnet T. This local circuit for the magnet T is controlled by the armature s and master-switch D, so that when said armature is against the contact m^3 the circuit from battery M to magnet T is closed, and this is the condition of this circuit throughout the writing operation and so long as the master-switch D remains in the position shown in Fig. 1. When this local circuit is thus closed, the rod t is kept constantly in a state of vibration by the magnet T, such rod when attracted by the magnet T moving away from contact t^2, thus opening the circuit from battery M to magnet T, and when released by the magnet reëngaging contact t^2 and reclosing this circuit, and so on so long as the writing operation continues and the armature s remains in the position in which it is shown in Fig. 2. When the armature s is moved from this position and biased against the contact r^7 by the movement of the master-switch D in the direction

of the arrow in Fig. 1, as hereinbefore described, this local circuit, like the other local circuits before described, is opened.

In Figs. 6, 7, and 8 I have illustrated modified forms of the devices through which current is supplied to the main-line circuits and for varying the strength of the currents so supplied to the main-line circuits. As the devices for this purpose for both of the main-line circuits are the same, only one set of such devices is shown in each of these figures—namely, that intended for the right-hand circuit b'.

In the construction illustrated in Fig. 6, V represents a motor connected to the battery H, and the opposite terminals of which motor are connected by contact-brushes v v' with the rotating armature v^2 of said motor, which armature is located beneath the drum 5, to which the pen-arm 3 is connected as in Figs. 1 and 2. In this construction, the currents from the motor are shunted into the main-line circuit by means of a contact 15, carried by an arm 12, which rotates with the drum 5, as previously described in connection with Figs. 1 and 2. The motor in this case is used as a means of generating a counter electromotive force in the independent circuit, the fall of potential between the brushes v and v' being determined mainly by this counter electromotive force and not by the ohmic resistance. This allows of a very low ohmic resistance of the armature in relation to the line resistance—the armature in this case corresponding to the arc-shaped member I or I′ of the preceding figures—which will cause the currents shunted into the main-line circuit from the independent circuit to vary more nearly proportional to the movements of the transmitting-tracer (providing the armature rotates in a substantially uniform field) than when a member I or I′ of comparatively high ohmic resistance is used through which the currents are shunted into the main-line circuit.

In the construction illustrated in Fig. 7 the opposite ends of the battery (not shown) are connected to the terminals i' i^2 of an insulated resistance-wire wound upon an arc-shaped plate I′, of suitable material, the arm 12, rotating with the drum 5, carrying a contact device consisting of a roller 15^a, preferably of carbon, which contacts with the coils of wire in line with the periphery of the arc-shaped plate I′, the insulation being removed from the coils at the points where the roller 15^a makes contact therewith. I prefer that this roller should be of carbon, because in passing from one coil to another of the wire it causes a more gradual change in strength of current sent to line than would be possible if a metallic contact were employed.

In the construction illustrated in Fig. 8 the opposite poles of the battery H (not shown) are connected to the terminals of an arc-shaped plate I′, which is of carbon, the contact-roller 15^a being also of carbon. The advantages of this construction—that is to say, of having both of these parts of carbon—reside in the fact that a more uniform contact is secured and there is little tendency to oxidation.

The several features of the present invention are not limited to the precise construction and arrangement of devices described and many modifications and changes may be made therein without departing from the spirit of this invention.

The methods disclosed by this application are not claimed herein, but form the subject-matter of an application filed by me December 21, 1900, Serial No. 40,636.

What is claimed is—

1. In a telautographic apparatus, the combination of a transmitting-tracer, a main-line circuit, an independent circuit including a source of electric energy, and means controlled by the transmitting-tracer for shunting from said independent circuit into the main-line circuit currents varying in strength according to the movements of said transmitting-tracer, substantially as described.

2. In a telautographic apparatus, the combination of a transmitting-tracer, a main-line circuit, an independent circuit including a source of electric energy, two relatively movable members, one included in the independent circuit and through which current is supplied to the main-line circuit, and the other leading therefrom to the main-line circuit, and connections between the transmitting-tracer and one of said members whereby the latter is moved relatively to the other member so as to shunt from said independent circuit into the main-line circuit currents varying in strength according to the movements of said transmitting-tracer, substantially as described.

3. In a telautographic apparatus, the combination of a transmitting-tracer, a main-line circuit, an independent circuit including a source of electric energy and a member through which current is supplied therefrom to the main-line circuit, a movable member in contact therewith and connected with the main-line circuit, and connections between the transmitting-tracer and said movable member whereby the latter is moved relatively to the other member so as to shunt from said independent circuit into the main-line circuit currents varying in strength according to the movements of said transmitting-tracer, substantially as described.

4. In a telautographic apparatus, the combination of a transmitting-tracer, a main-line circuit, an independent circuit including a source of electric energy and an arc-shaped member through which current is supplied to the main-line circuit, a member in contact with said arc-shaped member and connected with the main-line circuit, one of said members being rotatable relatively to the other, and connections between the transmitting-tracer and the rotatable member whereby the latter is moved relatively to the other mem-

ber so as to shunt from said independent circuit into the main-line circuit currents varying in strength according to the movements of said transmitting-tracer, substantially as described.

5. In a telautographic apparatus, the combination of a transmitting-tracer, a main-line circuit, an independent circuit including a source of electric energy and an arc-shaped member through which current is supplied to the main-line circuit, a rotatable member in contact with said arc-shaped member and leading therefrom to the main-line circuit, and connections between the transmitting-tracer and said rotatable member whereby the latter is moved relatively to the other member so as to shunt from said independent circuit into the main-line circuit currents varying in strength according to the movements of the transmitting-tracer, substantially as described.

6. In a telautographic system in which the movements of the receiving-pen in unison with the transmitting-tracer are effected by variations in current strength on line, the combination of a receiving-pen, a main-line circuit including a rectilinearly-movable coil connected to and controlling the movements of said pen, and a magnetic field excited separately from the coil and through which said coil is moved in accordance with the strength of current on line, substantially as described.

7. In a telautographic system in which the movements of the receiving-pen in unison with the transmitting-tracer are effected by variations in current strength on line, the combination of a receiving-pen, a main-line circuit including a vertically-movable coil connected to and controlling the movements of said pen, and a magnetic field excited separately from the coil and through which said coil is moved in accordance with the strength of current on line, substantially as described.

8. In a telautographic system in which the movements of the receiving-pen in unison with the transmitting-tracer are effected by variations in current strength on line, the combination of a receiving-pen, a main-line circuit including a vertically-movable coil suspended from a member connected to the receiving-pen and through said member controlling the movements of said pen, and a magnetic field excited separately from the coil and through which said coil is moved in accordance with the strength of current on line, substantially as described.

9. In a telautographic system, in which the movements of the receiving-pen in unison with the transmitting-tracer are effected by variations in current strength on line, the combination of a receiving-pen, a main-line circuit including a rectilinearly-movable coil, connections between said coil and the receiving-pen for operating the latter, said connections including a pivoted member to which said coil is connected, and a magnetic field excited separately from the coil and through which said coil is moved in accordance with the strength of current on line, substantially as described.

10. In a telautographic system, in which the movements of the receiving-pen in unison with the transmitting-tracer are effected by variations in current strength on line, the combination of a receiving-pen, a main-line circuit including a vertically-movable coil, connections between said coil and the receiving-pen for operating the latter, said connections including a pivoted member from which said coil is suspended, and a magnetic field excited separately from the coil and through which said coil is moved in accordance with the strength of current on line, substantially as described.

11. In a telautographic apparatus, the combination of a transmitting-tracer, a main-line circuit, an independent circuit including a source of electric energy, means controlled by the transmitting-tracer for shunting from said independent circuit into the main-line circuit currents varying in strength according to the movements of said transmitting-tracer, a receiving-pen, a movable coil included in the main-line circuit and connected to and controlling the movements of said receiving-pen, and a magnetic field through which said coil is moved in accordance with the strength of current on line, substantially as described.

12. In a telautographic apparatus, the combination of a transmitting-tracer, a main-line circuit, an independent circuit including a source of electric energy, means controlled by the transmitting-tracer for shunting from said independent circuit into the main-line circuit currents varying in strength according to the movements of said tsansmitting-tracer, a receiving-pen, a rectilinearly-movable coil included in the main-line circuit and connected to and controlling the movements of said receiving-pen, and a magnetic field through which said coil is moved in accordance with the strength of current on line, substantially as described.

13. In a telautographic apparatus, the combination of a transmitting-tracer, a main-line circuit, an independent circuit including a source of electric energy, means controlled by the transmitting-tracer for shunting from said independent circuit into the main-line circuit currents varying in strength according to the movements of said transmitting-tracer, a receiving-pen, a vertically-movable coil included in the main-line circuit and connected to and controlling the movements of said receiving-pen, and a magnetic field through which said coil is moved in accordance with the strength of current on line, substantially as described.

14. In a telautographic apparatus, the combination of a transmitting-tracer, a main-line circuit, an independent circuit including a source of electric energy, means controlled by the transmitting-tracer for shunting from said independent circuit into the main-line circuit

currents varying in strength according to the movements of said transmitting-tracer, a receiving-pen, a vertically-movable coil included in the main-line circuit and suspended from a member connected to the receiving-pen and through said member controlling the movements of said receiving-pen, and a magnetic field through which said coil is moved in accordance with the strength of current on line, substantially as described.

15. In a telautographic apparatus, the combination of a transmitting-tracer, a main-line circuit, an independent circuit including a source of electric energy, means controlled by the transmitting-tracer for shunting from said independent circuit into the main-line circuit currents varying in strength according to the movements of said transmitting-tracer, a receiving-pen, a rectilinearly-movable coil included in the main-line circuit, connections between said coil and the receiving-pen for operating the latter, said connections including a pivoted member to which said coil is connected, and a magnetic field through which said coil is moved in accordance with the strength of current on line, substantially as described.

16. In a telautographic apparatus, the combination of a transmitting-tracer, a main-line circuit, an independent circuit including a source of electric energy, means controlled by the transmitting-tracer for shunting from said independent circuit into the main-line circuit currents varying in strength according to the movements of said transmitting-tracer, a receiving-pen, a vertically-movable coil included in the main-line circuit, connections between said coil and the receiving-pen for operating the latter, said connections including a pivoted member from which said coil is suspended, and a magnetic field through which said coil is moved in accordance with the strength of current on line, substantially as described.

17. In a telautographic apparatus, the combination of a transmitting-tracer, a main-line circuit, an independent circuit including a source of electric energy, two relatively movable members, one included in the independent circuit and through which current is supplied to the main-line circuit, and the other leading therefrom to the main-line circuit, connections between the transmitting-tracer and one of said members whereby the latter is moved relatively to the other member so as to shunt from said independent circuit into the main-line circuit currents varying in strength according to the movements of said transmitting-tracer, a receiving-pen, a movable coil included in the main-line circuit and connected to and controlling the movements of said receiving-pen, and a magnetic field through which said coil is moved in accordance with the strength of current on line, substantially as described.

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

GEORGE S. TIFFANY.

Witnesses:
T. F. KEHOE,
S. WINTHAL.