No. 672,629.

Patented Apr. 23, 1901.

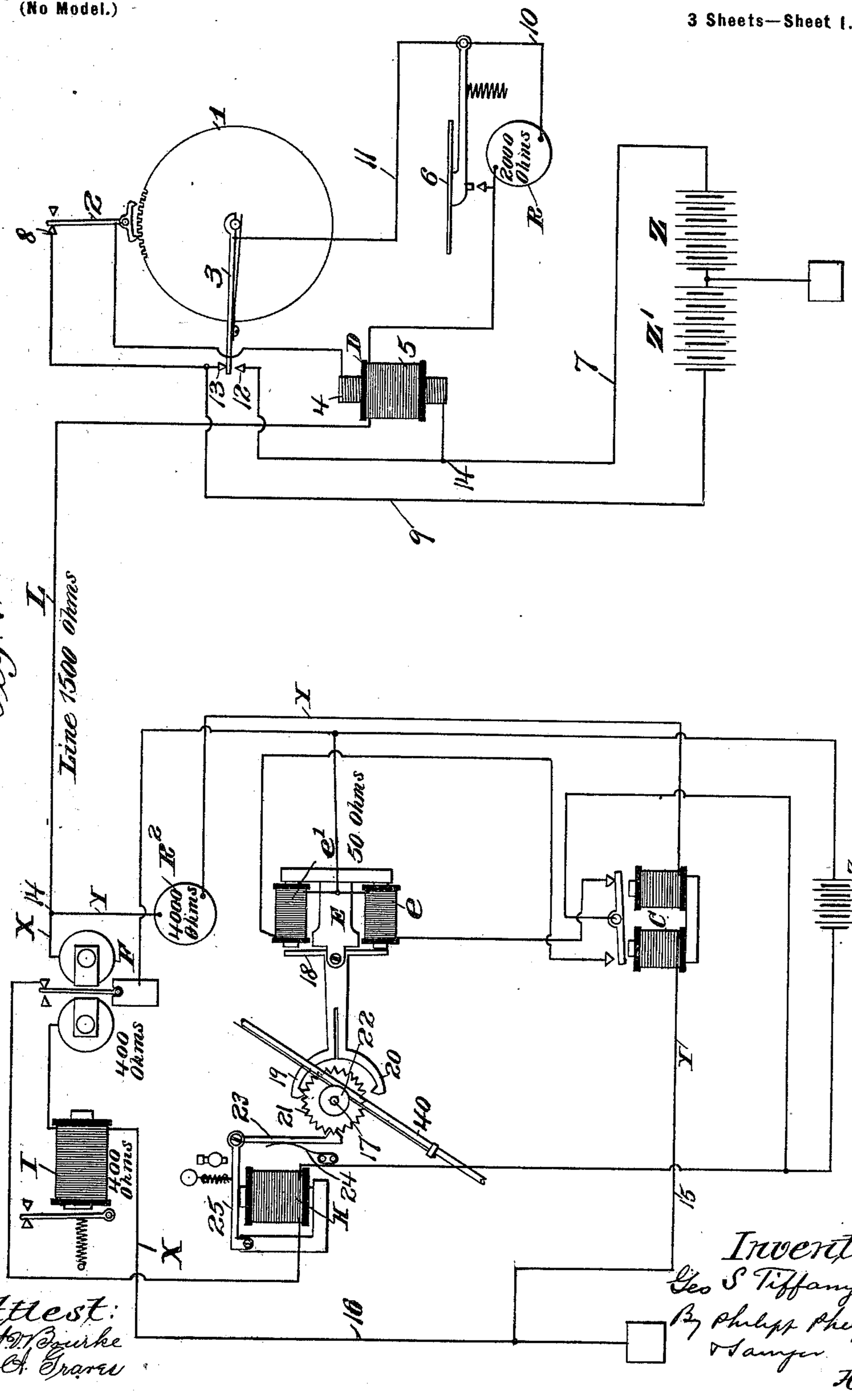
G. S. TIFFANY.

TELAUTOGRAPH.

(Application filed Aug. 26, 1898.)

(No Model.)

3 Sheets—Sheet 1.



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3 Sheets—Sheet 2.

Fig. 2.

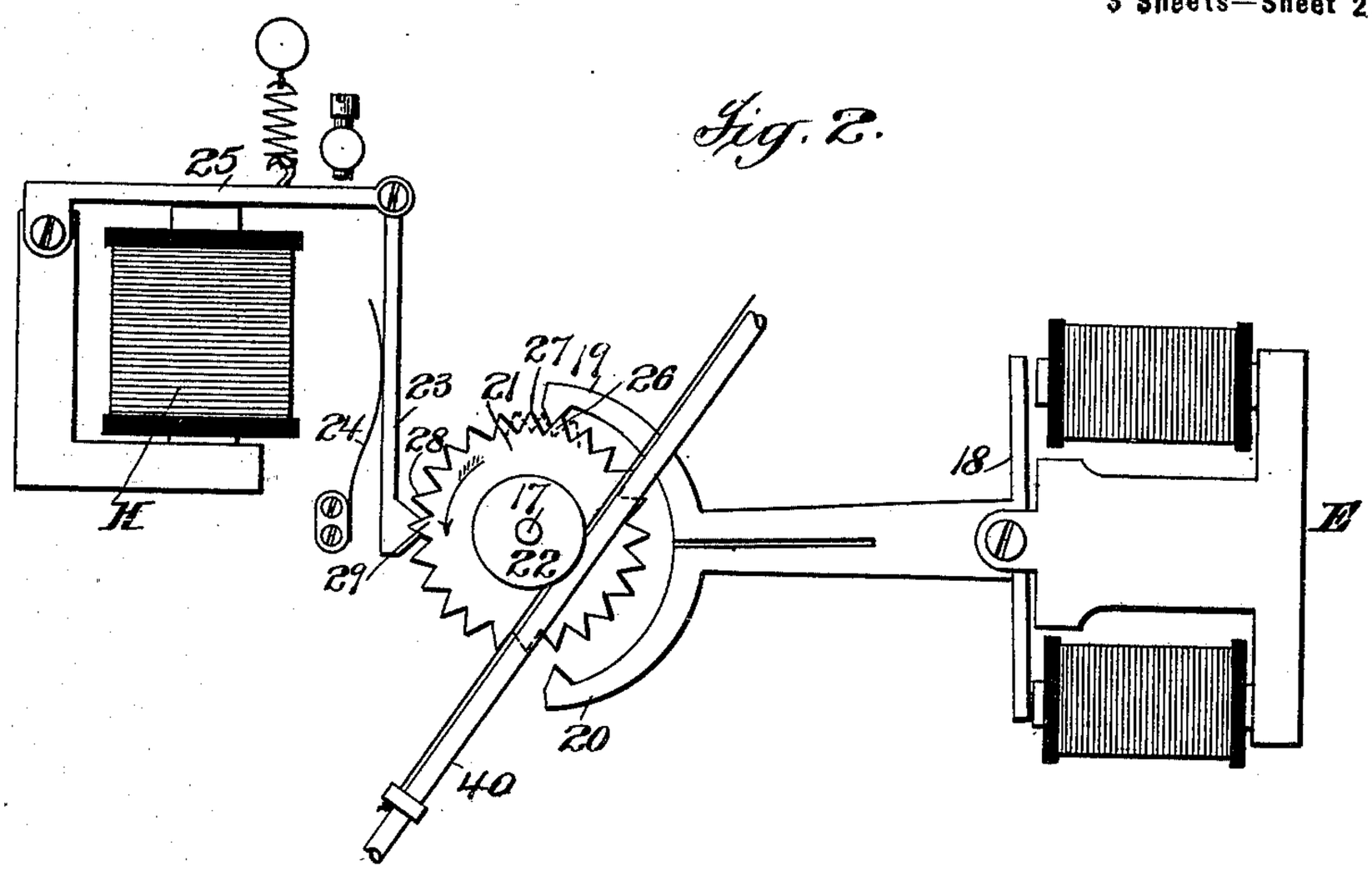
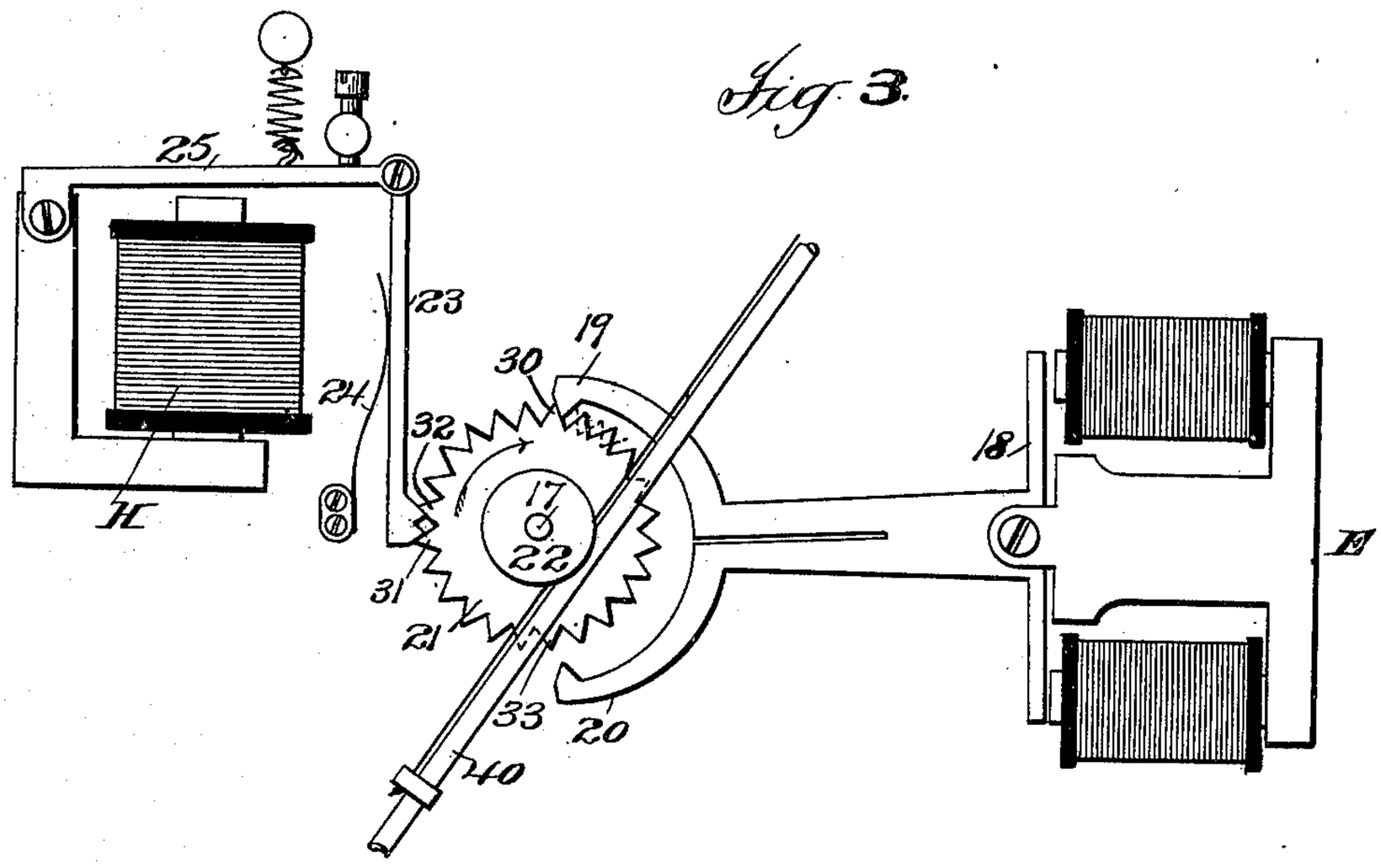


Fig. 3.



Attest.
J. M. Bourke
J. A. Graves.

Inventor
Geo S Tiffany
By Philipp Phelps Kanze
Attys

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3 Sheets—Sheet 3.

Fig. 4.

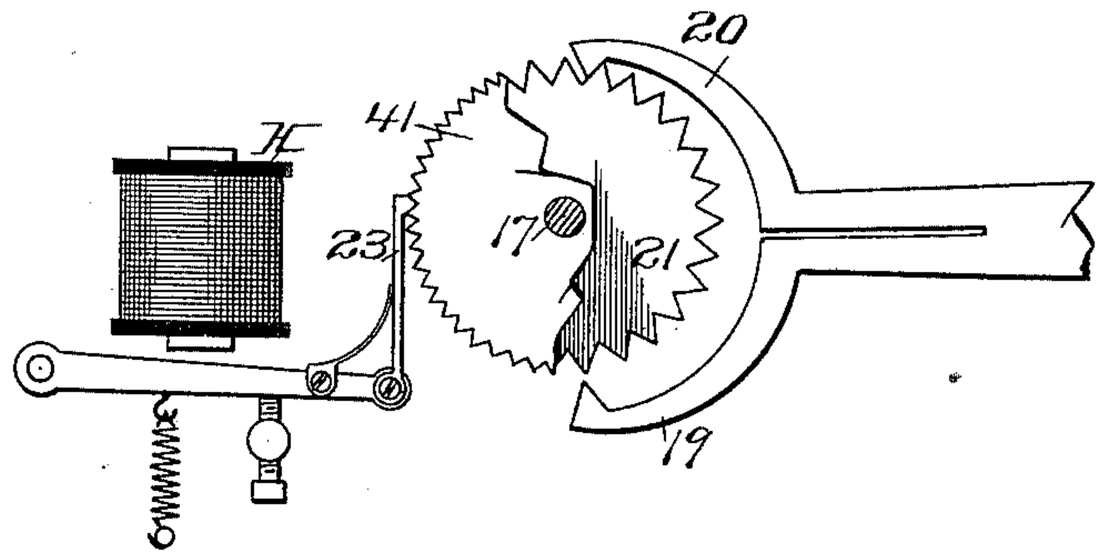
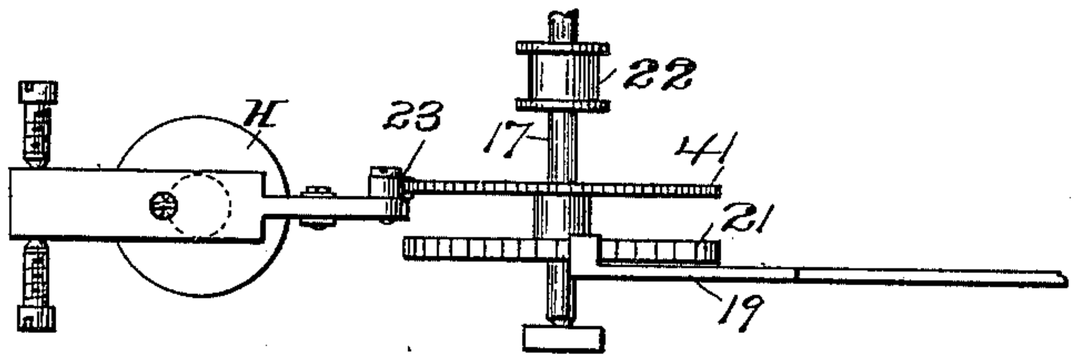


Fig. 5.



Attest:
J. H. Burke
J. L. Graves.

Inventor:
Geo. S. Tiffany
By Philipp Phelps Kenyon
Attys

UNITED STATES PATENT OFFICE.

GEORGE S. TIFFANY, OF HIGHLAND PARK, ILLINOIS, ASSIGNOR TO THE GRAY NATIONAL TELAUTOGRAPH COMPANY, OF RICHMOND, VIRGINIA.

TELAUTOGRAPH.

SPECIFICATION forming part of Letters Patent No. 672,629, dated April 23, 1901.

Application filed August 26, 1898. Serial No. 689,549. (No model.)

To all whom it may concern:

Be it known that I, GEORGE S. TIFFANY, 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.

My invention relates to telautographs patented by me, and is in part an improvement upon the construction and organization shown in United States Letters Patent Nos. 617,890, 617,891, and 617,892, granted January 17, 1899, on applications filed by me. In these patents I have shown organizations wherein the movements in extent of the transmitting-pen are transmuted into impulses of like polarity which are sent to line and at the receiver are transmuted into induced to-and-fro impulses, by which the mechanism for moving the receiving-pen step by step is operated or controlled. This organization necessitates the sending over the line-wire of impulses of like polarity, which I find to be injuriously affected by the static capacity of long lines.

One object of my present invention is to overcome this difficulty, and to that end I propose to transmute the movements of the transmitting-pen into high-tension induced impulses at the transmitting-station. These induced to-and-fro impulses then travel over the main line and control the operation of the step-by-step mechanism at the receiver. As to-and-fro impulses they meet with less obstruction in the static capacity of the line, and because of their high electromotive force they are especially adapted to effect prompt and accurate transmission over long lines.

My present invention also includes provision for effecting the reversal in direction of movement of the receiving-pen to correspond with reversal in direction of movement of the transmitting-pen over the same line-wire as that which transmits the said to-and-fro impulses. To secure this result, I place the step-by-step mechanism at the receiver or a repeating relay controlling it in one branch of the main line and the reversing mechanism in another branch. The former branch I cause to have a low inductive and high ohmic resistance, while the latter branch, conversely, is made to have high inductive and low ohmic resistance. I also provide the line with a constant current of low electromotive force, the polarity of which is changed upon each reversal in the direction of movement of the transmitting-pen. Owing to the adjustment of the resistances in the branches of the receiver, the induced impulses act practically only upon the branch containing the step-by-step mechanism, while the constant current acts practically only upon the branch containing the reversing mechanism.

My invention also has for its object improvements in the step-by-step escapement mechanism for the receiver, whereby the latter is simplified.

In the drawings annexed, forming a part of this specification, Figure 1 is a diagram of circuits, illustrating my invention. Figs. 2 and 3 show, on an enlarged scale, views of the escapement in different positions. Figs. 4 and 5 show a modification.

As usual in describing organizations of telautographic instruments, I have shown herein a single line-wire with its connections, which provides for the transmitting movements of the transmitting-pen in one of its two crosswise directions of movement and the reversal thereof. It will of course be understood that the complete instrument includes a second line-wire with a duplicate of the connections shown herein, whereby is provided means for transmitting the movements of the transmitting-pen in the other of its two crosswise directions of movement with the reversal thereof. As these two halves of the instrument are duplicates of each other, the description of one only is necessary.

A transmitting-pen and its two pen-arms and associated parts are shown in Fig. 1 of my Patent No. 617,890, above referred to.

The usual interrupter-disk rotating in one direction or the other, according to the direction of movement of the transmitting-pen, is shown at 1, the interrupter at 2, and the prony-brake at 3.

D is an induction-coil having primary winding 4 and secondary winding 5. The usual divided battery Z Z′ may be employed. The usual writing-platen is shown at 6, with pen-

raising resistance R. One terminal of the battery is connected by wire 7 with the primary winding 4 of the induction-coil and interrupter 2. When the interrupter 2 rests against contact 8, the circuit of the battery is completed through wire 9. The main line L passes through the secondary winding 5 to resistance R, thence by wire 10 to the writing-platen, thence by wire 11 to the Prony brake 3 and one or the other of contact-stops 12 13, respectively connected to opposite poles of the divided battery Z Z′ by wires 9 and 14. When the writing-platen is depressed, the resistance R is short-circuited. It will therefore be seen that the vibrations of the interrupter cause successive makes and breaks in the circuit of the primary winding of the induction-coil, thus producing to-and-fro reverse currents of momentary duration on line. The windings of the induction-coil are so related to each other that the induced currents are of high tension. It will also be seen that there is normally upon line from battery Z Z′ a constant current of a strength varied by the resistance R according to the position of the platen 6 and of which the polarity depends upon the contact of Prony brake 3 with one or the other of stops 12 13. This battery-current is arranged to be at comparatively low tension. The movements of the transmitting-pen in extent therefore result in sending to line a series of to-and-fro pulsations of relatively high tension, while the reversal of direction of movement of the transmitting-pen results in changing the polarity of the low-tension current constantly on line, and the depression of the platen increases this current by cutting out the resistance R.

At the receiving instrument the line divides at 14, and one branch, Y, passes through non-inductive resistance R^2, the coils of repeating relay C, wire 15 to ground. The other branch, X, of the main line passes through coils of reversing-relay F, relay I, controlling the pen lowering and lifting mechanism, wire 16 to ground. The first branch mentioned is arranged to have a high ohmic and low inductive resistance, while the second branch is conversely arranged to have a high inductive and low ohmic resistance. This is for the purpose of distinguishing the high and low tension impulses sent from the transmitter, it being intended that the high-tension impulses shall operate only the magnet C and that the low-tension impulses shall operate only the magnets in the second branch above described—to wit, magnets F and I. The armature of magnet I is so adjusted as to respond only to the current of battery Z Z′ when the resistance R is cut out by the depression of the writing-platen.

The reversing-magnet H is controlled by the relay F in the usual manner through a circuit with local battery *z*, as shown in Fig. 1, and in turn governs the direction of movement of the escapement, as will be hereinafter more particularly described.

The escapement-magnet E is controlled by circuits passing from the positive pole of battery *z* to both coils *e e′* and from these coils to the two contact-stops of the armature of magnet C and from this armature by a common return-wire to the negative pole of battery *z*, as shown in Fig. 1.

Those skilled in the art will understand the relative adjustments necessary to be given to the various resistances and magnet-coils from the foregoing description. I will, however, say that a suitable adjustment is one wherein the resistance R is of two thousand ohms, resistance R^2 four thousand ohms, the magnet E has a resistance of fifty ohms, magnet F a resistance of four hundred ohms, magnet I a resistance of four hundred ohms. These resistances are adjusted to a line resistance of fifteen hundred ohms. It will of course be understood that this adjustment of the resistances may be widely varied and will necessarily be more or less dependent upon the line resistance.

The operation is as follows: The movements in extent of the transmitting-pen send high-tension to-and-fro impulses of short duration to line, which, owing to the self-induction of the coils of magnets F and I, are prevented from passing to any substantial extent through the branch in which these coils are situated. These impulses are therefore forced through the branch in which is the relay C and through the escapement produce movements in extent of the receiving-pen. The low-tension current of battery Z Z′ is constantly on line; but it does not affect magnets of relay C on account of the high ohmic resistance R^2. It is caused by this resistance to flow through the coils of magnets F and I, and the armatures of these magnets are so adjusted that the armature of magnet F responds at all times to the current of battery Z Z′, and the armature of magnet I responds to that current only when the resistance R is cut out of circuit, as before explained. Consequently on each reversal of the transmitting-pen, causing the reversal in polarity of the battery-current, the armature of magnet F will be shifted, causing the reversing-magnet H to be energized or deënergized, according to the position of the armature, and thereby to determine the direction of rotation of the escapement-shaft 17.

Of course many other arrangements of circuits besides that shown might be employed for distinguishing between the different kinds of impulses on line. I wish it understood that I claim, broadly, herein any arrangement of circuits at the receiver which will cause by inductive effect the high and low tension impulses or currents to act selectively for the performance of their respective functions.

The escapement and operation of the reversing-magnet will now be explained.

The escapement-magnet E is an ordinary polarized magnet with a pivoted armature 18, carrying pawls 19 20, acting upon a ratchet-

wheel 21, carried by shaft 17, upon which is mounted the drum 22 of the receiving-pen arm 40. The escapement-teeth and the pawls are symmetrically inclined on each side, and the incline is such that the escapement-wheel may be driven by the pawls. The motive power which drives the escapement-shaft is the magnet E itself, operating through the pawls 19 20. The direction in which the pawls move the escapement-wheel is determined by the magnet H, operating through pawl 23. This pawl is provided with a double point, as shown in Fig. 3, and is therefore adapted either to embrace the point of one of the teeth of the escapement-wheel, as shown in Fig. 2, or to fall into the notch between two successive teeth, as shown in Fig. 3. It is pressed upward toward the escapement-wheel by the spring 24, and it is so placed with reference to the escapement-wheel that as it falls into a notch between two escapement-teeth or as it embraces the point of one of the escapement-teeth it forces the escapement-wheel slightly forward in the direction in which it is rotating. The escapement-wheel and pawls 19, 20, and 23 are so adjusted that when the pawl 23 is in the position shown in Fig. 2, the magnet H being energized, the escapement-wheel will be in a position (its position being controlled by the pawl 23) such that the inclines of the pawls 19 20 will strike the teeth of the escapement-wheel so as to rotate it in the direction of the arrow in Fig. 2. As the escapement-wheel rotates, the pawl 23 remaining stationary, the pawl 23 is pressed back by the succeeding teeth against the pressure of the spring 24, thus riding over the points of the teeth and alternately falling between the teeth, as shown in Fig. 3, and embracing the point of a tooth, as shown in Fig. 2, in each of its movements toward the escapement-wheel giving the escapement-wheel a slight movement forward, as already explained. When now the magnet H is deënergized and its armature 25 rises under the pull of its armature-spring to the position shown in Fig. 3, it gives the escapement-wheel 21 a slight rotation in the direction of the hands of a watch and brings it into a position such that the escapement-pawls 19 20 will fall upon the inclines of the escapement-teeth opposite to the inclines with which they formerly made contact and will therefore rotate the escapement-wheel in the opposite direction—viz., the direction of the arrow in Fig. 3. In Fig. 3 the position of the mechanism is shown just after reversal by deënergization of magnet H. When the pawl 19 last moved toward the escapement-wheel, it made contact with wheel 26, just as is shown in Fig. 2, rotating the wheel in the direction opposite to that of the arrow. The pawl 23 in coming to the position shown in Fig. 2 rotated the escapement-wheel, in a direction contrary to the arrow, to the position shown in broken lines, in which the pawl 19 was in contact with the face of tooth 27. At this instant the magnet H was energized, attracting its armature 25 and causing the pawl 23 to rotate the escapement-wheel to the position shown in Fig. 2, in which the pawl 19 is in contact with tooth 26. The next movement of the armature 18 will cause pawl 20 to strike the tooth of the escapement-wheel nearest to it, so as to rotate the escapement-wheel in the direction of the arrow. The pawl 23 will then drop into the notch between the teeth 28 and 29 and in so doing will give the escapement-wheel a slight motion forward, carrying the point of the tooth 26 beyond the point of the pawl 19, so that the latter on its next descent will clear the point of tooth 26 and will so strike the tooth 26 as to rotate the escapement-wheel in the direction of the arrow. It will therefore be seen that the function of the pawl 23 is twofold: first, after each action of the armature 18 to slightly move the escapement-wheel, so as to prevent the point of the pawl from exactly meeting the point of the tooth with which it next engages and to enable it to move the wheel forward, and, second, to shift the escapement-wheel on its axis in accordance with the energization or deënergization of magnet H, so as to determine the direction of rotation given to the escapement-wheel by the pawls 19 20.

In Fig. 3 the position of the mechanism is shown just after the reversal by a deënergization of the magnet H. When the pawl 19 last moved toward the escapement-wheel, it made contact with tooth 30, just as is shown in Fig. 3, rotating the escapement-wheel in the direction opposite to that of the arrow. As the pawl 23 moved into the opening between teeth 31 and 32 it slightly continued the rotation of the escapement-wheel in the direction imparted to it by pawl 19, moving the escapement-wheel into the position shown by broken lines. Thereupon the magnet H was deënergized, and the pawl 23 rotated the escapement-wheel into the position shown in full lines in Fig. 3. At the next movement of the armature 18 the pawl 20 will strike the tooth 33 and rotate the escapement-wheel in the direction of the arrow. The pawl 23 will be driven back by the point of tooth 31, and in returning under the pressure of spring 24 it will further rotate the escapement-wheel in the direction of the arrow, so as to cause the point of tooth 30 to clear the point of the pawl 19. The pawl 19 on its return movement will strike the face of the tooth 30 and continue the rotation of the escapement-wheel in the direction of the arrow.

In the construction shown in Figs. 4 and 5 there is mounted upon the shaft of the escape-wheel a disk 41, having double the number of teeth of the escape-wheel with which engages the single-pointed pawl 23. This mechanism operates in precisely the same manner as that shown in Figs. 2 and 3, the single-pointed pawl acting with reference to the teeth of disk 41 just as the double-pointed pawl, previously described, acts with reference to the teeth of the escape-wheel—that

is to say, after each stroke of the pawls 19 20, pawl 23 acts through disk 41 to slightly advance the escape-wheel, and on each change in condition of magnet H pawl 23 acts to shift the position of the escape-wheel, so that it will take on an opposite direction of movement.

What is claimed is—

1. In a telautograph, the combination of a transmitting-pen, means for transmuting the movements in extent of the transmitting-pen into pulsations of high electromotive force, means for transmuting changes in the direction of movement of the transmitting-pen into changes of condition in a current of low electromotive force, a receiving-pen mechanism for moving the receiving-pen step by step, mechanism for effecting reversal in direction of movement of the receiving-pen, and circuits at the receiver arranged so that selectively by inductive effect the high-tension impulses shall control the mechanism moving the receiving-pen and the low-tension current shall control the mechanism effecting the reversal in direction of movement of the receiving-pen, substantially as described.

2. In a telautograph, the combination of a transmitting-pen, means for transmuting the movements in extent of the transmitting-pen into pulsations of high electromotive force, means for transmuting changes in direction of movement of the transmitting-pen into changes of polarity in a current of low electromotive force traversing the same line-wire, a receiving-pen, mechanism for moving the receiving-pen step by step, mechanism for effecting the reversal in direction of movement of the receiving-pen, magnets controlling the step-by-step and reversing mechanisms respectively, and means for distinguishing between the two sets of impulses by proper adjustments of resistances in branches containing said magnets, substantially as set forth.

3. In a telautograph, the combination of a transmitting-pen, means for transmuting the movements in extent of the transmitting-pen into impulses of successively like polarity, means for transmuting said impulses into to-and-fro impulses of high electromotive force by induction, means for transmuting changes of direction in the movements of the transmitting-pen into changes of polarity in a current of low electromotive force, a receiving-pen, and means for controlling the movements in extent of the receiving-pen by means of said to-and-fro induced impulses and reversing the direction of movement of the receiving-pen by means of said changes of polarity, substantially as set forth.

4. In a telautograph, the combination of a transmitting-pen, a receiving-pen, mechanism for moving the receiving-pen step by step, mechanism for effecting the reversal in direction of movement of the receiving-pen, means for controlling said step-by-step mechanism by means of a magnet placed in a branch of the main-line circuit provided with low inductive and high ohmic resistances, means for controlling the reversing mechanism by means of a magnet placed in another branch of the main-line circuit provided with high inductive and low ohmic resistances, and means for sending to line impulses of high electromotive force corresponding in number to the extent of movement of the transmitting-pen and currents of low electromotive force corresponding to changes in the direction of movement of the transmitting-pen, substantially as set forth.

5. In a telautograph, the combination of a transmitting-pen, a receiving-pen, mechanism for moving the receiving-pen step by step in two crosswise directions, mechanism for effecting the reversal in direction of movement of the receiving-pen in said two crosswise directions, means for transmuting the movements in extent of the transmitting-pen in two directions crosswise of each other into two series of pulsations of high electromotive force, means for transmuting the changes in the direction of movement of the transmitting-pen in each of its two crosswise directions of movement into changes of condition in currents of low electromotive force, and circuits at the receiver arranged and adjusted so that the impulses of high electromotive force shall control the mechanism for effecting the step-by-step movements of the receiving-pen in its two crosswise directions and the changes in the currents of low electromotive force shall control the reversal of movement of the receiving-pen in said two crosswise directions, substantially as set forth.

6. In a telautograph the combination of means for producing to-and-fro impulses of high electromotive force corresponding in number with the movement in extent of the transmitting-pen, means for sending to line a current of low electromotive force corresponding in polarity with the direction of movement of the transmitting-pen, means for moving the receiving-pen in extent controlled by said to-and-fro impulses, and means for reversing the direction of movement of the receiving-pen controlled by the current of low electromotive force, substantially as set forth.

7. In a telautograph the combination of means for producing to-and-fro impulses of high electromotive force corresponding in number with the movement in extent of the transmitting-pen, means for sending to line a current of low electromotive force corresponding in polarity with the direction of movement of the transmitting-pen, a branch at the receiver from the main-line circuit containing the mechanism for controlling the movements in extent of the receiving-pen, and another branch from the receiver at the main-line circuit containing the mechanism for controlling the reversal of motion of the receiving-pen, the resistances being so adjusted that the major part of the impulses of high electromotive force flow through the first

above-mentioned branch and the major part of the current of low electromotive force flows through the second above-mentioned branch, substantially as set forth.

8. In a telautograph the combination of means for producing impulses of high electromotive force corresponding in number with the movements in extent of the transmitting-pen, means for sending to line a current of low electromotive force corresponding in polarity with the direction of movement of the transmitting-pen, a branch from the main line at the receiving-station having high ohmic and low inductive resistances, and mechanism for controlling the step-by-step movement of the receiving-pen placed in said branch, a second branch from the main-line circuit at the receiving-station having low ohmic and high inductive resistances, and reversing mechanism placed in said second-mentioned branch, substantially as set forth.

9. In a telautograph the combination of means for producing a series of impulses of successively like polarity dependent in number upon the extent of movement of the transmitting-pen, means for transmuting these impulses by induction into to-and-fro impulses of high electromotive force, means for supplying a constant line-current of low electromotive force, means for changing the polarity of the constant current to correspond with changes in the direction of movement of the transmitting-pen, mechanism for moving the receiving-pen step by step controlled by said induced impulses, and mechanism for reversing the direction of movement of the receiving-pen controlled by said current, substantially as set forth.

10. In a telautograph the combination of means for producing a series of impulses of successively like polarity dependent in number upon the extent of movement of the transmitting-pen, means for transmuting these impulses by induction into to-and-fro impulses of high electromotive force, a constant line-current of low electromotive force, means for changing the polarity of the constant current to correspond with changes in the direction of movement of the transmitting-pen, mechanism for moving the receiving-pen step by step in a branch of the main-line circuit having high ohmic and low inductive resistances, and means for reversing the direction of movement of the receiving-pen in a branch of the main-line circuit having high inductive and low ohmic resistances, substantially as set forth.

11. In a telautograph the combination of means for producing two series of impulses of high electromotive force corresponding in number with the movements in extent of the transmitting-pen in each of two directions crosswise of each other, means for sending to line currents of low electromotive force corresponding in polarity with the direction of movement of the transmitting-pen in each of its two crosswise directions of movement, means for moving the receiving-pen in extent controlled by said two series of impulses, and means for reversing the direction of movement of the receiving-pen in each of its two directions controlled by the currents of low electromotive force, substantially as set forth.

12. The combination with an escapement-wheel and a pawl or pawls for propelling the same, of means for shifting the wheel between successive strokes of the pawl so as to reverse the direction of movement imparted by the pawl to the wheel, substantially as set forth.

13. The combination with an escapement-wheel and a pawl or pawls for propelling the same, of another pawl or pawls acting to shift the wheel between successive strokes of the propelling-pawl so as to reverse the direction of movement imparted to the wheel, substantially as set forth.

14. The combination with an escapement-wheel, and a pawl or pawls for propelling the same, of means for advancing the wheel after each stroke of the pawl, and means for rotating the wheel backward when desired so as to reverse the direction of movement imparted by the pawl to the wheel, substantially as set forth.

15. The combination of a telautographic receiving-pen, an escape-wheel and a pawl or pawls for propelling the same, a magnet for controlling the escape-wheel, connections with the transmitter whereby said escapement-magnet is operated in accordance with the movements in extent of the transmitting-pen, means for shifting the escapement-wheel between successive strokes of the pawl so as to reverse the direction of movement imparted to the wheel, a reversing-magnet controlling said means, and connections with the transmitting instrument whereby the reversing-magnet is caused to operate on each reversal in the direction of movement of the transmitting-pen, substantially as set forth.

16. The combination of a telautographic receiving-pen, an escape-wheel and a pawl or pawls for propelling the same, a magnet for controlling the escape-wheel, connections with the transmitter whereby said escapement-magnet is operated in accordance with the movements in extent of the transmitting-pen, another pawl or pawls acting to shift the wheel between successive strokes of the propelling-pawl so as to reverse the direction of movement imparted to the escapement-wheel, a magnet controlling the action of said last-mentioned pawl and connections with the transmitter whereby said last-mentioned magnet is caused to operate to correspond with changes in the direction of movement of the transmitting-pen, substantially as set forth.

17. The combination of a telautographic receiving-pen, an escape-wheel and a pawl or pawls for propelling the same, a magnet for controlling the escape-wheel, connections with the transmitter whereby said escape-

ment-magnet is operated in accordance with the movements in extent of the transmitting-pen, means for slightly advancing the escapement-wheel after each stroke of the pawl and for rotating the escapement-wheel backward when desired so as to reverse the direction of movement imparted by the pawl to the wheel, an electromagnet for controlling said last-mentioned means, and connections with the transmitter whereby said electromagnet is caused to operate in accordance with changes in the direction of movement of the transmitting-pen, substantially as set forth.

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

GEORGE S. TIFFANY.

Witnesses:

HERMAN LOEB,

M. MOSES.