No. 666,271. Patented Jan. 22, 1901.

F. H. W. HIGGINS.

COLUMN PRINTING TELEGRAPHIC INSTRUMENT.

(No Model.) (Application filed Oct. 10, 1899.) 9 Sheets—Sheet 1.

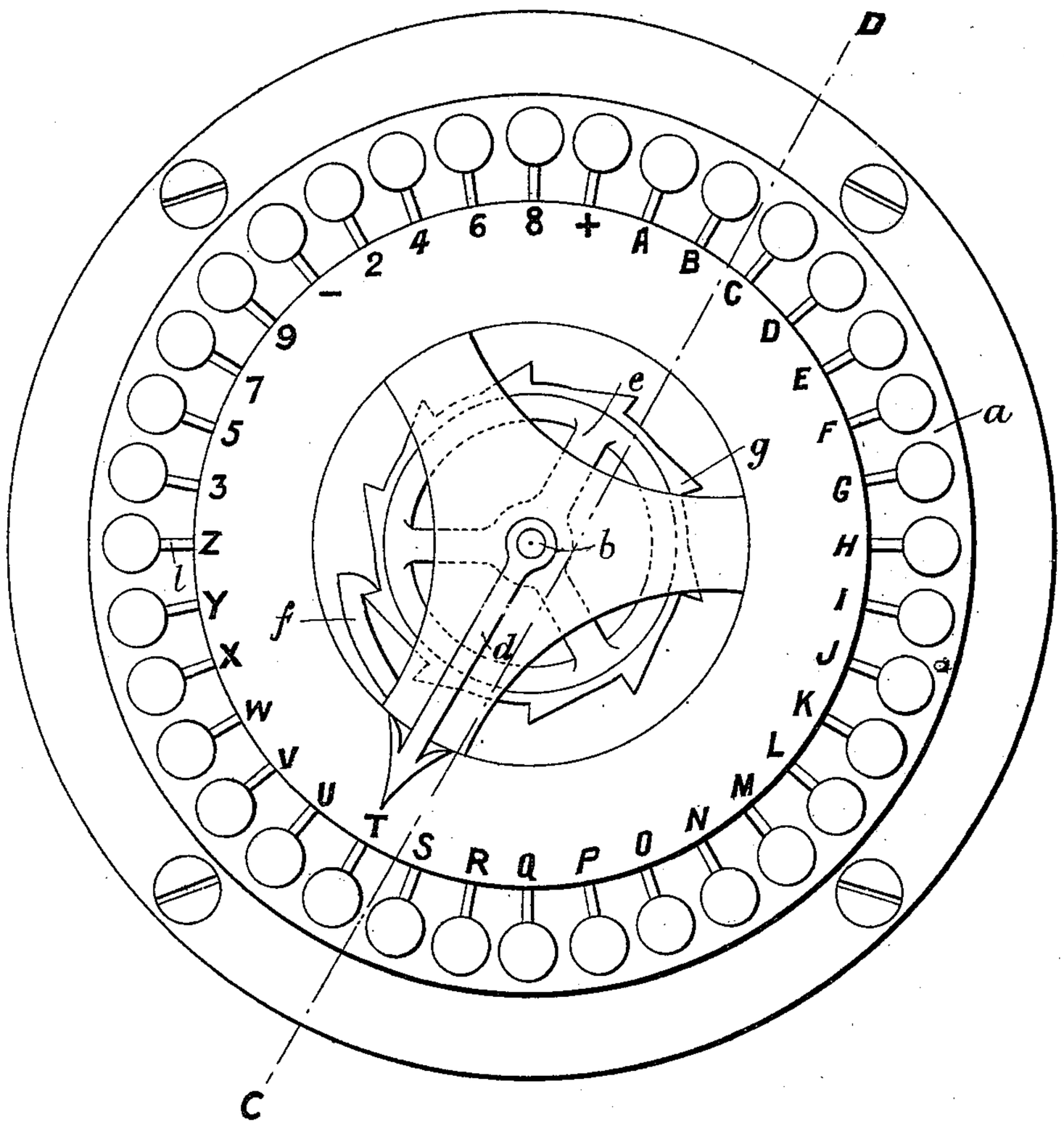

FIG. 1.

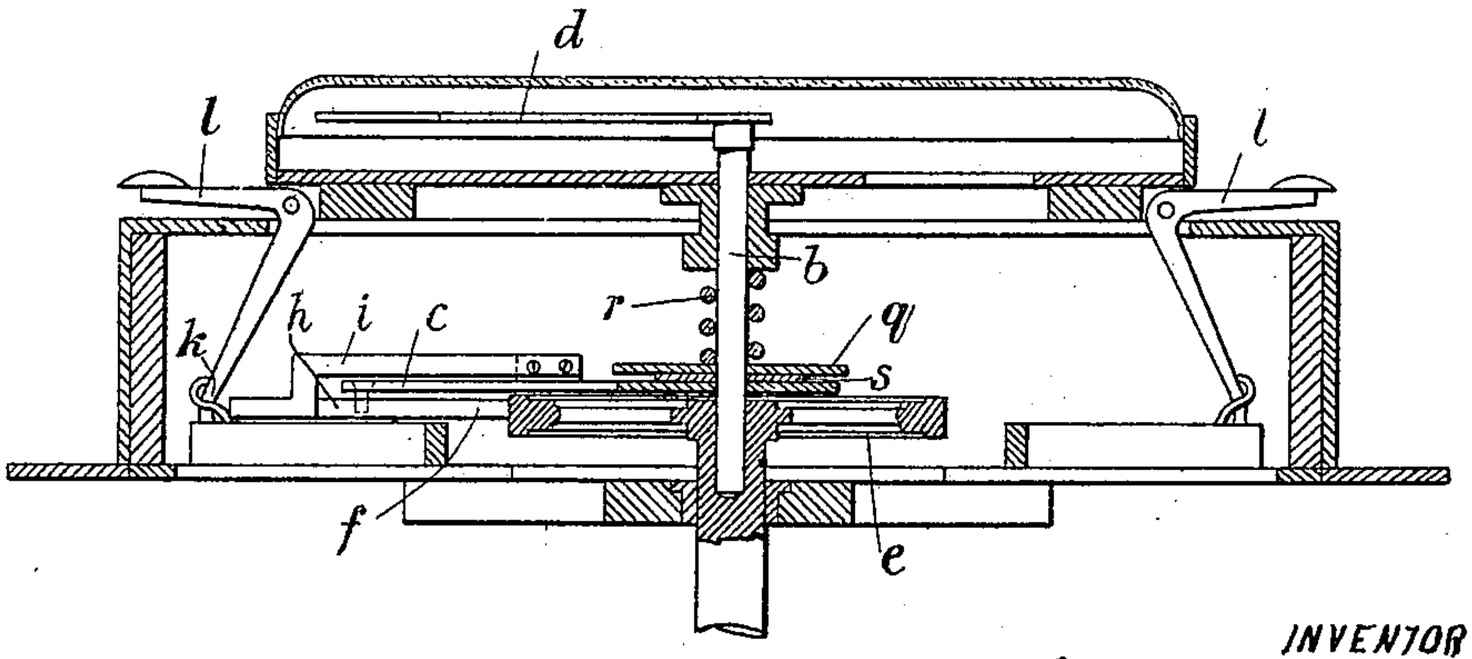

FIG. 2.

WITNESSES:
Ella L. Giles

INVENTOR
Frederick Herbert William Higgins
BY
ATTORNEYS

No. 666,271. Patented Jan. 22, 1901.

F. H. W. HIGGINS.

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(Application filed Oct. 10, 1899.)

(No Model.) 9 Sheets—Sheet 2.

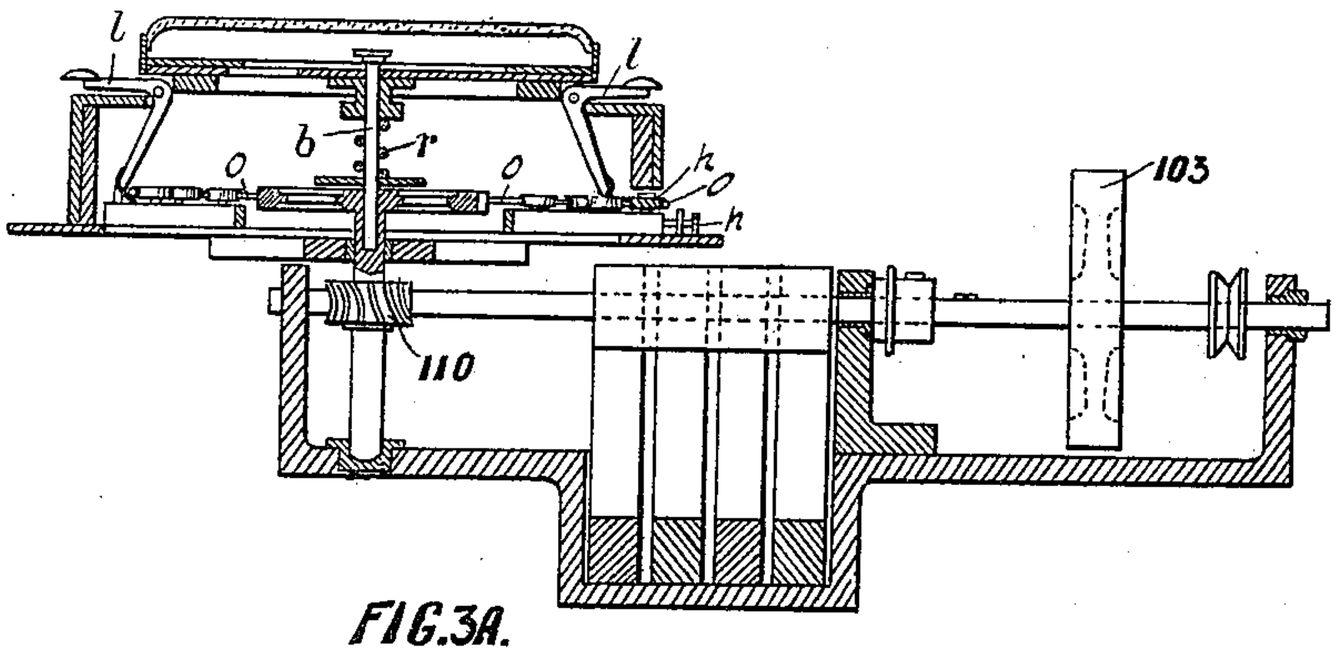

FIG. 3A.

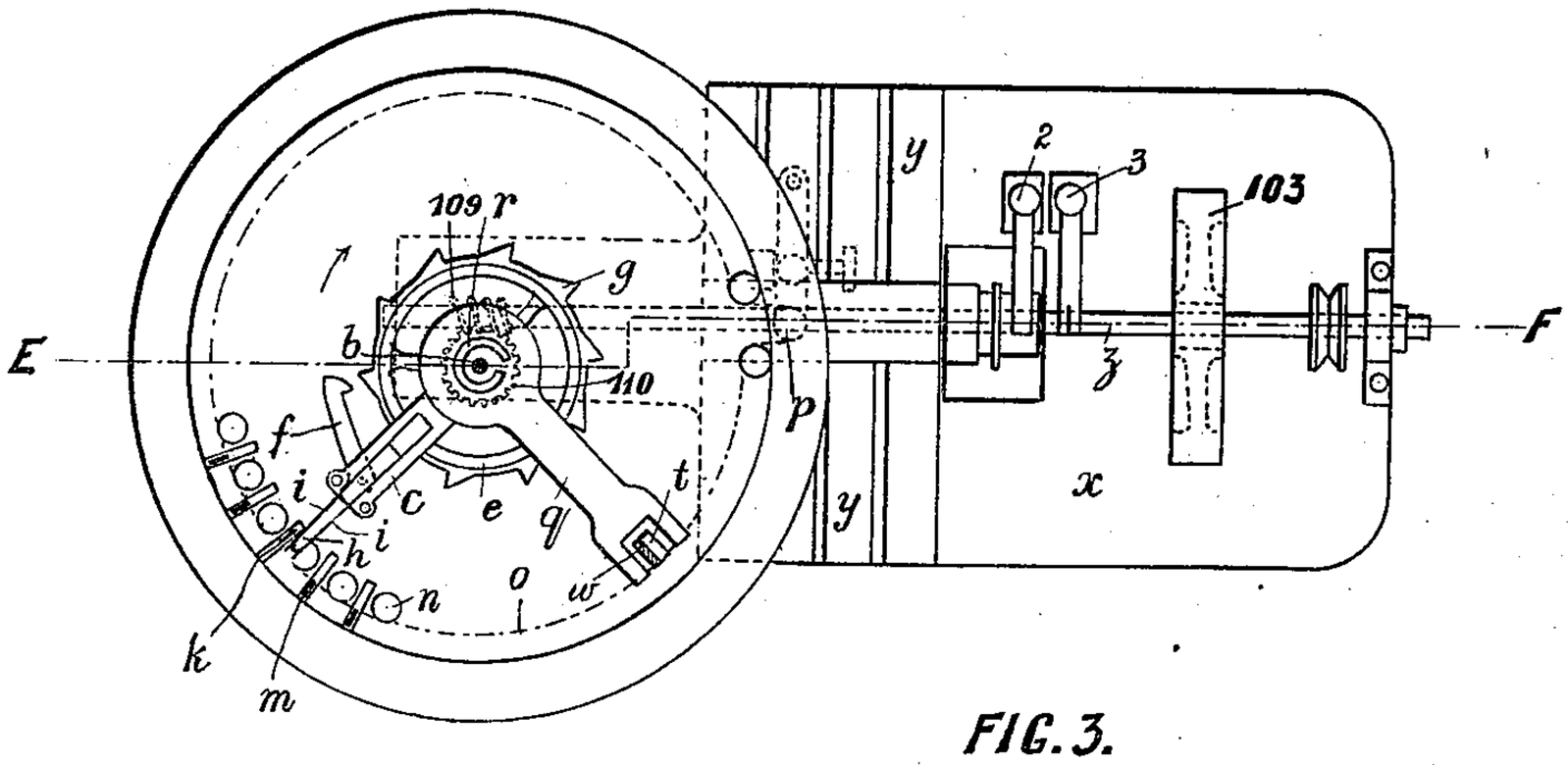

FIG. 3.

WITNESSES:
Ella L. Giles

INVENTOR
Frederick Herbert William Higgins
BY
ATTORNEYS

No. 666,271. Patented Jan. 22, 1901.

F. H. W. HIGGINS.

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9 Sheets—Sheet 3.

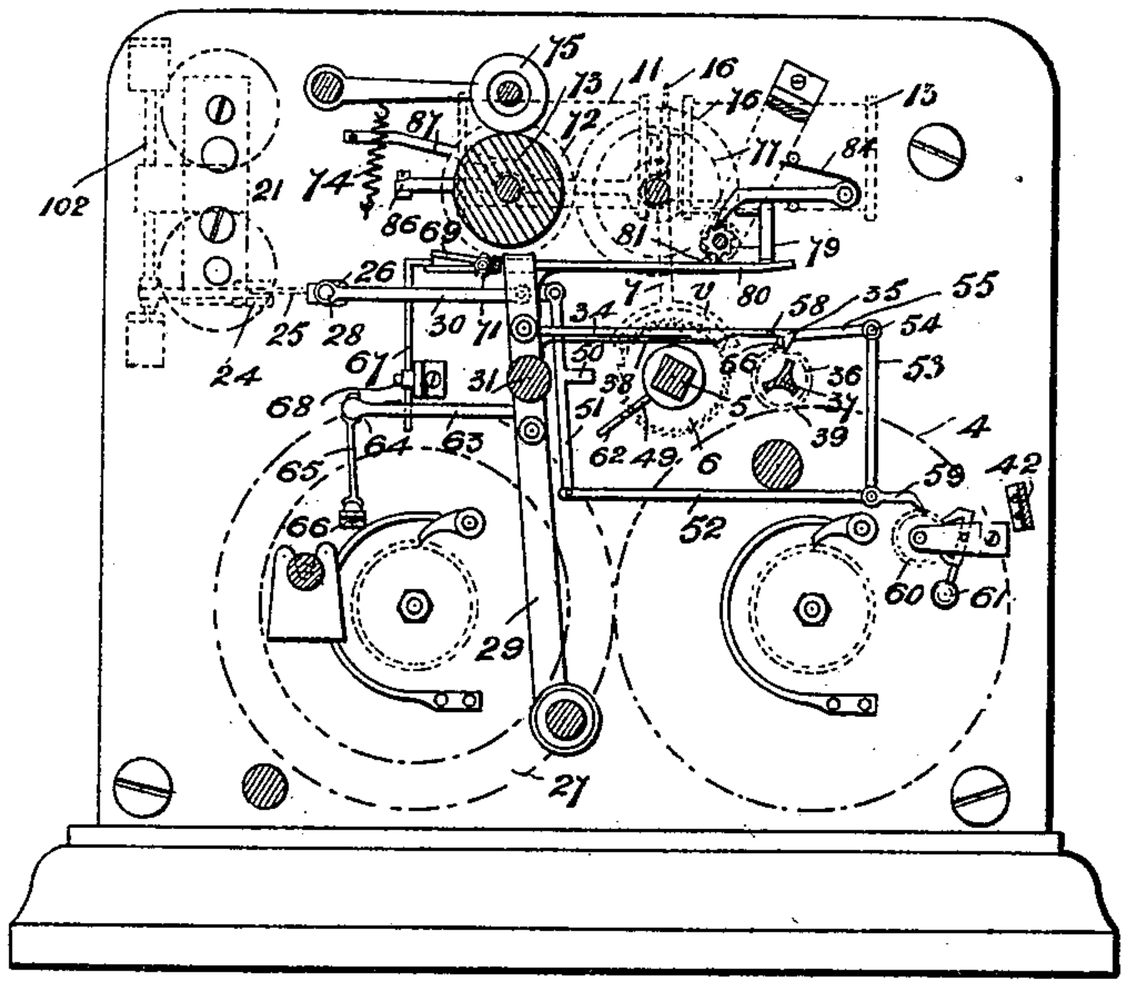

FIG. 5.

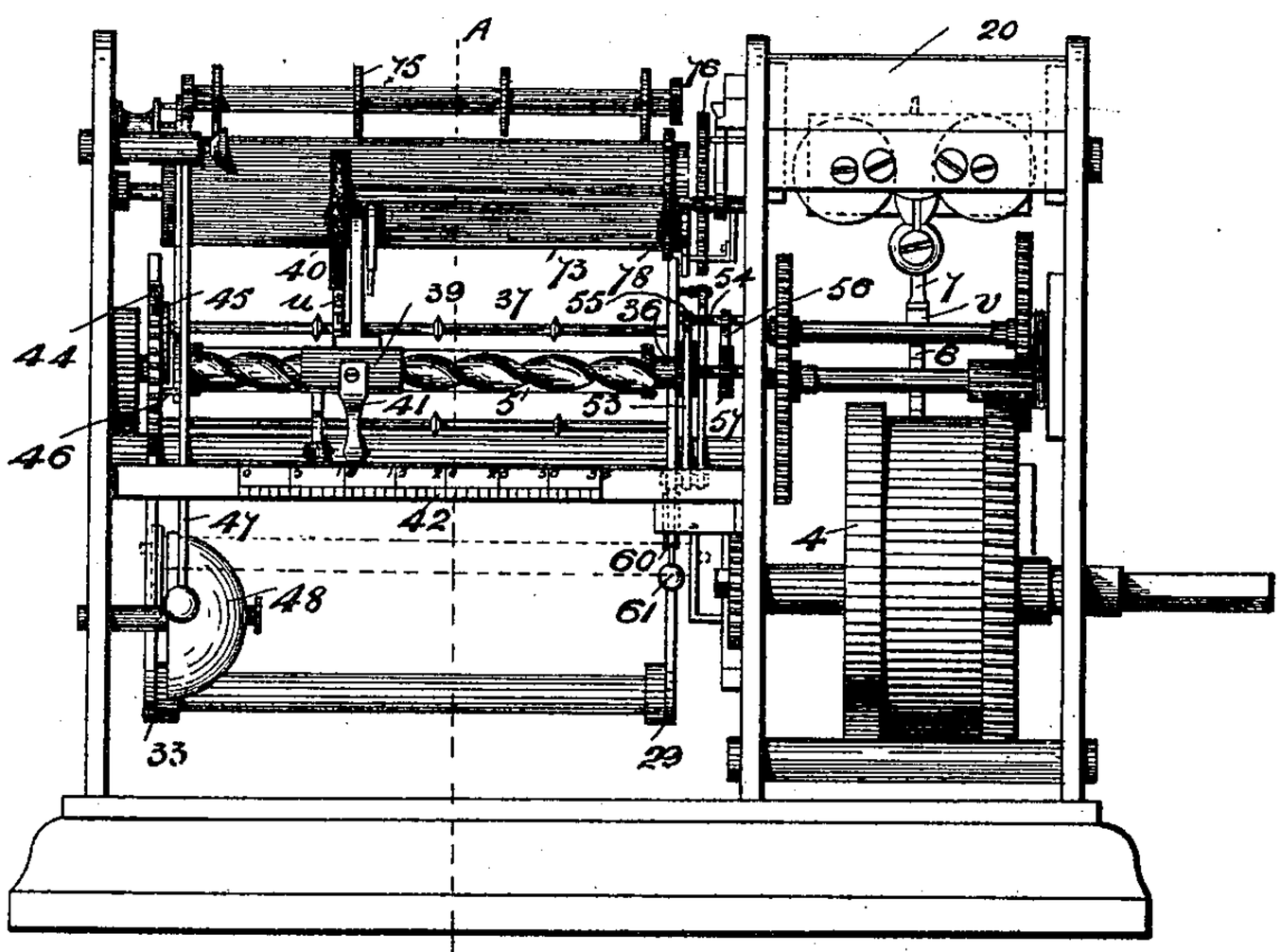

FIG. 4.

WITNESSES:
Ella L. Giles
Oldmann

INVENTOR
Frederick Herbert William Higgins
BY
Richards & Co.
ATTORNEYS.

No. 666,271. Patented Jan. 22, 1901.

F. H. W. HIGGINS.

COLUMN PRINTING TELEGRAPHIC INSTRUMENT.

(Application filed Oct. 10, 1899.)

(No Model.) 9 Sheets—Sheet 4.

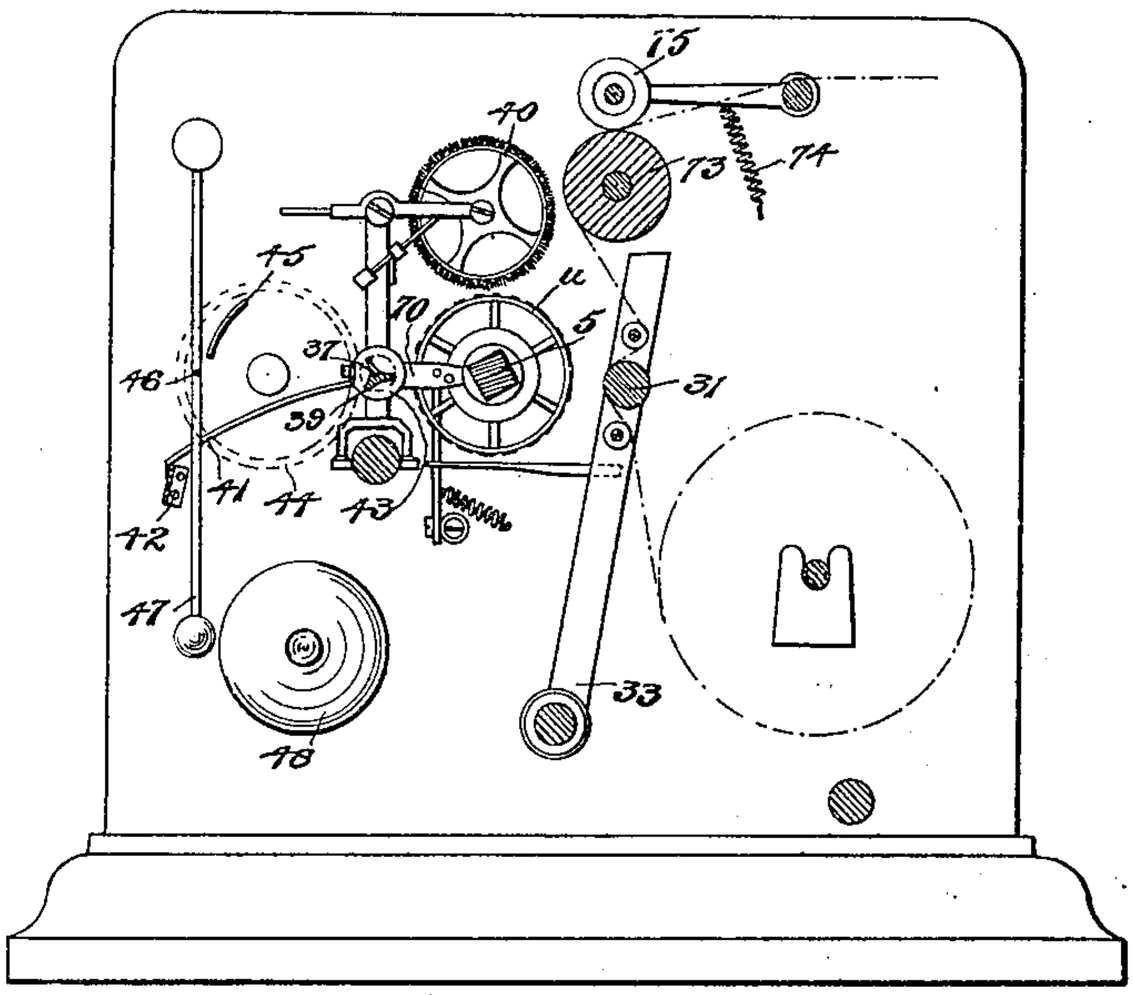

FIG. 6.

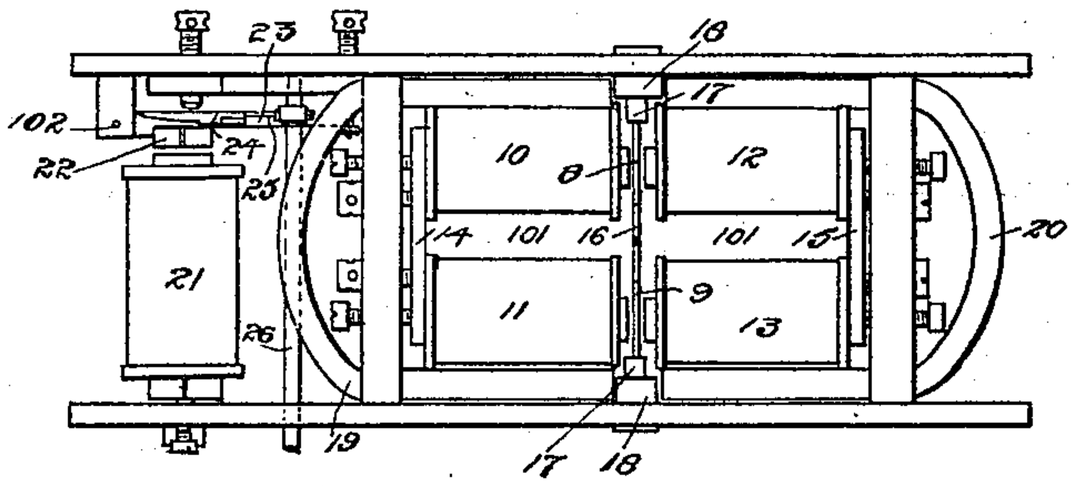

FIG. 7.

WITNESSES:
Ella L. Giles

INVENTOR
Frederick Herbert William Higgins
BY
Richards & Co.
ATTORNEYS

No. 666,271. Patented Jan. 22, 1901.

F. H. W. HIGGINS.

COLUMN PRINTING TELEGRAPHIC INSTRUMENT.

(Application filed Oct. 10, 1899.)

(No Model.) 9 Sheets—Sheet 5.

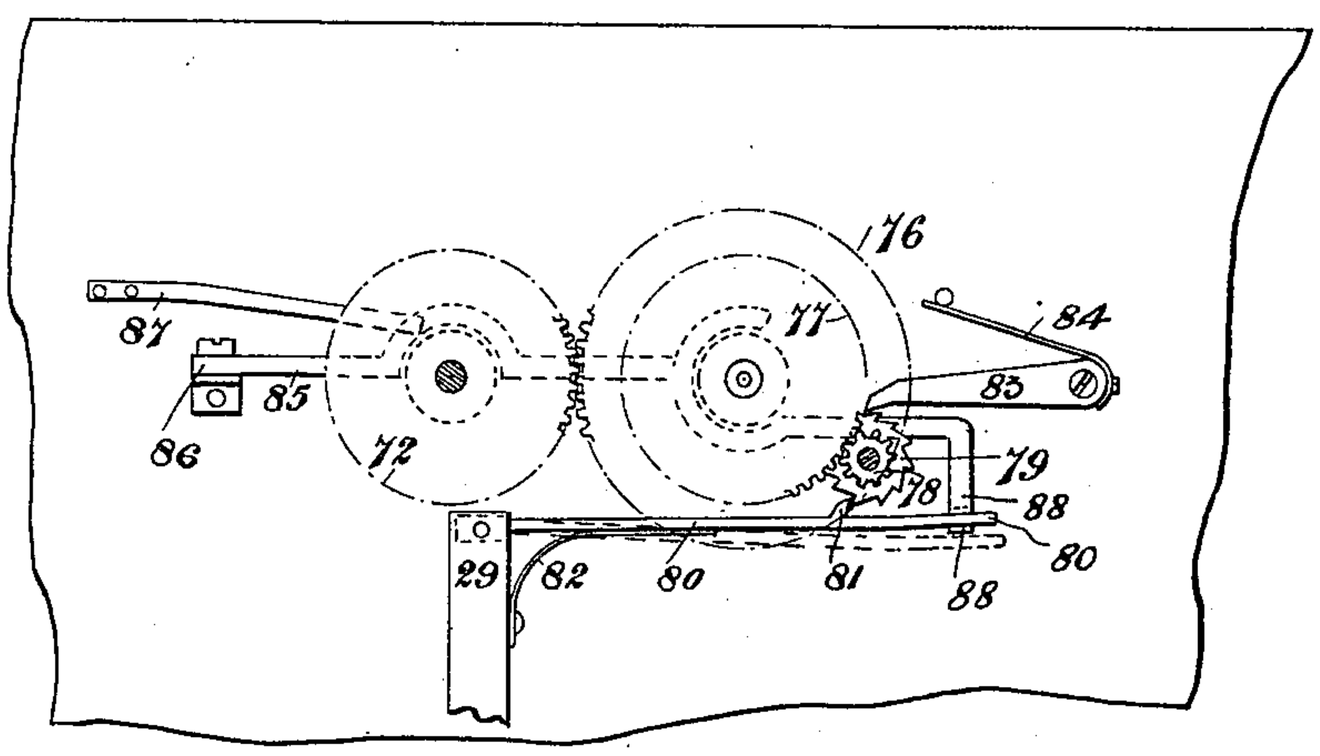

FIG. 8.

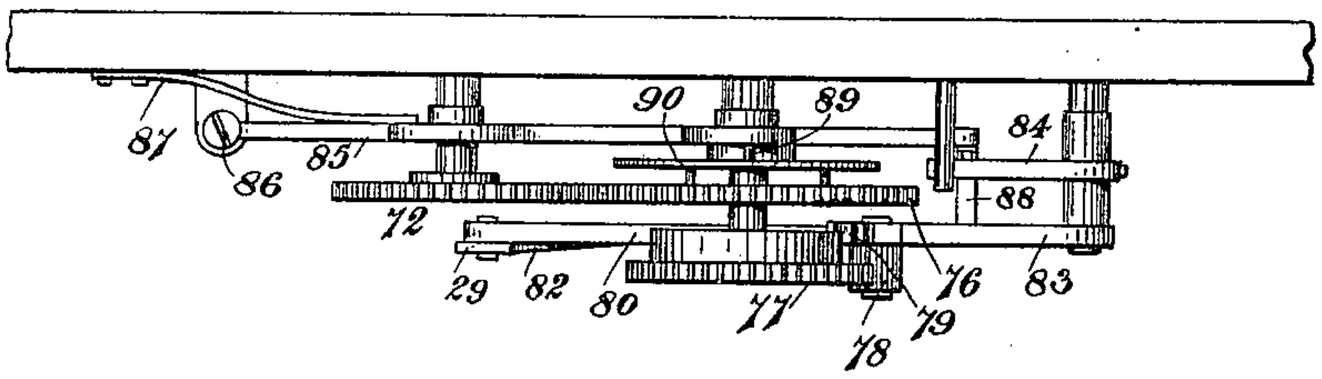

FIG. 9.

WITNESSES:
Ella L. Giles

INVENTOR
Frederick Herbert William Higgins
BY Richards & R
ATTORNEYS.

No. 666,271. Patented Jan. 22, 1901.

F. H. W. HIGGINS.

COLUMN PRINTING TELEGRAPHIC INSTRUMENT.

(Application filed Oct. 10, 1899.)

(No Model.) 9 Sheets—Sheet 6.

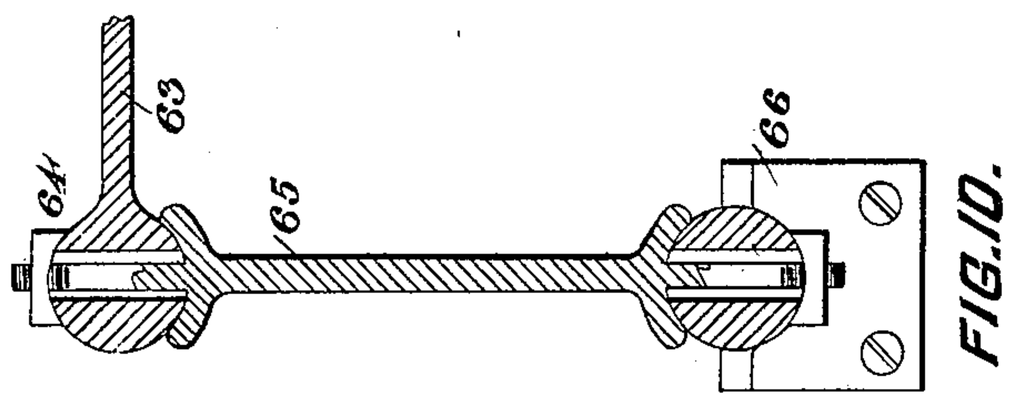

FIG. 10.

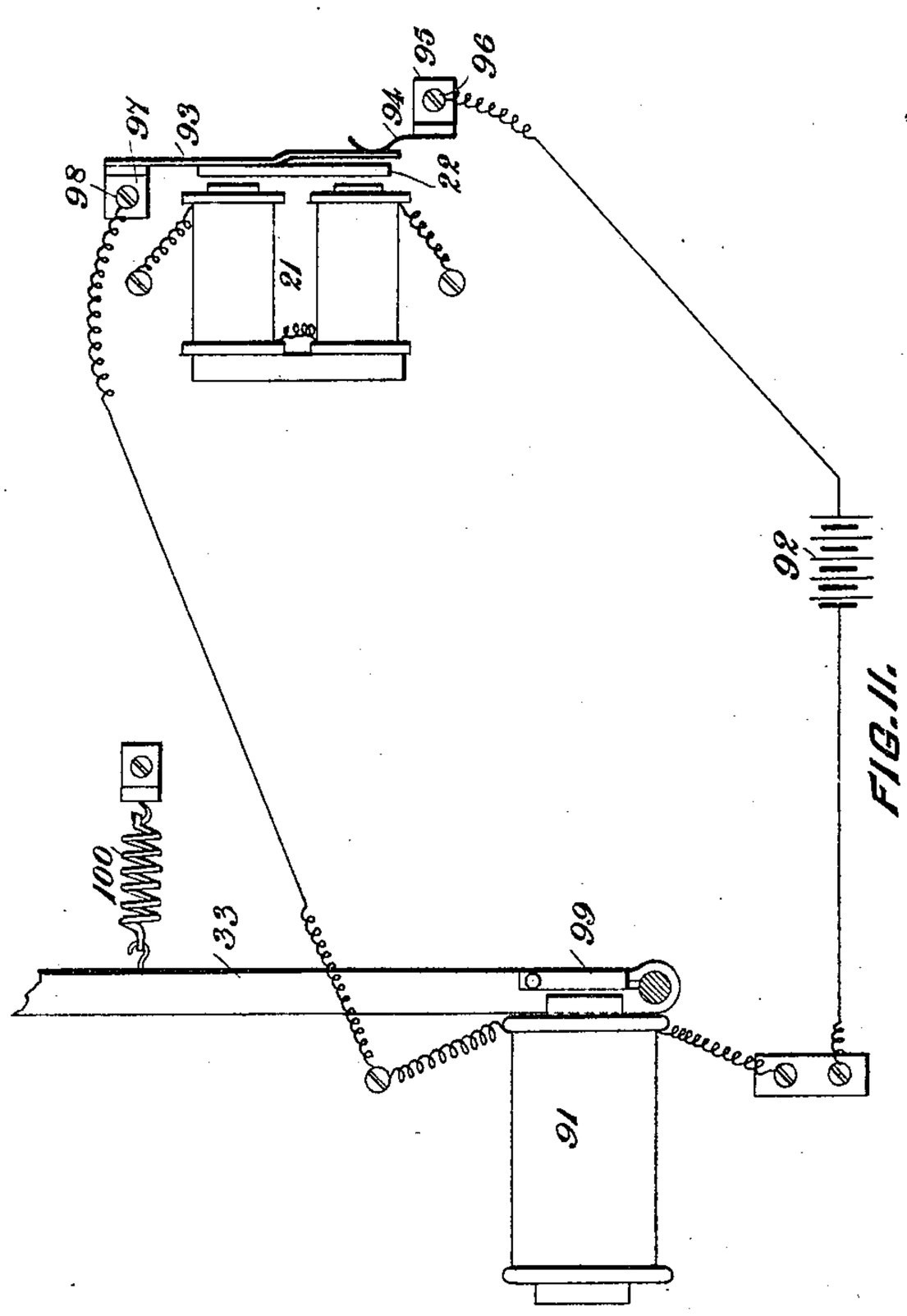

FIG. 11.

WITNESSES
Ella L. Giles

INVENTOR
Frederick Herbert William Higgins
BY Richards & R
ATTORNEYS

No. 666,271. Patented Jan. 22, 1901.

F. H. W. HIGGINS.

COLUMN PRINTING TELEGRAPHIC INSTRUMENT.

(No Model.) (Application filed Oct. 10, 1899.)

9 Sheets—Sheet 7.

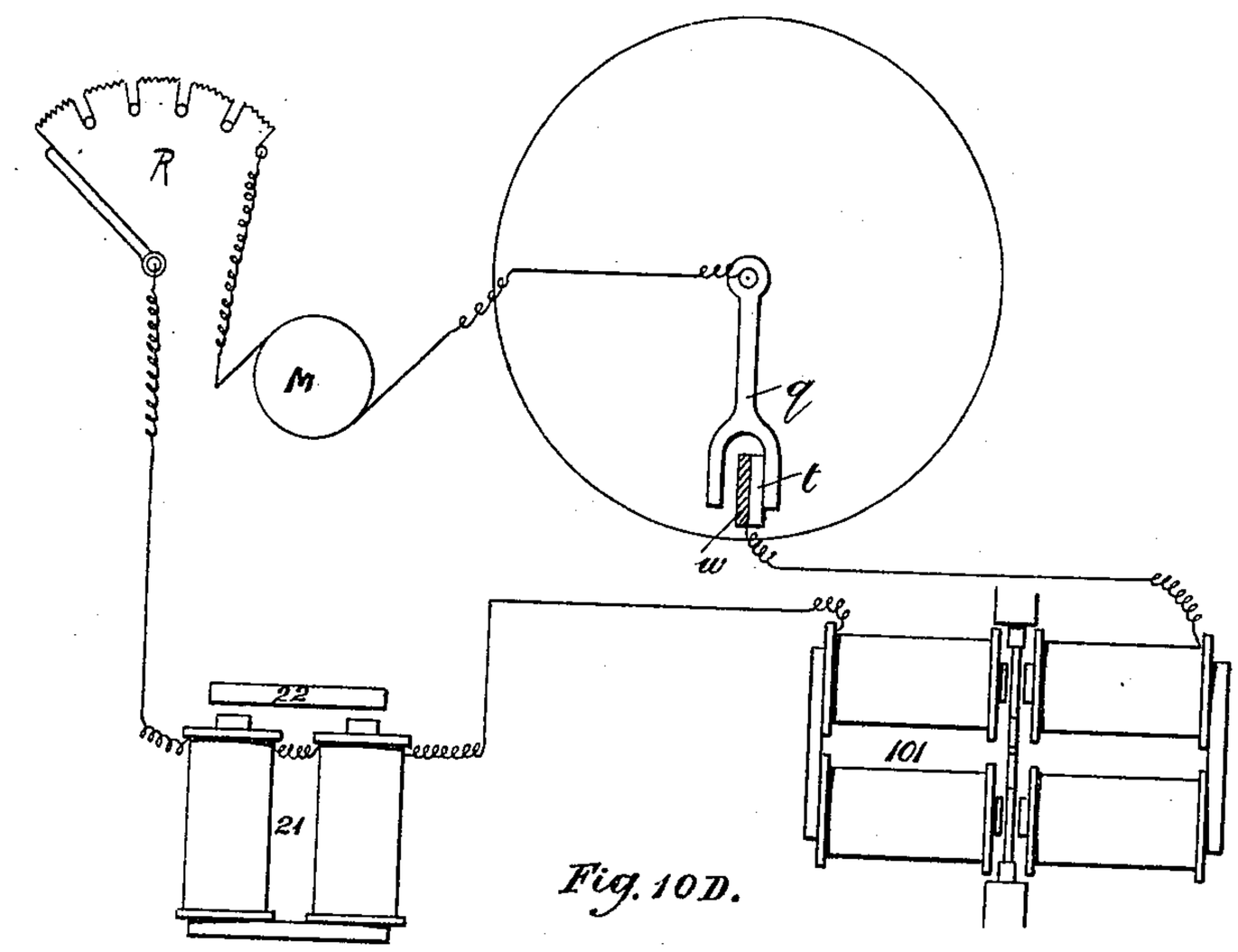

Fig. 10D.

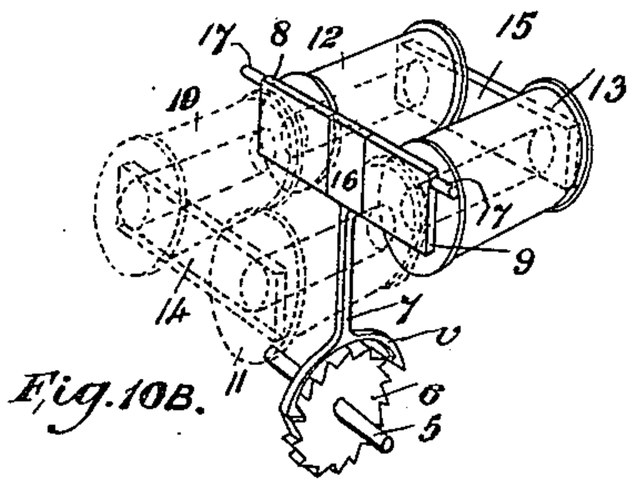

Fig. 10B.

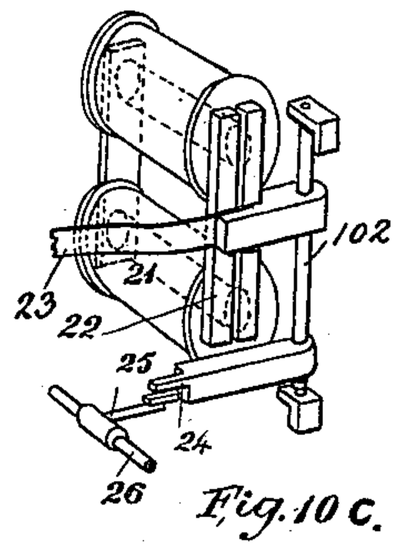

Fig. 10C.

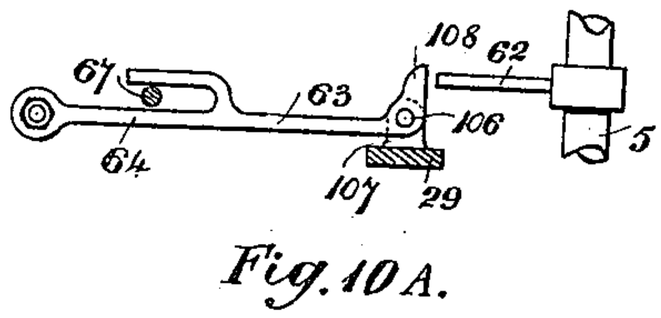

Fig. 10A.

WITNESSES:
Ella L. Giles.
Alderman

INVENTOR
Frederick Herbert William Higgins
By Richards & R
ATTORNEYS

No. 666,271. Patented Jan. 22, 1901.

F. H. W. HIGGINS.

COLUMN PRINTING TELEGRAPHIC INSTRUMENT.

(No Model.) (Application filed Oct. 10, 1899.)

9 Sheets—Sheet 8.

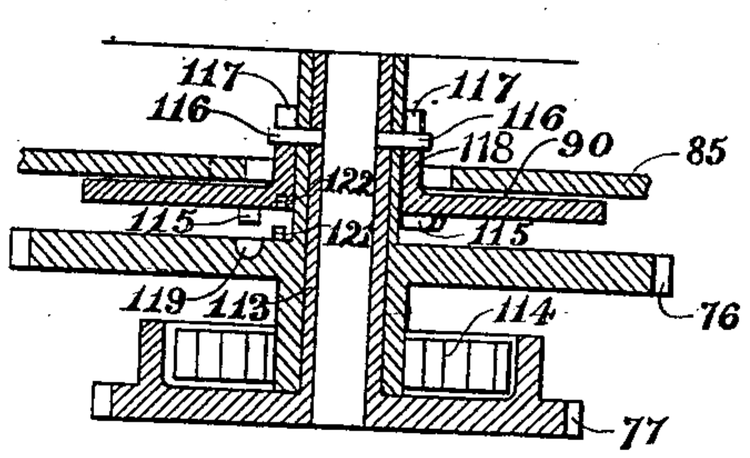

Fig. 10E.

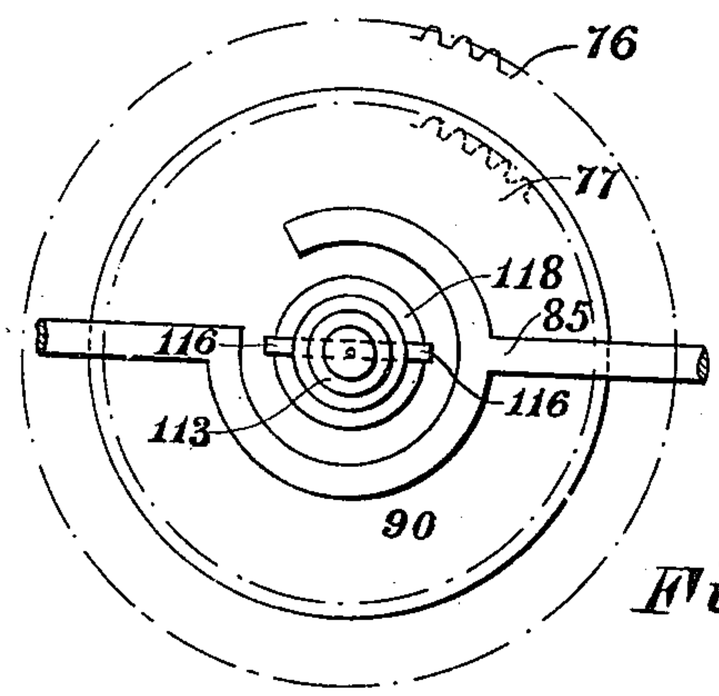

Fig. 10F.

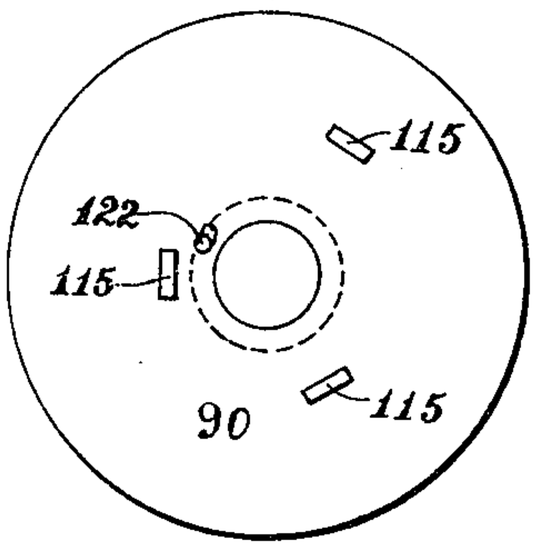

Fig. 10G.

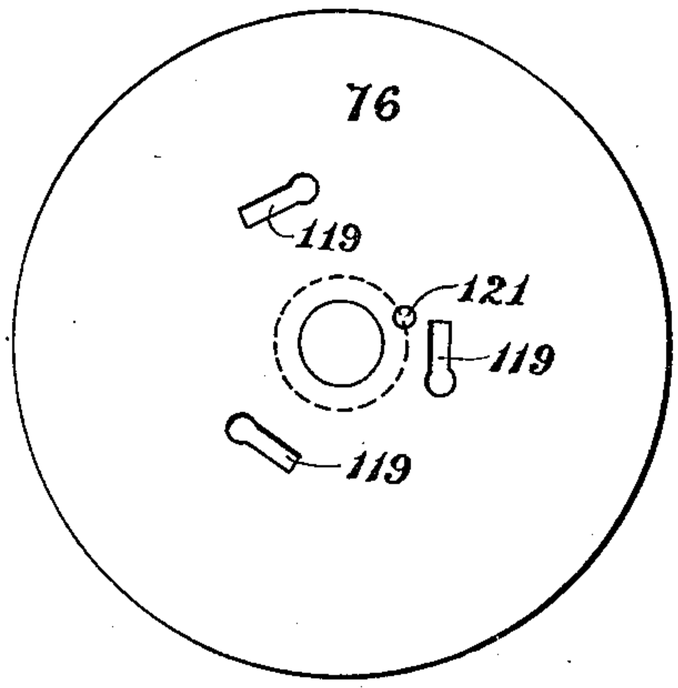

Fig. 10H.

WITNESSES:
Ella L. Giles
Otto Munn

INVENTOR
Frederick Herbert William Higgins
BY
Richards & Co
ATTORNEYS

No. 666,271. Patented Jan. 22, 1901.

F. H. W. HIGGINS.

COLUMN PRINTING TELEGRAPHIC INSTRUMENT.

(No Model.) (Application filed Oct. 10, 1899.)

9 Sheets—Sheet 9

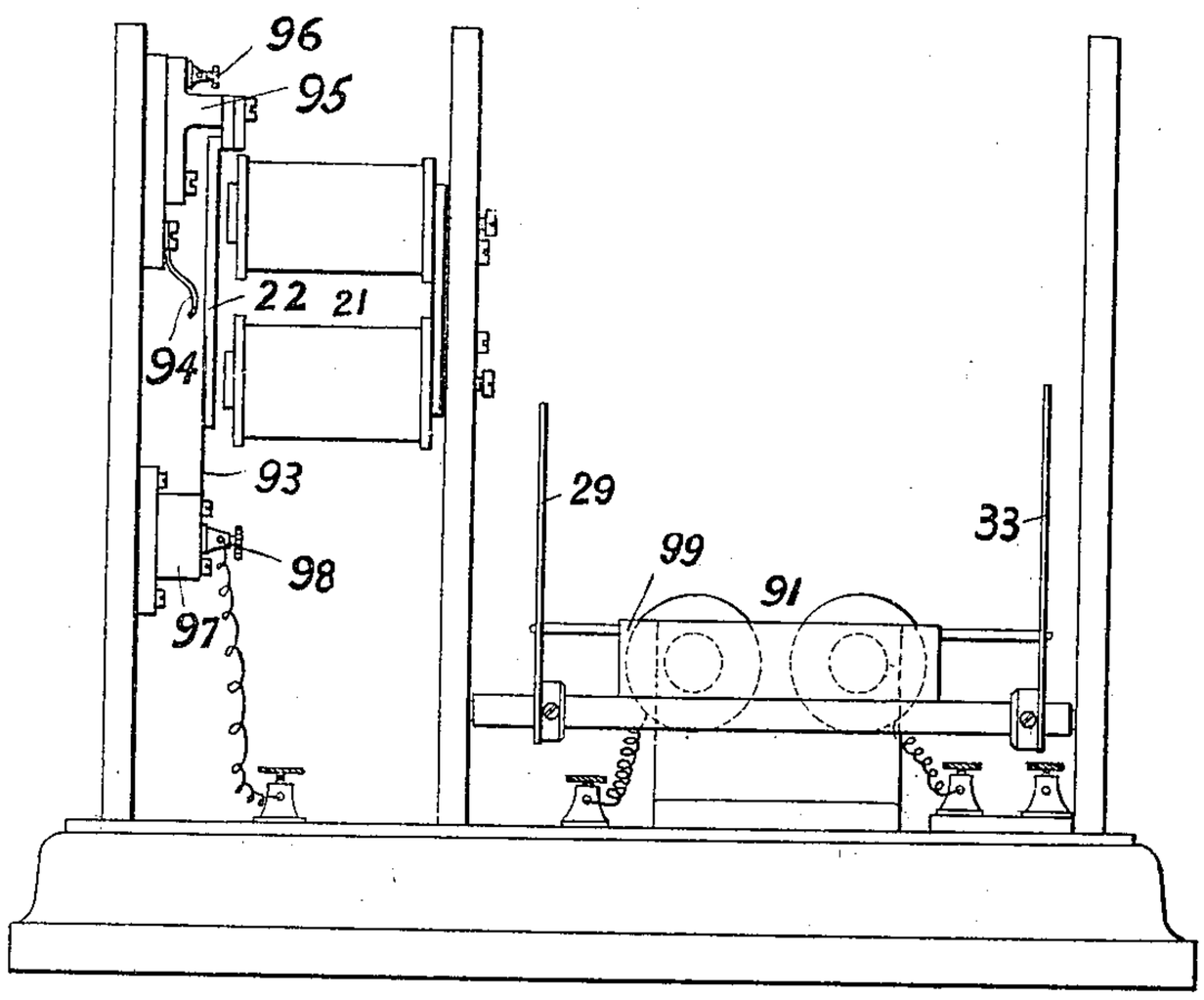

FIG. 12.

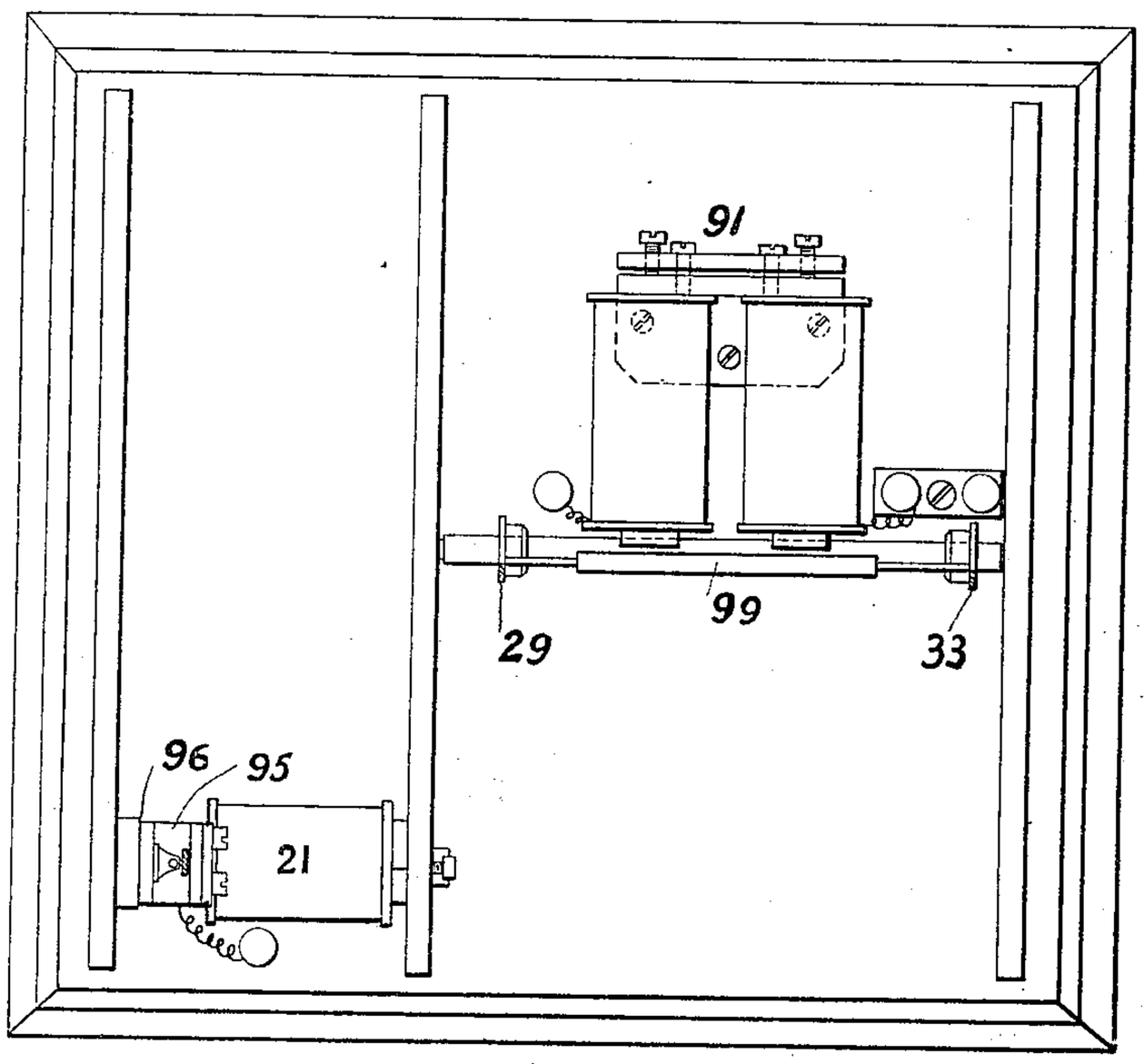

FIG. 13.

WITNESSES:
Ella L. Giles
Alburnye

INVENTOR
Frederick Herbert William Higgins
BY
Richards & R
ATTORNEYS

UNITED STATES PATENT OFFICE.

FREDERICK HERBERT WILLIAM HIGGINS, OF LONDON, ENGLAND, ASSIGNOR OF ONE-HALF TO WILFRED KING, OF SAME PLACE.

COLUMN-PRINTING TELEGRAPHIC INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 666,271, dated January 22, 1901.

Application filed October 10, 1899. Serial No. 733,195. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK HERBERT WILLIAM HIGGINS, electrical engineer, a subject of the Queen of Great Britain and Ireland, residing at 18 and 19 Cornhill, London, England, have invented certain new and useful Improvements in Column-Printing Telegraphic Instruments, (for which I have made application for Letters Patent in Great Britain, No. 6,229, dated the 22d day of March, 1899,) of which the following is a specification.

My invention relates to telegraphic apparatus for printing in column, like a type-writer, and principally to the receiving instrument of the apparatus.

My invention consists in certain novel devices and combinations, as will be hereinafter fully described, and pointed out in the claims.

I render the instrument very sensitive by supplying power at the instrument itself for operating the printing-frame, the traversing mechanism, and the paper-feed by using a spring, a weight, or a local battery, called into operation by the signaling-current from the main line in a manner to be more fully described hereinafter. By this arrangement it becomes unnecessary to use heavy currents. I send the currents signaling the instrument by a magneto treadle-operated machine.

Referring now to the accompanying drawings, illustrating my invention, Figure 1 is a plan of my Wheatstone transmitter. Fig. 2 is a transverse section on the line C D of Fig. 1. Fig. 3 is a plan view showing the magneto-machine and the transmitter with the dial removed. Fig. 3^A is a sectional elevation on the line E F of Fig. 3. Fig. 4 is a front elevation of my improved receiving instrument. Fig. 5 is a section on the line A B or Fig. 4 looking toward the right. Fig. 6 is the same, but looking toward the left. Fig. 7 is a part plan of my improved receiving instrument, showing the magnets and armatures. Fig. 8 is an elevation, to a larger scale, of part of my paper-feed mechanism. Fig. 9 is a plan of the same. Fig. 10 is a sectional elevation, to a larger scale, of another detail of my paper-feed mechanism. Fig. 10^A is a plan of another detail of my paper-feed mechanism. Fig. 10^B is a detailed perspective view of the escapement mechanism for controlling the type-wheel. Fig. 10^C is a similar view of the escapement mechanism for controlling the printing, traversing, and paper-feeding. Fig. 10^D is a diagrammatic illustration showing the circuit of the alternating current through the transmitter and receiver. Fig. 10^E is a horizontal section, drawn to an enlarged scale, of the spring for actuating the paper-feed mechanism and its accompanying parts. Fig. 10^F shows the same part in back elevation. Figs. 10^G and 10^H show details of the same and will be described hereinafter. Fig. 11 is a diagrammatic illustration showing the local electric circuit in a modification of my invention. Fig. 12 is a part elevation of this modification of my invention. Fig. 13 is a part plan of the same.

In a transmitter constructed in accordance with my invention (see Figs. 1, 2, 3, and 3^A) I arrange a horizontal keyboard *a* and carry the ends of the levers passing from the keys radially inward in such a manner as to surround a vertical spindle or shaft *b*, furnished with a lever *c* and pointer *d*, both fixed to *b*, and a toothed wheel *e*, driven from the magneto-machine spindle and rotating on the spindle *b* free of it till the lever *c* engages a tooth on the wheel *e*. The lever *c* carries a bell-crank-pawl *f*, (see Fig. 3,) which is arranged to engage with the teeth *g* on the ratchet-wheel *e*. The other end *h* of the bell-crank is held between two thin flat springs *i*, which cause the pawl-tooth to remain in such a position that it will be engaged by a tooth on the wheel *e*. When the wheel *e* carries the pawl *f* around the axis, the outer end *h* will catch on the inner end *k* of any key *l* which may be depressed, thus stopping the pointer at that key.

Figs. 3 and 3^A show, in plan, the method of making the keys dependent on one another.

The lower ends *k* of the keys *l* move in the slots *m*. Between these slots are placed a series of small pulleys *n*. Around the pulleys there is stretched a flexible chain *o*, which has just sufficient slack to permit of one of the keys being depressed at a time. Whenever

a second key is depressed, it pulls the slack of the chain around to itself, thus lifting up the key which was first depressed. Therefore no two keys can be depressed simultaneously. The chain-tension adjustment is shown at *p*. An arm *q* is pressed down by a spring *r* onto the collar *s*, fixed on the spindle *b*, thus making a frictional contact with it, so that if it were free to revolve the arm *q* would be driven by the spindle; but as it is not free it is continuously pressed against the contact-pillar *t* when the spindle *b* is revolving.

The impulses from the magneto cause the type-wheel *u*, Figs. 4 and 6, of the receiver described hereinafter to be moved by means of the escapement *v*, Figs. 5 and 10[B], in time with the movements of the pointer *d* of the transmitter. When the arm *c* of the transmitter is being driven by the spindle *b*, one side of the forked end of the arm *q* is being pressed against one side of the contact-pillar *t*, thus completing the circuit through the line and instruments, and when the lever or arm *c* is stopped by the pawl coming in contact with the lower end *k* of a depressed key the arm *q* is thereby moved to the other side of the contact-pillar *t*, on which is placed a piece of insulating material *w*, so that now the circuit of the receiver is broken, and this will happen whenever the arm *c* is stopped by a depressed key. This is due to the backward movement which is given to the lever *c* by the action of the springs *i*. These springs are so set as to move back the said lever *c* when the pawl is liberated from the teeth *g*. The breaking of the circuit causes the type-wheel *u* of the receiver to be stopped at the letter corresponding to the depressed key on the transmitter and causes the printing-frame to come into operation and print the letter on the strip by means of mechanism to be described later.

The upper part of the vertical spindle or shaft *b* is supplied with an effective grip-brake to stop it instantly when the depressing of one of the bell-crank levers 1 liberates the lever *c* from one of the teeth on *e* and thus stops the pointer at a particular letter or sign. The whole keyboard-transmitter is similar in construction, both as to shaft and brake, to a well-known form of Wheatstone transmitter. To supply the current, I provide a magneto-machine with powerful permanent magnets, within which rotates a Siemens alternating armature, and to prevent Foucault currents I provide an armature with slit iron laminæ or plates. This magneto-machine is driven from a treadle and supplies alternating current to actuate the receiving instrument as controlled by the sending instrument.

x is the base of the magneto. *y* represents its permanent magnets, *z* its spindle, and 103 its fly-wheel. 2 3 are its current-collectors. On the end of the spindle is placed a worm 109, which drives the toothed wheel *e* by means of a worm-wheel 110 in such a manner that the dial-pointer *d* makes one complete revolution for every nineteen revolutions of the magneto-spindle. Now as there are two impulses—*i. e.*, an impulse in one direction and a reverse impulse—produced during every revolution of the armature and there are thirty-eight keys on the keyboard, so each impulse produced corresponds to a motion of the pointer from one key to the next.

Neither the keyboard nor the magneto-machine constitute in themselves parts of my invention. They are merely parts of my combination.

Referring now to Figs. 4, 5, 6, 7, 8, 9, 10, 10[A], 10[B], 10[C], 10[D], 10[E], 10[F], 10[G], and 10[H], which illustrate one modification of my receiving instrument, I arrange within a suitable frame two spring-barrels 4 and 27, each barrel operating a train of wheels and each barrel wound up separately. The barrel 4, through its train of wheels, drives the square shaft 5, on which the type-wheel *u* can freely slide longitudinally, but is forced to rotate with 5. The train of wheels is controlled by an escapement *v*, Figs. 5 and 10[B], acting on an escapement-wheel 6 upon the type-wheel shaft 5. This escapement *v* is operated by a lever 7, attached to the armature 8 9 of an electromagnet 101. This electromagnet I prefer to consist of two pairs of cores 10 11 and 12 13, each pair united at the back by a piece of steel, as 14 and 15, the cores being wound with the wire carrying the alternating current from the magneto-machine in the transmitter just described. In Fig. 10[B] the cores 10 and 11, with their connecting-piece 14, are indicated only by dotted lines for the sake of clearness. I prefer that the inner coils should be wound in one direction and the outer coils in the other direction and then the coils joined up, so that the current flows around the core in the same direction in both inner and outer coils. By this device I obtain an electromagnet in which the winding facilitates rapid charge and discharge and so causes rapid and sharp changes of polarity. Between the opposing poles of electromagnets so constructed I place the armature which is composed of two iron pieces 8 9, separated by a piece 16 of non-magnetic material, such as brass. At the upper outside corners of the pieces 8 9 are pins 17, formed of iron, continuous with the pieces 8 9, which pins work in circular holes in iron blocks 18, placed between the poles of two opposing permanent magnets 19 20 of the horseshoe type, which encircle the upper part of the electromagnets. By this device I make each side 8 and 9 of the armature an extended pole-piece of the permanent magnet. The use of a keeper, as 14, of steel instead of iron between the cores of each electromagnet provides residual magnetism to cause a slight sticking after the current is stopped. Each alternation of the current alters the polarity of the electromagnets and causes a to or fro movement of the armature. The escapement *v* thus allows the escapement-wheel 6 to move forward one

tooth. There are thirty-eight teeth on the escapement-wheel and an equal number of letters or signs on the type-wheel, so that each alternation of the current moves the type-wheel forward one letter or sign. Therefore the movement of the type-wheel corresponds exactly with the motion of the pointer in the transmitter.

The same current which passes through the electromagnet 10 also passes through a second electromagnet 21, Figs. 5, 7, and 10ᶜ, having an armature 22, which is not polarized. This electromagnet, like the other, is made sharp in action; but the mass of the soft-iron armature 22 is so proportioned to the strength of the spring 23, tending to pull it off the electromagnetic core, that it does not leave the core between the reversals—that is, this armature adheres to the core so long as the alternating current is passing. The armature 22 is pivoted on the vertical axle 102 and is controlled by the flat spring 23. This armature operates a forked escapement-lever 24, which acts on a pin 25 on a spindle 26, and thus controls the movement of the other train of wheels actuated by the other spring-barrel 27. This escapement is so contrived as to allow one revolution of the controlled spindle 26 for each complete to-and-fro oscillation of the armature 22. This revolution takes place on the release of the armature—*i. e.*, when the circuit of the magnet is broken—and thus at the time when the type-wheel is stopped. On the end of the spindle 26 is a crank 28, which oscillates the lever 29 by means of the link 30. The printing-roller 31 is supported by the lever 29 and an opposite lever 33. These levers 29 33, with their connecting-pieces, are called the "printing-frame." When the printing-frame moves forward, the paper (shown in dotted lines in Fig. 6) around the roller 31 is pressed against the type-wheel *u* and a letter is printed. The type-wheel *u* has the rim with the type formed of india-rubber.

The rod 34, Fig. 5, is pivoted at one end to the lever 29, and at the other end it has a pawl 35, which works with a ratchet-wheel 36, fixed on the shaft 37. The pawl is forced down on the ratchet-wheel by means of a spring 38. The pawl and ratchet-wheel are so arranged that a forward movement of the printing-frame causes the pawl to slip over the teeth of the ratchet-wheel; but on the return movement of the printing-frame the pawl catches a tooth of the ratchet-wheel and rotates the latter one tooth. The shaft 37 is screwed with a quick thread and carries a nut 39, Figs. 4 and 6. Therefore the rotation of the ratchet-wheel 36 will give a traversing motion to the nut 39. The rotation of the ratchet-wheel through one tooth causes the type-wheel to traverse a distance equal to the lateral pitch of the letters in a word. The nut 39 carries an arm 70, which causes the type-wheel *u* to traverse the machine with the nut, but does not interfere with the rotation of *u*. The nut 39 also carries the inking-brush 40, which is adjusted so as to press lightly on the type-wheel, and it also carries the pointer 41, which shows on the scale 42 the extent of traverse movement of the type-wheel. The shaft 37 carries at its end a pinion 43, which gears with a wheel 44, pivotally suspended from the frame of the machine. The wheel 44, on rotating by the action of the pawl 35 on the ratchet-wheel 36, through the medium of the shaft 37 and pinion 43, winds up a spring on its axle, which spring will turn the wheel in the opposite direction on the shaft 37 being freed. The wheel 44 carries on its face a cam 45, which acts on a pin 46, carried by a spring hammer-rod 47, so that the hammer is pushed away from a bell 48 when the spring is being wound up. Before, however, the spring is quite wound up—*i. e.*, when the pointer 41 is at four or five divisions from the end of the scale—the pin 46 slips over the top of the cam 45 and the hammer strikes the bell. By modifying the cam slightly the hammer may be made to strike the bell also at the very end of the movement of the pointer. As the operator of the transmitting instrument has a receiving instrument before him while working, the index-scale and bell inform him when he is approaching the end of a line of printing. When he wishes to start a new line, he presses a key on the transmitter which corresponds with a space on the type-wheel occupying the place of a letter. In line with this space there is on the shaft 5 a pin 49, which on the forward oscillation of the printing-frame strikes a projection 50 on a lever 51, pivoted to a projection on the lever 29. This lever 51 is pivoted at its lower end to one extremity of the link 52, the other extremity of which is supported by the arm 53, rigidly fixed to the short spindle 54. The spindle 54 has also fixed to it another arm 55 and a pawl 56. The pawl 56 works with a ratchet-wheel 57 on the shaft 37, alongside the ratchet-wheel 36. In Fig. 5 the pawl 56 and ratchet-wheel 57 are hidden by the arm 55 and ratchet-wheel 36. When the pin 49 strikes the projection 50, the short spindle 54 is rocked a little, the pawl 56 is lifted out of gear with the ratchet-wheel 57, and the arm 55 pushes against a pin 58 in the pawl 35 and lifts the latter out of gear with the ratchet-wheel 36. The shaft 37 being then free rotates back by virtue of the wound-up spring attached to the wheel 44, and the type-wheel and index-pointer traverse back to commence and to indicate the commencement of a new line. The cam 45 travels back on the outside of the pin 46. To prevent the backward movement of the arm 55 and pawl 56 occurring too quickly, which would prevent the full backward travel of the type-wheel, I attach to the link 52 a pawl 59, which gears with a small ratchet-wheel 60, so as to rotate the latter several teeth for each downward movement of 55 and 56, and I control the rotation of the

ratchet-wheel 60 by means of a pendulum-escapement 61.

Every time a new line is started the paper must be moved forward. This is done in the following way: On the square shaft 5 and alongside the pin 49 is a similar pin 62. The lever 63, Figs. 5, 10, and 10[A], is supported at one end 64 by the vertical rod 65, and at the other end it is pivotally connected by the vertical pin 106 to the projection 107 on the printing-lever 29. The rod 65 is shown best in Fig. 10. It is supported on a bracket 66, attached to the wall of the machine, and has a universal joint at both top and bottom. At the same time as the pin 49 strikes the lever 50 to actuate the back traverse of the type-wheel the other pin 62, Figs. 5 and 10[A], strikes a bell-crank projection 108 on the lever 63, so that the end 64 is moved out from the wall of the machine. The end 64 is forked, and between the prongs is one end of a vertical lever 67, pivoted at 68, the other end of which lever controls an escapement 69, attached to a small pinion 71, so that the pinion can make one revolution for every to-and-fro movement of the lever 67. The pinion 71 gears with a toothed wheel 72, and 72 is fixed to the same axle as the feed-roller 73. Pressed down on the roller 73 by springs 74 are four disks 75, between which and the roller 73 the paper is gripped. The wheel 72 gears with a wheel 76, Figs. 5, 8, 9, 10[E], and 10[F], mounted loosely on a sleeve 113, which is made in one piece with or rigidly attached to another wheel 77. One end of a coil-spring 114, Fig. 10[E], is attached to 76 and the other end to 77. 77 gears with a pinion 78, fixed to the same shaft as a ratchet-wheel 79. A link 80 is pivoted to the top of the printing-lever 29 and carries a pawl 81, which is forced into gear with the ratchet-wheel 79 by a spring 82. A retaining-pawl 83, controlled by a spring 84, is also in gear with the ratchet-wheel 79. Therefore every time that the printing-lever 29 moves forward the wheel 77 is rotated through a small angle and the spring 114 wound up a little. The spring is prevented from unwinding, on the one hand, by the retaining-pawl 83 and, on the other hand, by the before-mentioned escapement 69. When, however, the escapement is released by the action of the pin 62 on the lever 63, the force of the spring rotates the wheel 76, which rotates the wheel 72, which feeds forward the paper. When the spring is wound up sufficiently, the lever 85, pivoted at 86, Figs. 8 and 9, is pressed laterally by the spring 87, so that its end 88 catches the end of the link 80 and holds the pawl 81 out of gear with the ratchet-wheel 79. During the winding of the spring the lever 85 is kept out of action by a disk 90, mounted on the sleeve 113, Figs. 10[E] and 10[F], so that the disk can move along the sleeve parallel to its axis, but is prevented from rotating relatively to the sleeve by pins 116, fixed to the sleeve and sliding in slots 117 in the boss 118 of the disk 90. The disk 90 is shown in front elevation in Fig. 10[G]. It carries three cams 115, at equal angles from each other, but distant unequal amounts from the axis of the disk. Opposite these cams are three holes 119 in the wheel 76, so situated that all the cams can enter the holes at the same time. These holes are shown in Fig. 10[H], which is a back elevation of the wheel 76. I do not limit myself to three cams and three holes. I may employ more or less; but I prefer three. While the spring 114 is being wound up, the cams 115 slide on the face of the wheel 76; but when the spring has been wound as far as desirable the cams fall into the holes 119, the disk 90 is pressed against the face of the wheel 76, and a pin 121, carried by this wheel, enters a hole 122 in the disk and prevents the further rotation of the disk, and therefore the further winding of the spring, the end 88 of the lever 85 at the same time catching the end of the lever 80 and holding the pawl 81 out of action, as before described. On the release of the escapement 69, as before mentioned, the wheel 76 is forced by the coil-spring to rotate in the same direction as the disk was rotating during the winding process, and the cams, rising out of their holes, force back the disk 90, free the pins 121, and allow the pawl 81 to again gear with the ratchet-wheel 79. The spring is thus always wound up when required, and yet is never overwound.

Fig. 10[D] shows, diagrammatically, the alternating-current circuit through the transmitter and receiver, M representing the magneto, and R the rheostat.

The following is a description of the operation of the apparatus: The operator at the transmitting instrument having put the magneto-machine in motion depresses a key. The toothed wheel *e* carries around the pawl *f* until the outer end *h* of the latter strikes the inner end of the depressed key. The operator now depresses another key, which by means of the chain *o* raises the first depressed key, and therefore allows the pawl *f* to again engage with the toothed wheel *e*, which then carries it around until its outer end *h* strikes the inner end of the second depressed key, and so the process is continued. Now as the wheel *e* moves through a distance equal to a distance between two adjacent keys for every impulse of current and as the type-wheel rotates an amount equal to the pitch of the type on its circumference for every impulse of current it follows that if the receiving instrument is in unison with the transmitter to start with it will always remain so except for accidents, and therefore the letters on the type-wheel will move into the printing position according as the keys corresponding to them are depressed at the transmitter. Now every time that the end *h* of the pawl *f* strikes the lower end of a key 1 the current is broken, as before described, and therefore the electromagnet 21 releases its armature 22, and this actuates the escapement-lever 24 and causes it to release the printing-frame, which

therefore makes one to-and-fro motion under the action of its train of wheels. In consequence of this the paper on the printing-roller 31 is pressed against the letter on the type-wheel which is in printing position—that is, the letter whose key is depressed at the transmitter. Each time that the printing-frame makes a to-and-fro oscillation it rotates the ratchet-wheel 36 by means of the pawl 35 on the end of the rod 34. This rotation of the ratchet-wheel revolves the quick-threaded shaft 37, which therefore gives a traversing motion to the nut 39, which therefore moves the type-wheel *u* and inking-brush 40 a distance equal to the pitch of the letters on the printing-paper. At the same time the pinion 43 on the end of the shaft 37 rotates the wheel 44, and therefore winds up the spring on its axle. Every to-and-fro motion of the printing-frame also rotates the ratchet-wheel 79, by means of the link 80, with its pawl 81. This ratchet-wheel, through the medium of the pinion 78 and wheel 77, winds up the spring 114. When this spring is fully wound up, the pawl 81 is thrown out of gear with the ratchet-wheel by means of the lever 85, as before described. When a new line should be started, the operator at the transmitting instrument presses the key corresponding to the blank space in the type-wheel in line with the pin 49 on the shaft 5. This pin on the forward oscillation of the printing-frame strikes the projection 50 on the lever 51, which by means of the link 52, the arm 53, and short spindle 54 oscillates the arm 55 and pawl 56, so as to free both the ratchet-wheels 57 and 36. The spring on the axle of the wheel 44 then rotates back the quick-threaded shaft 37, which brings back the type-wheel and inking-brush to their starting positions. At the same time as the pin 49 strikes the projection 50 on the lever 51 the pin 62 strikes the bell-crank projection 108 on the lever 63, so that the end 64 of the lever is moved out from the wall of the machine and causes the lever 67 to free the escapement 69, and so allow the rotation of the pinion 71, the wheels 72 and 76, and the paper-feed roller 73 by the action of the wound-up spring 114. The paper is thus fed forward at the same time as the type-wheel traverses back to commence a new line.

Instead of using the spring-barrels 4 and 27 I may use weights attached to cords to give the power necessary for operating the mechanism.

In another modification of my machine I retain the spring-barrel 4, but I substitute for the other spring-barrel 27 a local battery. This modification is illustrated in Figs. 11, 12, and 13. Instead of the spring-barrel 27, with its train of wheels, escapement, and mechanism for oscillating the printing-frame, I employ an electromagnet 91, which is energized by a local battery 92 and has its circuit made and broken by the action of the electromagnet 21, which is the same as that used with my first modification. The armature 22 in this case is pressed by its supporting-spring 93 into contact with the spring 94, attached to the insulated block 95, which carries the terminal screw 96 for the connection of one wire from the local battery. The spring 93 of the armature is attached to the insulated block 97, carrying the terminal screw 98, which is connected through the coils of the electromagnet 91 with the other terminal of the local battery. I do not confine myself to the exact method described of closing and breaking the circuit of the local battery, but I do this through suitable means by the action of the magnet 21 on its armature 22. The electromagnet 91 has an armature 99 rigidly attached to the printing-frame. Thus when the local-battery circuit is closed the armature 99 and printing-frame are moved forward, and when the local circuit is broken the frame is pulled back by springs, such as 100. In all other respects this modification resembles my first.

I provide the instrument in all the modifications with any usual zeroizing or unison device, but I prefer an arrangement consisting of a lever engaging with the type-wheel spindle by means of a helix or screw-thread carried on the spindle and a pin on the lever dropping into this thread, which pin carries the lever under a stop when the desired number of turns have been made, and so stops the type-wheel at the required point until the release of the printing-armature causes the lever to fly back and liberate the rotating pin.

I provide an alternating current powerful enough to deal with great resistance in the line and I adopt the most rapidly-acting magnets possible, and by these devices I provide instruments which are not readily affected by change in electrical conditions of the line. To set my instruments, I adjust them to a standard resistance and I provide a small rheostat which can be at once altered for any variations of the resistance of the line, and this renders it quite unnecessary for me to alter the mechanism or spring adjustments of the instrument.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A column-printing telegraphic apparatus comprising in combination a transmitting and receiving instrument, the transmitting instrument comprising a keyboard of the Wheatstone type and a magneto-electric machine sending alternating currents, and the receiving instrument comprising a spring-operated train of wheels, an escapement controlling the train, a type-wheel actuated by the train, an electromagnet with a polarized armature for controlling the escapement, a printing-frame arranged to press the paper against the type-wheel, a local source of energy adapted to actuate said printing-frame, an electromagnet with an armature which is not polarized, means whereby this electromagnet controls the local source of energy, a spring-

actuated quick-threaded shaft, a nut on said shaft arranged to cause the type-wheel to traverse the machine, a ratchet controlling the quick-threaded shaft, means with which the printing-frame is provided for releasing the ratchet-wheel, means for winding up the actuating-spring, a spring-operated train of wheels to rotate the paper-feed roller, means for winding up and preventing overwinding of the operating-spring, an escapement controlling the last-mentioned train of wheels, means with which the printing-frame is provided to release this escapement, circuit connections between both of the aforesaid electromagnets and the magneto-machine whereby alternating currents are sent to said electromagnets, and a rheostat in the circuit, substantially as described.

2. A column-printing telegraphic apparatus comprising in combination a transmitting and a receiving instrument, the said transmitting instrument comprising a keyboard of the Wheatstone type and a magneto-electric machine sending alternating currents, and the receiving instrument consisting of two spring-operated trains of wheels, escapements controlling both trains, a type-wheel actuated by one train, a printing-frame arranged to press the paper against the type-wheel, said frame being actuated from the other train, a spring-actuated quick-threaded shaft, a nut on said shaft arranged to cause the type-wheel to traverse the machine, a ratchet controlling the quick-threaded shaft, means with which the printing-frame is provided for releasing the ratchet-wheel, means to wind up the actuating-spring, a spring-operated train of wheels to rotate the paper-feed roller, means for winding up and preventing overwinding of the operating-spring, an escapement controlling the last-mentioned spring-operated train of wheels, means with which the printing-frame is provided to release this escapement, an electromagnet with a polarized armature for controlling the type-wheel escapement, an electromagnet with an armature which is not polarized for controlling the printing, traversing and paper feeding mechanism, circuit connections between both of the said electromagnets and the magneto-machine whereby alternating currents are sent to said electromagnets, and a rheostat in the circuit, substantially as described.

3. In a column-printing telegraphic receiving instrument, the combination of a spring-operated train of wheels, an escapement for controlling the said train, a type-wheel and type-wheel-rotating mechanism actuated by said train, an electromagnet with a polarized armature for controlling the escapement, a printing-frame, a local source of energy to actuate said printing-frame, an electromagnet with an armature which is not polarized, means whereby this electromagnet controls the local source of energy, a quick-threaded shaft, a nut thereon for causing the type-wheel to traverse the machine, a spring for actuating the quick-threaded shaft, means to wind up the actuating-spring, a ratchet for controlling the quick-threaded shaft, means with which the printing-frame is provided for releasing this ratchet, a paper-feed roller, a spring-operated train of wheels to rotate said roller, an escapement for controlling this train of wheels, means with which the printing-frame is provided for releasing this escapement, means for winding up and preventing overwinding of the feed-roller-operating spring, and means for energizing both the aforesaid electromagnets by an alternating current, substantially as described.

4. In a column-printing telegraphic receiving instrument, the combination of two spring-operated trains of wheels escapements controlling both trains, a type-wheel-rotating mechanism connected with one train to be actuated thereby, a printing-frame connected to the other train to be actuated thereby, a quick-threaded shaft, a nut thereon for causing the type-wheel to traverse the machine, a spring for actuating the quick-threaded shaft, means to wind up the actuating-spring, a ratchet for controlling the quick-threaded shaft, means with which the printing-frame is provided for releasing the ratchet controlling the spring-actuated quick-threaded shaft, a paper-feed roller, a spring-operated train of wheels to rotate the same, an escapement for controlling said train of wheels, means with which the printing-frame is provided for releasing this escapement, means for winding up and preventing overwinding of the operating-spring; an electromagnet and a polarized armature for controlling the type-wheel escapement, an electromagnet and an armature which is not polarized for controlling the traversing and paper-feeding mechanism and means for energizing both electromagnets by an alternating current, substantially as described.

5. In combination in a column-printing telegraphic receiving instrument, type-wheel-traversing mechanism, a wheel rotated by said mechanism, a cam such as 45 carried by said wheel and in the form of an arc eccentric to said wheel, a bell, a spring hammer-rod arranged to strike the bell, a pin carried by said hammer-rod and adapted to be acted on by said cam, substantially as described.

6. In combination, in a telegraphic receiving instrument, a type-wheel, a type-wheel-rotating shaft, a pin projecting therefrom, a bell-crank lever operated by the said pin and having a forked end, a lever controlled thereby, an escapement controlled by said lever, and a spring-actuated paper-feed roller controlled by said escapement, substantially as described.

7. In a telegraphic receiving instrument, a coil-spring, paper-feeding means actuated thereby, the two toothed wheels 76 and 77 connected respectively to the ends of the

spring, an escapement and gearing controlling one of said wheels, a type-wheel and type-wheel-rotating shaft, a pin on said shaft for actuating the escapement, a ratchet-wheel and gearing for controlling the other of the two wheels, a printing-frame, and a pawl attached to and reciprocating with the printing-frame and operating the ratchet and gearing, substantially as described.

8. In a telegraphic receiving instrument, a paper-feed mechanism comprising a spring-operated train of wheels, an escapement for controlling the same, a movable printing-frame, a system of levers actuated thereby under the control of the operator of the transmitting instrument for releasing the escapement by said system of levers, and means for winding up and preventing overwinding of the operating-spring, substantially as described.

9. In a column-printing telegraphic receiving instrument, a type-wheel arranged to traverse the machine, and a retarding device adapted to allow sufficient time for the type-wheel to traverse the machine before starting a new line, said device comprising an escapement, the inertia of which is adapted to permit only a slow step-by-step rotation of a ratchet-wheel in gear with the escapement, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

FREDERICK HERBERT WILLIAM HIGGINS.

Witnesses:
G. F. WARREN,
W. J. NORWOOD.