(No Model.) 6 Sheets—Sheet 1.

H. VAN HOEVENBERGH.

PRINTING TELEGRAPH.

No. 251,658. Patented Dec. 27, 1881.

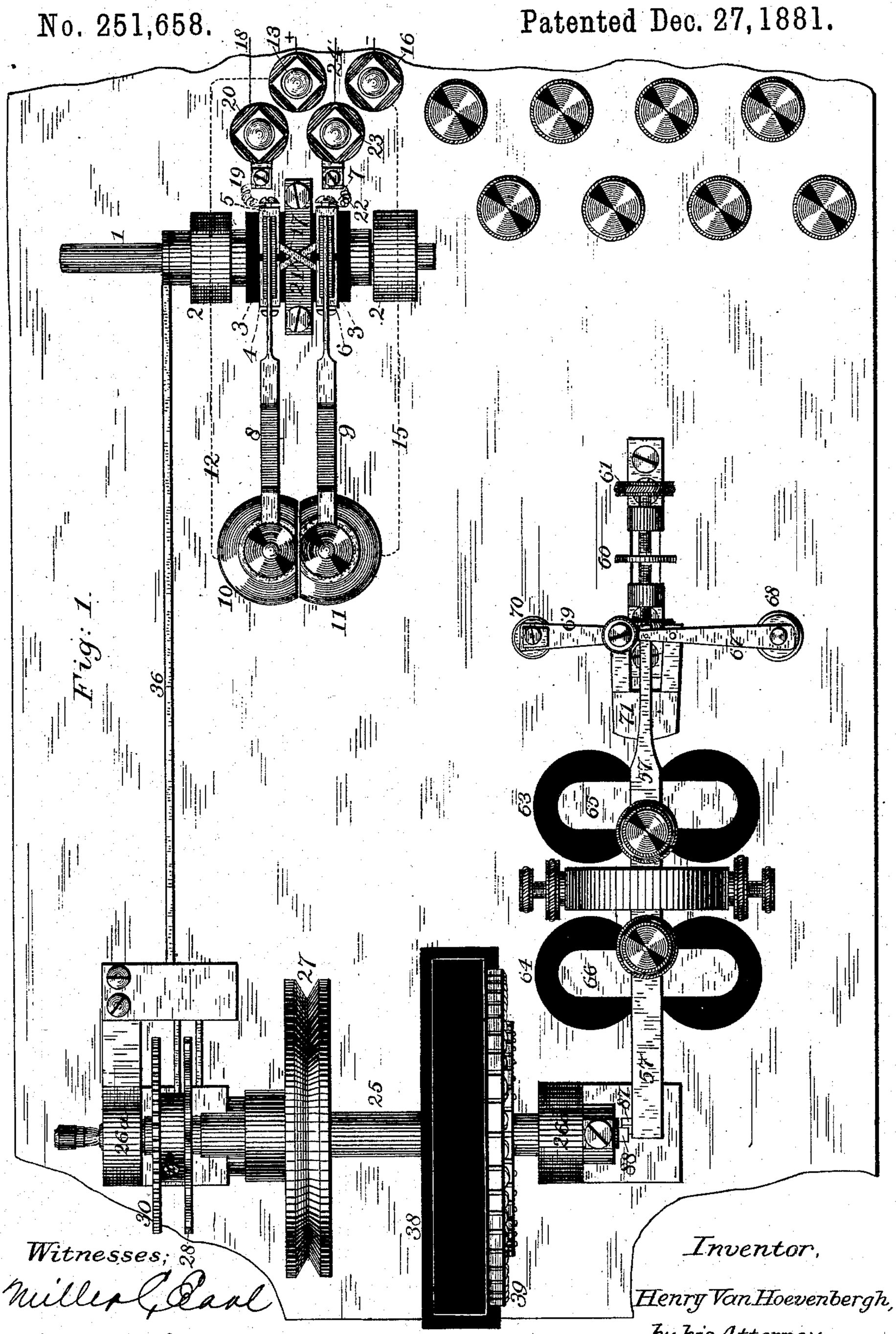

Fig. 1.

Witnesses;
Miller C. Earl
Chas. A. Terry.

Inventor,
Henry Van Hoevenbergh,
by his Attorney,
Frank L. Dyer

(No Model.) 6 Sheets—Sheet 2.

H. VAN HOEVENBERGH.

PRINTING TELEGRAPH.

No. 251,658. Patented Dec. 27, 1881.

Fig: 6.

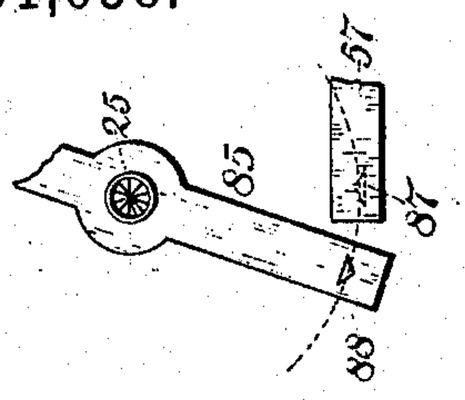

Fig: 5.

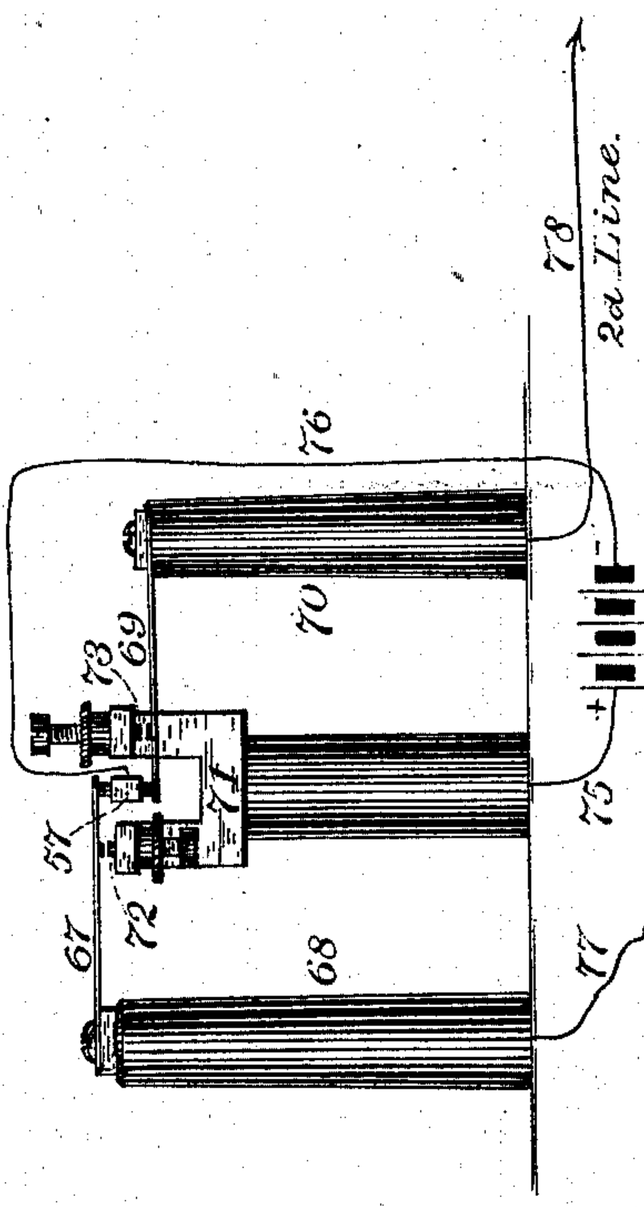

Fig: 2.

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(No Model.) 6 Sheets—Sheet 3.

H. VAN HOEVENBERGH.

PRINTING TELEGRAPH.

No. 251,658. Patented Dec. 27, 1881.

Fig: 12.

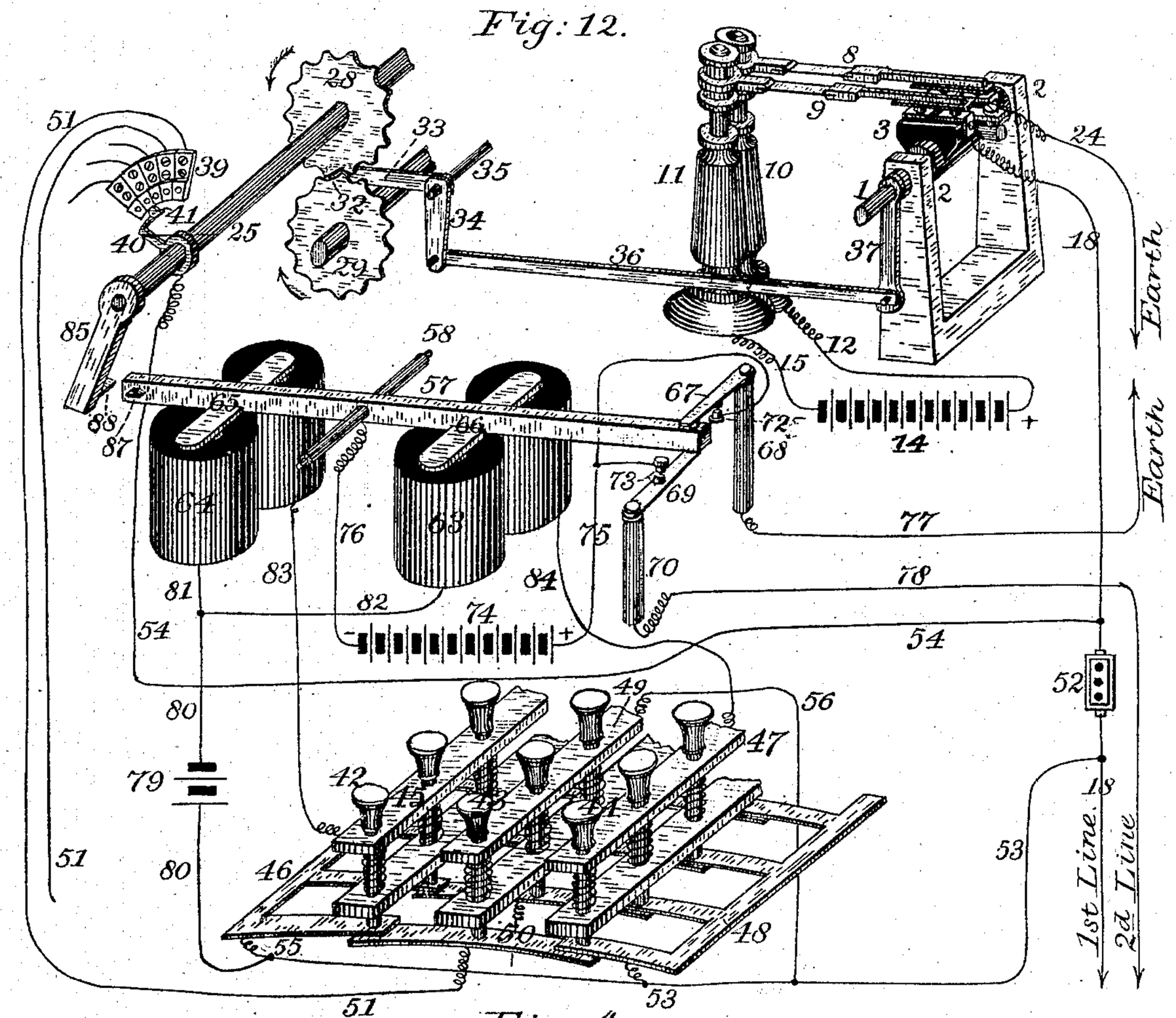


Fig: 4.

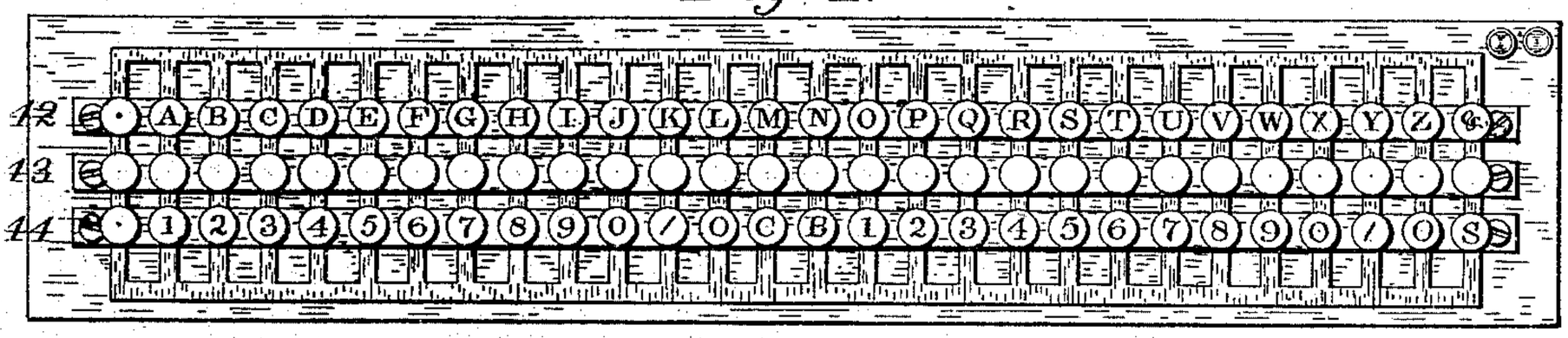
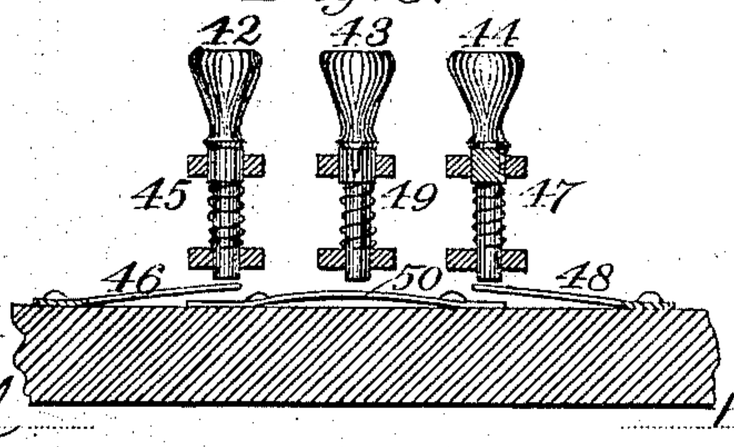


Fig: 3.



Witnesses:

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(No Model.) 6 Sheets—Sheet 4.

H. VAN HOEVENBERGH.

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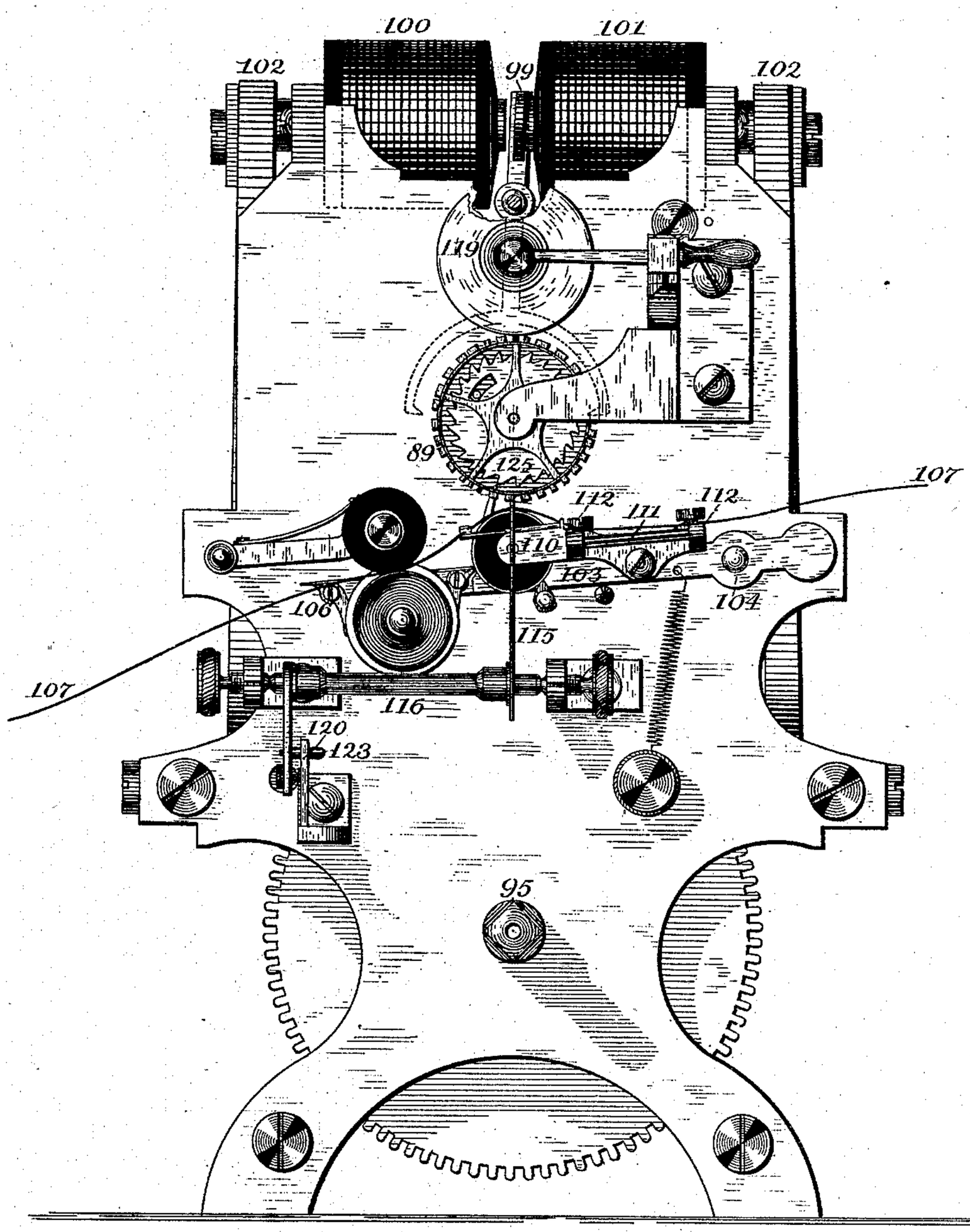
No. 251,658. Patented Dec. 27, 1881.

Fig: 7.



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Frank L. Pope

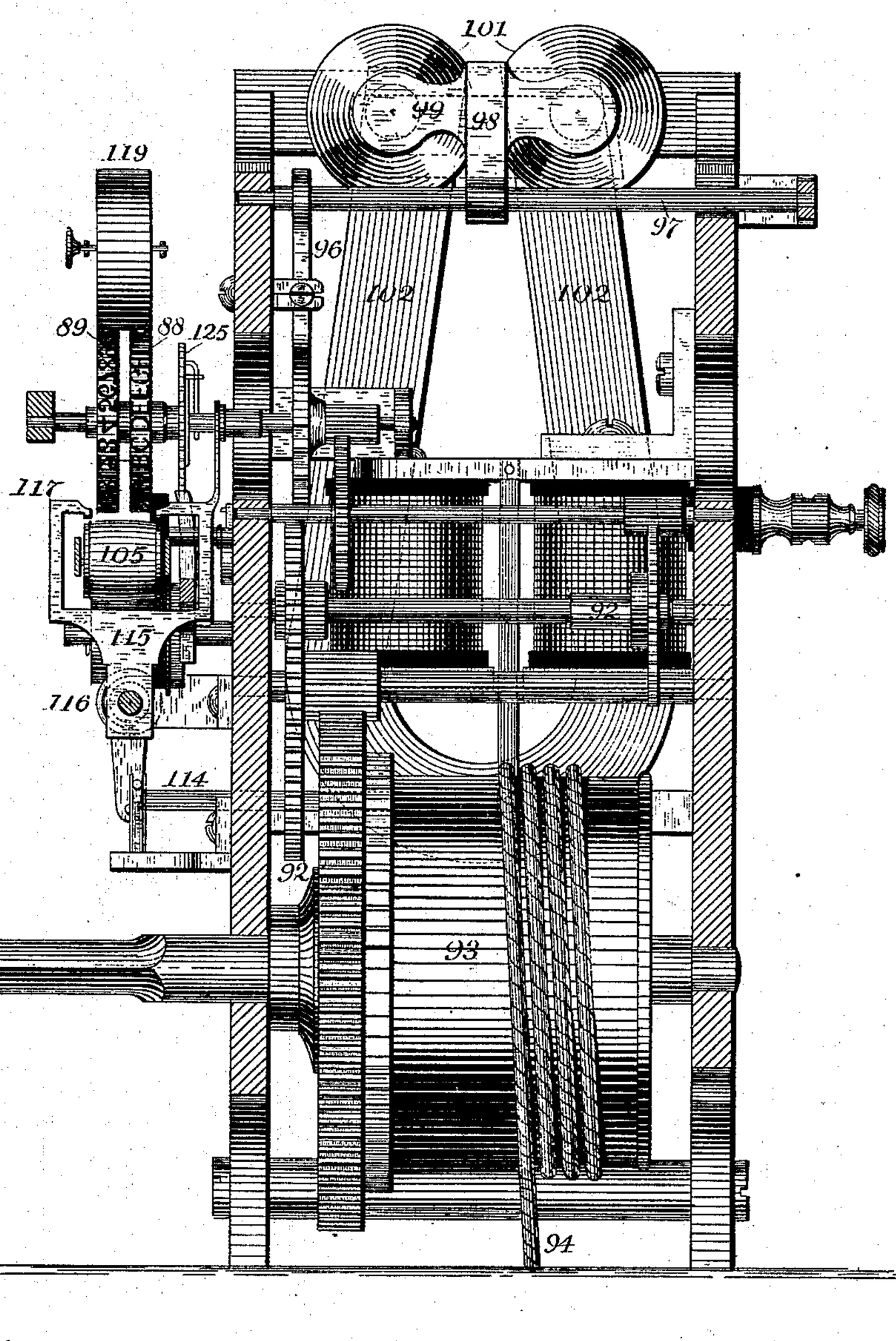
(No Model.) 6 Sheets—Sheet 5.

H. VAN HOEVENBERGH.

PRINTING TELEGRAPH.

No. 251,658. Patented Dec. 27, 1881.

Fig: 8.



Witnesses:

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(No Model.) 6 Sheets—Sheet 6.

H. VAN HOEVENBERGH.

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No. 251,658. Patented Dec. 27, 1881.

Fig: 9.

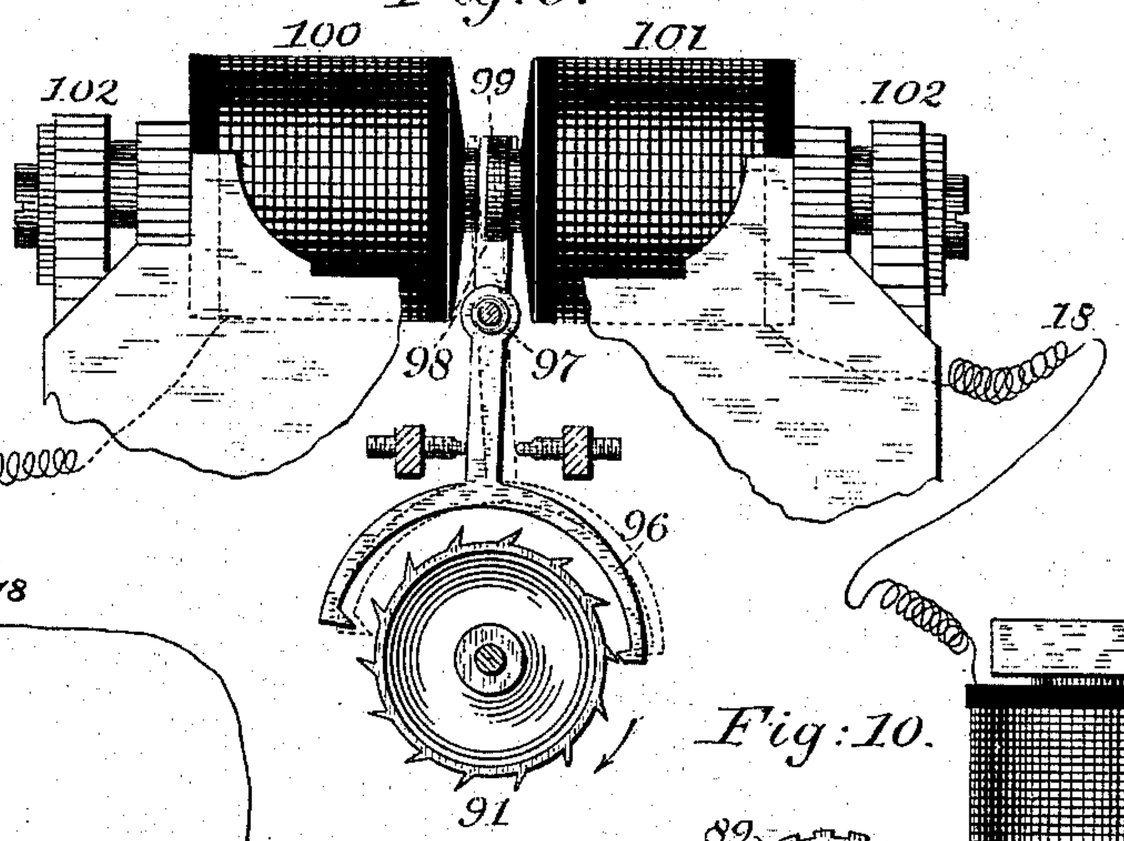


Fig: 10.

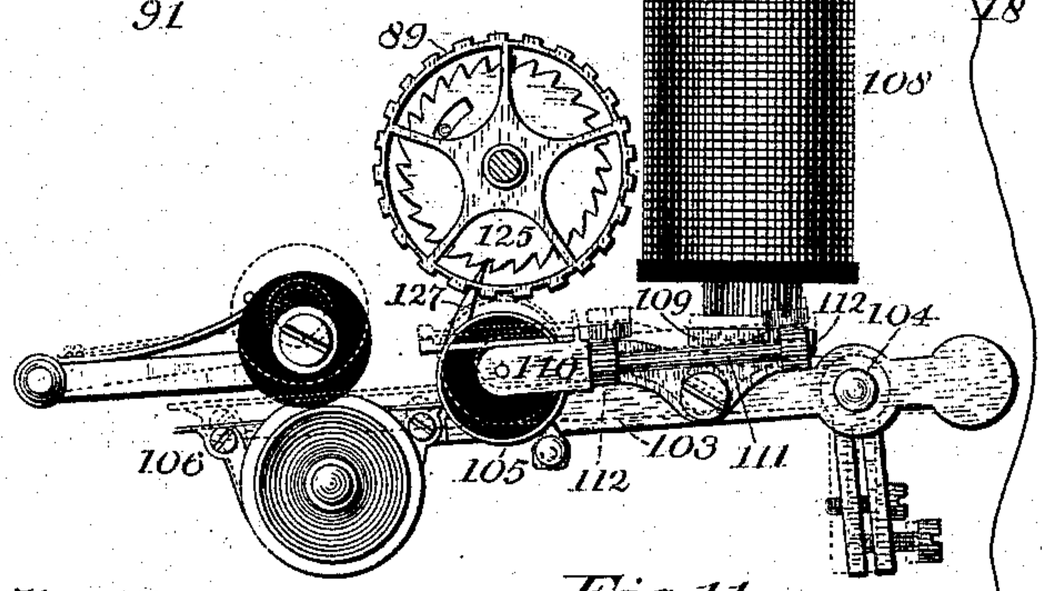


Fig: 11

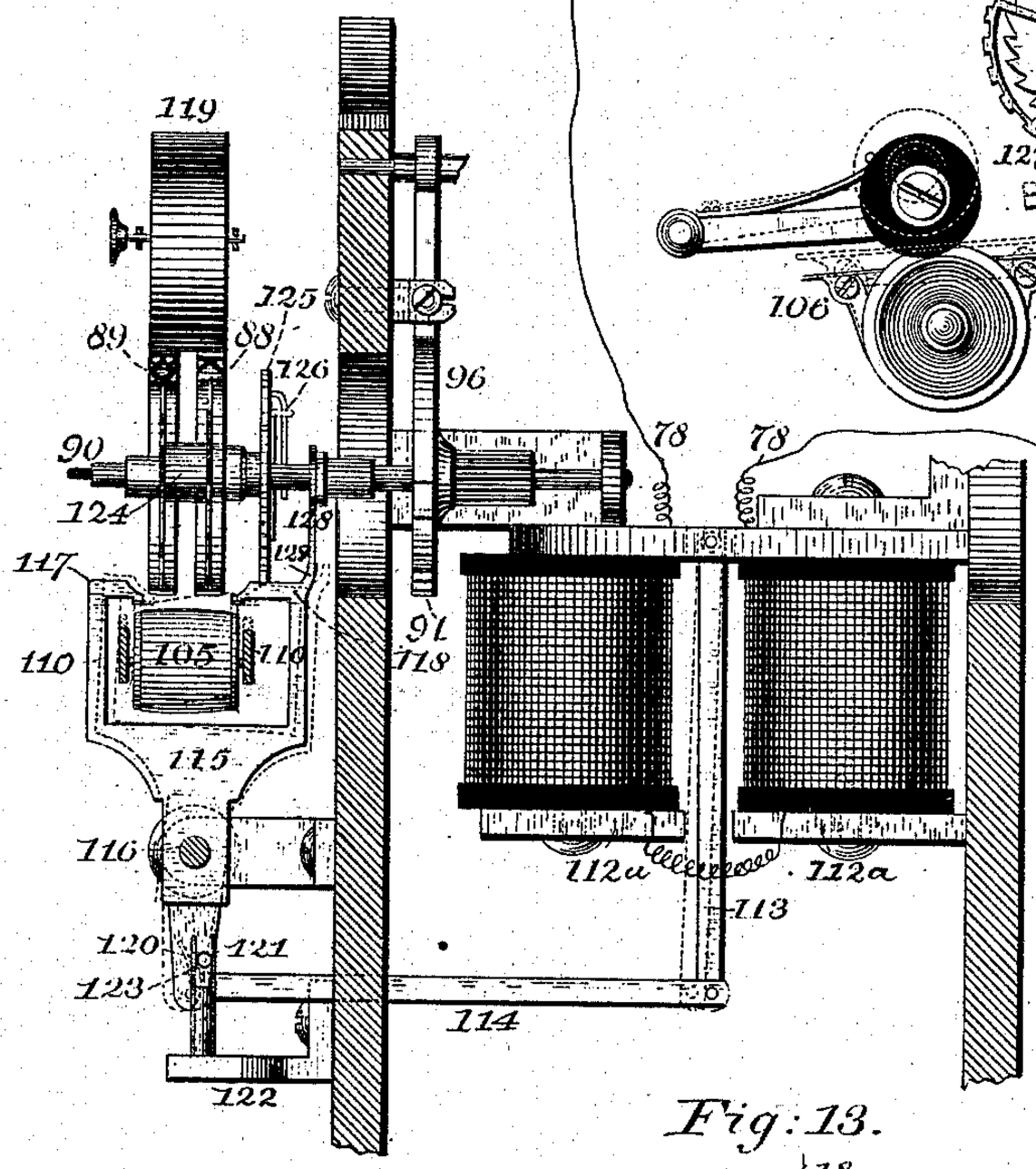


Fig. 11a

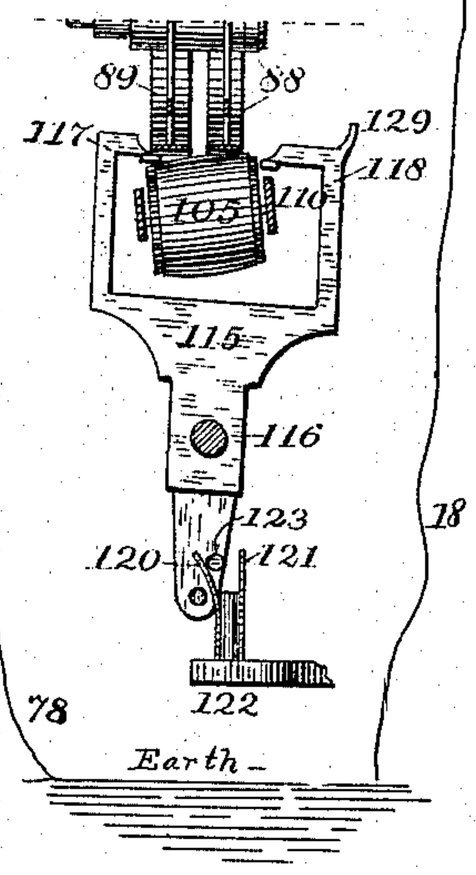
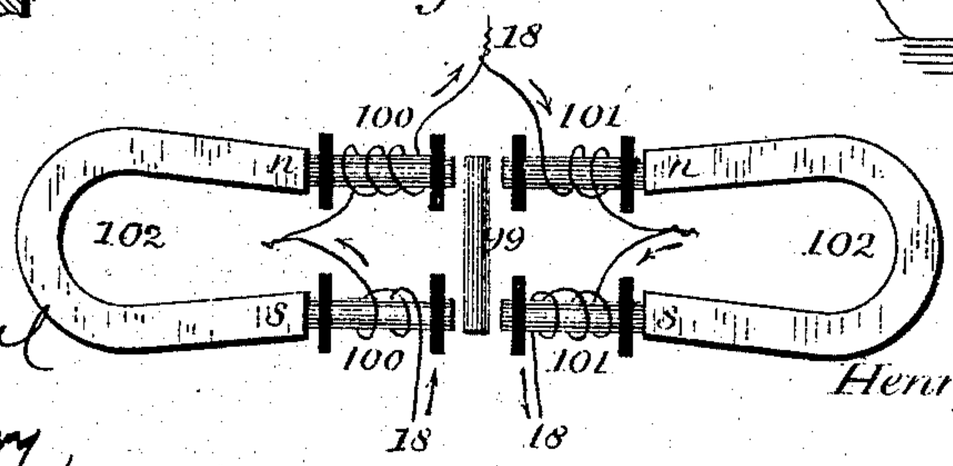


Fig: 13.



Witnesses:
Millard C Eaton
Chas. A. Terry,

Inventor.
Henry Van Hoevenbergh,
by his Attorney, Frank L Pope

UNITED STATES PATENT OFFICE.

HENRY VAN HOEVENBERGH, OF ELIZABETH, NEW JERSEY.

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 251,658, dated December 27, 1881.

Application filed September 27, 1881. (No model.)

To all whom it may concern:

Be it known that I, HENRY VAN HOEVENBERGH, a citizen of the United States, and a resident of Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Printing-Telegraphs, of which the following is a specification.

My invention relates to that class of printing-telegraphs in which the type-wheels of the receiving-instruments are impelled by a weight or spring acting through suitable intermediate wheel-work, and the progressive movements of said type-wheels are controlled by a series of electrical pulsations, alternately of opposite polarity, which are transmitted over the main line from the sending-station. These pulsations cause the rapid to-and-fro vibration between electro-magnets of an armature suitably constructed to be actuated by such alternating currents, and the vibrating armature in turn controls the type-wheel by means of a step-by-step escapement of well-known construction.

In my improved apparatus, hereinafter described, the printing is effected by increasing the strength of the electric current during some one of the pulsations without reference to its polarity at the instant the required division of the type-wheel is opposite the platen, and this action takes place without retarding the progressive movement of the type-wheel or interrupting the regular succession of electric pulsations. The momentary stoppage of the type-wheel shaft at the termination of each vibration of the step-by-step escapement affords sufficient time to permit an impression to be taken from the type-wheel by means of proper mechanism. The receiving or printing instrument is provided with a double type-wheel, consisting of two type-wheels fixed side by side upon the same axis, and an oscillating printing-platen is made use of, by means of which either one of the two type-wheels may be printed from at the will of the transmitting-operator.

In the organization of electric circuits for operating my improved apparatus two independent main lines are required. The currents transmitted over the first line control the progressive movement of the type-wheels, and also actuate the printing mechanism. The currents over the second line control the angular position of the oscillating platen, and thus determine from which of the two type-wheels a given impression shall be taken, and the currents upon this line also actuate the unison mechanism, by means of which the synchronism between the transmitting and receiving instruments is maintained.

The oscillating printing-platen hereinbefore referred to is governed in its movements by a clutch-lever in such a manner that either one of three different results may be produced by a given movement of the printing mechanism—that is to say, either the letters of the alphabet upon one type-wheel or the numerals and other miscellaneous signs upon the other type-wheel may be printed, or spaces or blanks may be made in the printed record without the necessity of waiting for the type-wheels to reach the zero-point, as in apparatus of this kind heretofore constructed.

The unison mechanism, by means of which the synchronism between the transmitting and the receiving instrument is maintained, is preferably actuated by means of the same clutch that controls the oscillating platen hereinbefore referred to, and its function is to automatically adjust the position of the type-wheels of the receiving-instrument, when out of correspondence with the transmitter, by the normal operation of the instrument acting at a particular point once during each complete revolution of the type-wheel.

In the accompanying drawings, Figure 1 is a plan view of a portion of the transmitting apparatus. Fig. 2 is a front elevation of the same. Fig. 3 is a transverse vertical section of the key-board which forms a portion of the transmitting apparatus, and Fig. 4 is a plan of said key-board, (the last two figures being on a reduced scale.) Fig. 5 is a detached view of the pole-changing circuit-closer which transmits currents over the second line-wire. Fig. 6 is a detached view, showing certain details of the transmitting apparatus. Fig. 7 is a front elevation of the receiving and printing mechanism. Fig. 8 is a side elevation of the same. Fig. 9 is a front elevation, showing the scape-wheel and its controlling mechanism. Fig. 10 is a front elevation, showing the printing mechanism. Fig. 11 is a side elevation of the same.

Fig. 11ª is a similar view, showing the oscillating platen in a different position. Fig. 12 is a theoretical diagram, illustrating the organization of the electric circuits and their relation to the mechanical portions of the transmitting apparatus; and Fig. 13 is a diagram illustrating the construction of the electro-magnet of the receiving apparatus.

The transmitting apparatus may conveniently be regarded as composed of four divisions. The first of these controls the transmission of the alternate positive and negative electrical pulsations by which the intermittent rotation of the double type-wheel of the receiving-instrument is effected. The second produces a printed impression of the required character upon the type-wheel at the proper point in its revolution. The third determines the specific character of the impression thus produced at any given point in the revolution of the type-wheel; and the fourth readjusts, when necessary, the position of the type-wheel at the receiving-station, and thus maintains its synchronism with the transmitting apparatus at the sending-station.

The first part of the transmitting apparatus consists of a pole-changing or battery-reversing commutator, which is driven at a determinate and uniform rate of speed by some suitable mechanical means. This "pole-changer," as it will be hereinafter termed, is shown in Figs. 1, 2, and 12. A shaft, 1, is mounted in suitable stationary bearings upon standards 2 2, upon which shaft is fixed a piece of hard rubber or other like insulating material, 3. Upon this latter are mounted four metallic contact-points, 4 5 6 7. Two metallic spring-fingers, 8 and 9, are so arranged with reference to the four contact-points upon the hard-rubber block 3 that when the shaft 1 is in one position (which is that shown in Figs. 2 and 12) the spring 8 rests upon the contact 5 and the spring 9 upon the contact 7. If, however, the shaft 1 be rotated a short distance in the direction indicated by the arrow in Fig. 2, the spring 8 will be brought into contact with and will rest upon the contact 4, and will be thereby lifted from the contact 5, and in like manner the spring 9 will rest upon the contact 6 and be lifted from the contact 7. The spring 8 is electrically connected, through the post 10, wire 12, and binding-screw 13, with the positive pole of the main battery 14, and the spring 9 is in like manner connected with the negative pole of the main battery 14 through the post 11, wire 15, and binding-screw 16. The contacts 5 and 6 are electrically united with each other by a short conductor, 17, and also with the line-wire 18 through the wire 19 and binding-post 20. In like manner the contacts 4 and 7 are united by the conductor 21, and are also connected through the wire 22 and binding-post 23 with the earth-wire 24. The line-wire 18, hereinafter termed the "first line-wire," extends to the distant station or stations, as shown in the diagram Fig. 12, and there passes through the different electro-magnets which control the movements of the type-wheel and the printing mechanism, respectively, of the receiving instrument or instruments, as will be hereinafter described and explained in detail. Thus it will be understood that if the shaft 1, hereinafter termed a "rock-shaft," be caused to oscillate backward and forward, alternate positive and negative pulsations from the main battery 14 will be transmitted over the line 18, for the reason that the connections between the poles of the battery and the line and earth wires are interchanged at each oscillation.

In practice any required number of separate or independent lines may be operated from one key-board and system of transmitting mechanism by making use of as many separate commutators or pole-changers as there are independent lines to be operated, and by mounting all these pole-changers upon a single rock-shaft, which may be of any required length and will actuate all the lines in unison.

The mechanical instrumentalities for imparting motion to the rock-shaft and pole-changer hereinbefore described consists of a shaft, 25, (see Figs. 1 and 12,) which is mounted upon suitable standards or bearings, 26ª 26ª, and is provided with a pulley, 27, around which passes a belt or band from another shaft, (not shown in the drawings,) which latter shaft may be driven by any suitable motor—as, for example, an electro-motor. By this means the shaft 25 is kept in continuous and uniform rotation, and the oscillation of the rock-shaft 1 and its attachments is effected thereby through the medium of certain mechanism, which will now be described: Upon the shaft 25 is fixed a wheel, 28, hereinafter termed a "scroll-wheel," the periphery of which is formed into alternate recesses or projections of a wave-like form, as best seen in Fig. 12.

Directly beneath and in the same plane of rotation with the wheel 28 is mounted another precisely similar scroll-wheel, 29. The number of projections and recesses upon each of these wheels, taken together, is made equal to the number of positive and negative impulses, taken together, which are necessary to effect one complete revolution of the type-wheel of the receiving-instrument, as hereinafter described. The scroll-wheels 28 and 29 are compelled to revolve isochronously by means of spur-gearing 30, consisting of two toothed wheels having each a like number of teeth, the upper wheel (seen in Fig. 1) being fixed to the shaft 25, and communicating motion therefrom to the lower wheel, which is directly beneath it upon the axis of scroll-wheel 29. The scroll-wheels 28 and 29 are so mounted with reference to each other that the projections of one wheel are directly opposite the recesses of the other as they revolve, as will be understood by reference to Fig. 12. The space between the scroll-wheels 28 and 29 is just sufficient to admit a pin, 32, which is inserted in the arm 33 of a right-angled or bell-crank le-

ver, 33 34, mounted upon an axis, 35, the other arm, 34, of which is connected by a rod, 36, with a crank-arm, 37, fixed to the rock-shaft 1. It will be understood, therefore, that as the scroll-wheels 28 and 29 revolve in the direction denoted by the arrows an oscillatory motion will be communicated to the pin 32, which will be transmitted to the lever 33 34, and thence to the rock-shaft 1, upon which the pole-changer is mounted, and hence that the number of oscillations of the latter during each revolution of the shaft 25 will be determined by the number of projections and recesses upon the scroll-wheels 28 and 29. From this it necessarily follows that so long as the shaft 25 is kept in continuous rotation a determinate number of alternate positive and negative electric pulsations will be transmitted over the line during each revolution which it makes. By means hereinafter to be described the type-wheel of the receiving-instrument is caused to revolve synchronously with the shaft 25 and its attachments.

The impression of any particular character upon the paper is effected at the receiving-station by increasing the strength of the electric pulsation which occurs at the same moment the required character upon the rotating type-wheel is opposite the printing-platen. The transmission of a pulsation of increased strength at the proper time and in the proper sequence is effected by the following mechanism, (see Figs. 1, 2, and 12:) Upon an upright plate, 38, of hard rubber or other suitable insulating material, is mounted a segmental ring, 39, technically termed a "sunflower." This consists of a number of metallic segments insulated from each other and arranged in a circle, as shown in Fig. 2. These segments are equal in number to the whole number of projections and recesses taken together upon the scroll-wheels 28 and 29. Upon a spring-arm, 40, fixed upon the shaft 25, is mounted a sliding contact-point, 41, hereinafter termed a "traveler," which revolves within the segmental circle or sunflower, and thus comes in contact successively with the inner edge of all the segments during each of its revolutions.

The key-board is shown in cross-section in Fig. 3 and in plan in Fig. 4, both of which figures are on a reduced scale. The keys of the key-board are arranged in three rows, 42, 43, and 44, as seen in Fig. 4. I prefer to place twenty-eight keys in each row, this being a sufficient number to provide for all the letters of the alphabet, as well as the numerals and other characters ordinarily employed in commercial telegraphy. The letters of the alphabet are arranged in the first row, 42, the numerals, punctuation points, and other signs in the third row, 44, while the second row, 43, consists of keys whose sole office it is to form blank spaces between words or wherever needed in the communication to be printed. The electrical connections of the key-board will be best understood by reference to Figs. 3 and 12. Each key consists of a vertical pin having a knob or button at the top, by means of which it may be depressed by the finger of the operator, and a spring for returning it to its normal position. The keys in row 42 are all mounted in a long metallic rack, 45, and each one, when depressed by the operator, falls upon a corresponding tooth of the metallic comb 46, which extends the whole length of the row of keys with its teeth extending underneath them. In like manner the keys 44 are mounted in a separate rack, 47, and act upon the teeth of a comb, 48. The middle row of keys, 43, are likewise mounted in a similar rack, 49; but when depressed they fall upon and make contact with a series of insulated metallic springs, 50, there being one such spring for each key in the row. Each one of the series of springs 50 is permanently fastened to the base of the apparatus at both of its ends, and extends underneath the ends of a tooth of the combs 46 and 48, respectively, as will be understood by reference to Figs. 3 and 12. The springs 50 are electrically connected by means of a corresponding number of separate conducting-wires, 51, with the corresponding insulated segments of the sunflower 39.

The general principle upon which the key-board, sunflower, and traveler act together to increase the strength of a given electrical pulsation upon the line is that of cutting out or short-circuiting an artificial resistance normally interposed in the main circuit during the time in which the traveler is passing over that segment of the sunflower which corresponds to the particular key which is depressed upon the key-board. The operation of the devices by means of which this is effected will be best understood by reference to Fig. 12. A rheostat or artificial resistance, 52, is placed in the main-line wire 18. Wires 53 and 54 are united with the line-wire 18 on each side of said rheostat. The wire 53 is connected with the comb 48, and also, by a branch wire, 55, with the comb 46. The wire 54 is electrically connected with the shaft 25, and through that with the traveler 41. The rack 49 of the middle row of keys, 43, is also connected by a branch wire, 56, with the wires 55 and 53. Hence it will be understood that whenever any key whatsoever upon the key-board is depressed by the operator a shunt or circuit of small resistance is closed at that point passing around the rheostat 52, which shunt, however, is only completed so as to cut out the rheostat by the passing of the traveler 41 over the segment of the sunflower corresponding to and connected with the particular key which has been depressed; and, moreover, it is to be understood that the shunt-circuit through any particular segment of the sunflower may be formed by either one of three different keys, one in each row. For example, referring to Fig. 4, if the key lettered B is depressed, it will close the shunt-circuit through the same segment of the sunflower as if the key marked

with the numeral 2 were depressed, or the unmarked space-key immediately between the two named. Whether the letter B, the numeral 2, or the space shall appear upon the record at the receiving-instrument is a matter that is determined by the action of other and additional mechanism actuated through the second line-wire, and hereinafter to be described.

The mechanism for determining whether a letter, numeral, or space shall be printed by the receiving-instrument when the printing mechanism is actuated, and for automatically securing synchronism between the transmitting and receiving instruments, is actuated by means of an independent circuit or second line-wire, which extends through the receiving instrument or instruments, and is preferably operated by an independent battery at the transmitting-station. The electrical currents or pulsations traversing this second main circuit are transmitted by a special pole-changing key, the movements of which are controlled by the apparatus hereinbefore described. This key consists of a horizontal metallic lever, 57, pivoted, in the usual manner of a key, at its center 58. (See Figs. 1, 2, and 12.) An L-shaped arm, 59, extends downward from the center of the lever 57, passing underneath or within the base, and terminating in a flexible resilient upward projection, 60, which is clamped between the adjustable screws 61 and 62. The object of this device is to maintain the key-lever 57 normally in a horizontal or central position, but to permit it to be inclined in one direction or the other in response to the action of the electro-magnets 63 and 64 upon their armatures 65 and 66, which armatures are fixed upon the key-lever 57 at equal distance from but on opposite sides of its fulcrum 58. The key-lever 57 actuates certain pole-changing devices for transmitting electric currents, which are shown in Figs. 1, 2, and 12, but will be more readily understood by reference to Fig. 5, which shows an end view of the lever 57 in its normal or central position. When in this position the lever 57 rests between two flexible resilient contact-springs, 67 and 69, which are mounted upon suitable standards, 68 and 70, projecting from the base of the apparatus. When the lever 57 is in its normal position of rest the circuit-springs 67 and 69 are both in contact with it, as shown in Fig. 5. The standard 71 is yoke-shaped at its upper extremity, and carries adjustable contact-screws 72 and 73. The contact-screw 72 is so adjusted that when the end of the lever 57 is depressed the spring 67 is brought into contact therewith, and by the same movement the existing contact between the lever 57 and the spring 67 is interrupted. In the same manner, when the lever 57 is elevated the spring 69 comes in contact with the screw 73, and at the same time breaks contact with the lever 57.

The arrangement of the second main battery and second main circuit with reference to the pole-changing key last described will be best understood by reference to Figs. 5 and 12. The main battery 74 has its positive pole connected by a wire, 75, with the standard 71, and its negative pole in like manner connected by a wire, 76, with the key-lever 57. The standard 68 is connected by a wire, 77, with the earth, and the standard 70 with the second line-wire, 78, extending to the receiving-station. By an inspection of Figs. 5 and 12 it will be seen that when the key-lever 57 is in its normal position the line 78 is connected directly with the earth through the standard 70, spring 69, key-lever 57, spring 67, standard 68, and wire 77. When the key-lever 57 is elevated the positive or copper current is sent to line, the circuit being as follows: from the earth, through the wire 77, standard 68, spring 67, lever 57, wire 76, main battery 74, wire 75, standard 71, contact-screw 73, spring 69, and standard 70, to the line 78. When, on the contrary, the key-lever is depressed, a negative or zinc current is sent to line, the route of which is as follows: from the earth to the wire 77, standard 68, spring 67, contact-screw 72, standard 71, wire 75, main battery 74, wire 76, key-lever 57, spring 69, and standard 70, to the line-wire 78.

The movements of the pole-changing key 57 are controlled by means of the two electro-magnets 63 and 64 and a local battery operated by the keys of the key-board. The connections of this local battery will be understood by reference to Fig. 12. The local battery is shown at 79, one of its poles being connected by a wire, 80, with the key-board wires 53 and 55, which are also a part of the main circuit, and have already been described in that connection. The other pole of the local battery 79 is connected by means of the wire 80 and the branch wires 81 and 82 with the electro-magnets 63 and 64, which operate the hereinbefore-described pole-changing key. The electro-magnet 64 is connected by means of a wire, 83, with the metallic rack 45, in which the row or series of keys 42 is mounted. In like manner the electro-magnet 63 is connected by means of the wire 84 with the metallic rack 47, in which the row of keys 44 is mounted. Hence if any one of the keys in the row 42 (representing the letters of the alphabet) is depressed it not only closes the shunt of the rheostat in the first main circuit, as hereinbefore explained, but also closes the local circuit of the local battery 79 through the electro-magnet 64, the route of the current being from the battery 79 through the wires 80 and 81, electro-magnet 64, wire 83, rack 45, key 42, tooth of metallic comb 46, and wires 55 and 80. In precisely the same manner, if any key in the row 44 (representing the numerals or other characters) is depressed, the circuit of the local battery 79 is closed through the electro-magnet 63, the route being as follows: from the battery 79 by the wires 80 and 82, electro-magnet 63, wire 84, rack 47, key 44, tooth of comb 48, and wires 53 and 80. The general

effect produced by this organization therefore is that when any one key of the row 42 is depressed a local circuit is completed from battery 79 through the electro-magnet 64, and a positive current is thereby caused to pass over the second line-wire, 78, from the second main battery, 74, so long as the said key is depressed; and in like manner when any key in the row 44 is depressed a negative current is sent over the second line-wire from the same battery, and the polarity of the current thus transmitted over the second line-wire, through the operation of mechanism hereinafter to be described, determines whether a letter or a numeral shall be printed from the type-wheel of the receiving-instrument or a space or blank produced in the printed record.

The means which I employ for maintaining correspondence between the transmitting and receiving mechanism consists in the transmission of a single electric impulse, always of the same polarity, once in each revolution of the traveler 41, which impulses pass over the second line-wire to the receiving-station. This result is effected by means of a rotating arm, 85, fixed upon the shaft 25, which carries the traveler 41. This arm is provided with a projecting beveled pin, 88, (best seen in the detached view, Fig. 6,) which pin, at each revolution of the arm 85, comes in contact with a similar beveled pin, 87, upon the key-lever 57 when the latter is in its normal position of rest, but not otherwise. The effect of this arrangement is that once during each revolution of the shaft 25, just as the traveler 41 passes the zero-point, the pin 88 passes by and depresses the pin 87, thus elevating the opposite end of the key-lever 57 and sending a momentary positive pulsation over the second line-wire, 78. It will be understood, therefore, that this positive pulsation of momentary duration is transmitted at one particular point—that is to say, the zero-point—in each revolution of the transmitting apparatus.

The apparatus at the receiving-station which is employed for printing the communications may, like the transmitting apparatus, be conveniently regarded as consisting of four sets of mechanism. The first of these produces or controls the intermittent rotation of the type-wheel axis and type wheel. The second produces the impression of each character as required upon the paper and moves the latter forward to the type-wheel, in readiness for the next impression. The third determines the particular character of the impression, whether it shall be a letter, numeral, or space, and the fourth maintains the synchronism of the type-wheel with the transmitting apparatus at the sending-station and restores the type-wheel to its proper position in relation to the transmitter in case it is thrown out of correspondence by accident or otherwise.

The first part of the receiving apparatus comprises a double type-wheel, (see Figs. 7, 8, 10, and 11,) which consists of two separate type-wheels, 88 and 89, mounted side by side upon the same arbor, 90. Each of these type-wheels contains the same number of divisions—viz., twenty-eight. The type-wheel 88 has twenty-eight characters corresponding with those upon the twenty-eight keys of the key-board 42 in Fig. 4. The type-wheel 89 has a similar set of characters, consisting of numerals, &c., corresponding to those of the row of keys 44 upon the key-board. Upon the type-wheel arbor 90 is fixed a scape-wheel, 91, having fourteen teeth. The type-wheel and scape-wheel tend to rotate continuously in the direction indicated by the arrow in Fig. 9, being impelled by a train of wheel-work, 92, which receives its motion from a barrel, 93, and cord 94, to which a weight is attached. This mechanism may be wound up as required by applying a suitable key to the winding-post 95. The type-wheels 88 and 89 are held in check by a double-acting anchor-escapement, 96, the pallets of which engage alternately with opposite teeth of the scape-wheel 91. The escapement 96 is fixed to a rock-shaft, 97, from which projects an arm, 98, carrying the armature 99. Two electro-magnets, 100 and 101, are arranged with their poles facing each other upon opposite sides of the armature 99, as best seen in Figs. 7 and 9. The yoke or back armature of each of these electro-magnets consists of a permanent magnet of horseshoe form, 102 and 102, into the opposite poles of which the respective cores of the electro-magnets 100 and 101 are inserted. Each permanent magnet induces corresponding polarity in the respective cores of its attached electro-magnet, and thus the latter are rendered in effect permanently magnetic while of opposite polarity.

By reference to Fig. 13 it will be seen that the north and south poles of the permanent magnets 102 102 (indicated by the letters *n* and *s*,) are placed in such relation to the cores of the electro-magnets 100 and 101 that the respective similar poles of the latter face each other upon opposite sides of the armature 99—that is to say, two north poles face each other at one end and two south poles at the other end of the same armature. The continuous conducting-wire 18, which is included in and forms a part of the first line-wire, is wound helically around these cores, successively, in the manner illustrated in the figure. By tracing this wire in the direction indicated by the arrows it will be observed that it is wound in one direction around one core of the electro-magnet 100 and in the opposite direction around the other core of the same, after which it passes to that core of electro-magnet 101 whose like pole faces that of the last-named core and is wound around it in the same direction; but its direction is again reversed in passing around the other core of the electro-magnet 101, so that its convolutions are now in the same direction as those of the facing core of the other electro-magnet. Thus it will be understood that the conductor is wound in the

same direction around the cores whose like poles face each other and in opposite directions around the cores which do not face each other. If, therefore, no current is passing through the wire 18, the armature 99 will be attracted indifferently by either electro-magnet 100 or 101; but if a current of one polarity is made to traverse the wire 18 the normal magnetism in one of the electro-magnets will be increased and that in the other diminished, and the reverse effect will take place when a current of opposite polarity traverses the circuit. Thus a positive current flowing in the direction indicated by the arrows would tend to increase the normal magnetism existing in the cores of the electro-magnet 100 and to diminish or destroy that in the electro-magnet 101, while a negative current would produce precisely the opposite effect. Hence when alternate pulsations of positive and negative electricity are transmitted through both electro-magnets (these being included in the same circuit) the armature 99 is caused to vibrate to and fro with great rapidity.

The printing mechanism consists of a lever, 103, (see Figs. 7 and 10,) fixed upon an arbor or shaft, 104, which lever carries a cylindrical pad or platen, 105, and a paper-feeding mechanism, 106, of the usual or of any suitable construction, by means of which a paper ribbon or tape, 107, is drawn forward to receive the impression of the successive characters from the type-wheel, as required. The paper-feeding mechanism is actuated in a well-known manner by the retrograde movement of the printing-lever 103 after the impression has been taken. The electro-magnet 108 actuates the printing-lever by direct magnetic attraction exerted upon its armature 109, which armature is attached to the axis 104 of the printing-lever 103, as best seen in Fig. 10.

The printing-magnet 108, Fig. 10, is included in the first main-line circuit, 18, together with the magnets 100 and 101, Fig. 9, which control the movements of the type-wheels, and is brought into action, when required, by an increased strength of current during the time of a single pulsation proceeding from the transmitting-station, irrespective of its polarity. The printing mechanism is thus actuated for the reason that the soft-iron or neutral armature 109 responds equally to either positive or negative currents, provided they are of sufficient strength. The current of increased strength required for printing is transmitted from the sending-station by the short-circuiting of the rheostat 52 at the transmitting-station through a key of the key-board, in the manner hereinbefore explained. The normal positive and negative pulsations traversing the first main line, although of sufficient strength to oscillate the type-wheel armature, are quite insufficient to actuate the printing mechanism. Hence the printing is effected by simply increasing the strength of one of the pulsations, whether positive or negative, at the instant the required character upon the type-wheel is opposite the platen, and this is done, as hereinbefore shown, without stopping the type-wheel.

The mechanism which determines whether a given impression shall be taken from one or the other of the two type-wheels, or from neither of them, when it is necessary to produce a space, will now be described. The platen 105 consists of a roller having a curved or convex face, as best seen in Figs. 11 and 11ª. This platen is mounted in a frame, 110, which is fixed upon a horizontal axis, 111, which axis is mounted in bearings 112 upon the lever 103, so as to admit of a horizontal rocking or oscillatory motion of the platen 105. The second main circuit, 78, coming from the transmitting-station, passes through the coils of an independent electro-magnet, 112ª, Fig. 11, which is provided with a polarized armature, 113, which latter is connected by a link, 114, with a clutch-lever, 115, which moves upon an axis, 116. The clutch-lever 115 is provided with two angular arms, 117 and 118, which extend inwardly far enough to engage with one end or the other, as the case may be, of the oscillating platen 105. If the clutch-lever 115 is in its central position, as shown in Fig. 11, and the printing-lever 103 is then actuated, the platen 105 cannot come quite into contact with the type-wheels, because it is arrested by the projections 117 and 118 of the clutch 115; but the paper-feeding mechanism operates as usual upon the return of the platen, and hence a space is produced upon the paper. If the polarized armature 113 is deflected, as indicated by the dotted lines in Fig. 11, the clutch 115 is moved to one side, as shown by dotted lines in Fig. 11, and in the detached view, Fig. 11ª. Hence if the printing-lever 103 is actuated the platen 105, in moving toward the type-wheels, strikes against the projection 117 only and is tilted on its axis, so that its face comes in contact with the type-wheel 88, but not with the type-wheel 89, as shown in Fig. 11ª. On the other hand, if the polarized armature 113 is deflected in the opposite direction, the clutch-lever 115 will be shifted, and the impression will be taken from the other type-wheel, 89, in the same manner. Thus it will be understood that while the impression is produced by the action of the electro magnet 108 the position of the polarized armature 113 determines whether that impression shall be taken from the type-wheel 88 or 89, or from neither of them, and consequently, whether the character printed shall be a letter, a numeral, or a space. When no current whatever is passing through the electro-magnet 112ª, which, as heretofore explained, is the normal condition of the second circuit, the central position of the armature 113 is maintained by means of springs 120 and 121, mounted upon a standard, 122. A pin, 123, is inserted into the clutch-lever 115 and plays between these two springs. The yielding of the respective springs

permits the lever to play in one direction or the other, according as the deflection of armature 113 is produced by a positive or a negative current, and they restore it to a central position when no current is passing. The double type-wheel is supplied with ink, in the usual manner, by means of a suitable ink-roller, 119.

In order to render it certain that the engraved letter upon the type-wheel from which the impression is to be taken shall be exactly opposite the platen when the latter is brought into contact with it, so as to insure a clear and distinct impression upon the paper, the type-wheels 88 and 89 are not attached rigidly to the arbor 90, but are mounted upon a sleeve, 124, together with a toothed wheel, 125. This sleeve, with its toothed wheel and type-wheels, is attached to the shaft by means of a yielding spring, 126.

Upon the printing-lever 103 is fixed a corrector, 127, which consists of a projecting arm or tooth, which engages with one tooth of the wheel 125 when the printing-lever rises, and holds the type-wheels in the proper position during the instant that elapses while the impression is being made, even if the type-wheel axis 90 is moving forward at the same instant.

The unison mechanism comprises an arm, 128, which is fixed upon the type-wheel shaft 90 and revolves with it. A stop, 129, projects from the upper corner of the clutch-lever 115 into the path of the rotating arm 128, provided the clutch-lever 115 is in its normal—that is to say, central—position. Hence if the clutch-lever remained constantly in this position the stop 129 would arrest the motion of the arm 128, and consequently that of the type-wheels also. So long, however, as the transmitting and receiving instruments remain in correspondence the projection 129 is withdrawn from the path of the arm 128 at the proper moment by the action of the electric pulsation which is transmitted once during each revolution of the traveler 41, as hereinbefore explained, by the action of the arm 85 and beveled pin 86. If, however, the type-wheels 88 and 89 are out of correspondence with the traveler 41, the stop 129 will not be withdrawn from the path of the arm 128 at the moment of its arrival, and consequently the type-wheels will be arrested and held until the traveler arrives at the zero-point in its next revolution, when the transmission of the synchronizing pulsation will act upon the electro-magnet 112^a and unlock the arm 128, permitting the type-wheel to go forward. The instruments at the transmitting and receiving stations may therefore be brought into correspondence at any time when necessary by merely permitting the type-wheels to make one or more revolutions without printing.

The manner in which the apparatus is operated requires but little additional explanation other than that which is contained in the description hereinbefore given. When the apparatus is to be used the shaft 25 is kept in continuous rotation by the band passing around the pulley 27, and an uninterrupted succession of alternate positive and negative pulsations is transmitted over the first main line, 18. These pulsations pass through the electro-magnets 100 and 101, which control the type-wheels of the receiving-instrument, and also through the electro-magnet 108, which actuates the printing mechanism. The vibrating armature of the electro-magnets 100 and 101 permits the type-wheel shaft 90, by the propelling force of the weight and the clock-work, to revolve constantly in one direction with a uniform rate of progression. The type-wheels at the receiving-station move synchronously with the traveler at the transmitting-station, and the correspondence between the two is insured by the agency of the unison device, which has already been described. When one of the keys upon the key-board is depressed no effect is produced upon the first line-wire until the traveler passes over that segment of the sunflower which corresponds to the depressed key. When this occurs, however, the rheostat 52 is momentarily cut out of the main circuit, which increases the strength of the current sufficiently to actuate the printing-magnet 108 of the receiving-instrument, which attracts its armature momentarily, and thereby raises the platen 105 toward the type-wheels 89 and 88. If the key depressed be one of the first row, representing a letter of the alphabet, a positive current is sent over the second wire during the time it is so depressed, which acts upon the polarized armature 113 of the electro-magnet 112^a and causes the platen to be tilted, as in Fig. 11^a, so as to print a letter from the type-wheel 88, whereas if a key in the third row is depressed a negative current is transmitted and a numeral is printed from the type-wheel 89. If any one of the middle row of keys is depressed, no current is transmitted over the second main circuit. Hence the armature 113 remains in its central position and the platen 105 is prevented from coming in contact with either of the type-wheels, and a blank or space accordingly appears upon the paper.

My improved apparatus is capable of transmitting communications with much greater rapidity—that is to say, of printing a much greater number of characters in a given time or by means of a given number of pulsations—than those heretofore in use. This result is partly due to the method which is employed of printing from the type-wheel without interrupting or retarding its progressive movement, and partly to the circumstance that a space may be printed during any portion of the revolution of the type-wheel and without reference to its position, instead of a single point only in each revolution. Under ordinary circumstances at least one space is required in every four or five letters. Hence it is obvious that an important saving of time is effected by inserting the space or blank in the printed record immediately after the last letter of any given

word, and during that portion of the revolution of the type-wheel which takes place after the last letter of one word has been printed, and prior to the printing of the first letter of the next succeeding word.

It is to be understood that any required number of independent printing-instruments at the same or different receiving-stations may be included in the circuit of the same pair of main-line wires and actuated simultaneously by a single key-board and transmitting apparatus constructed and operated in the manner hereinbefore set forth.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of a main line, a main battery, a series of insulated metallic segments, a series of branch conductors, one of which is electrically connected with each of said segments, a series of finger-keys for establishing electrical connection between the main line and any one of said branches at the will of the operator, a traveler and mechanism for causing the same to pass over and make electrical contact successively with each segment in the series, an artificial resistance included in the circuit of said main line, and a branch conductor connecting the traveler with the main line, whereby the said resistance is cut out of the main circuit by the traveler while passing over the segment corresponding to the particular key which is depressed.

2. The combination, substantially as hereinbefore set forth, of a main line, a main battery, a series of insulated metallic segments, a traveler and means for causing the same to pass successively over each segment in the series, a pole-changer mechanically connected with the axis of said traveler for reversing the poles of the main battery with reference to the line when the traveler passes from one segment to the next succeeding one, a series of keys, each key of which is connected with one of said segments, and a rheostat included in said main line, which is cut out by the traveler while passing over the segment corresponding to the particular key which is depressed.

3. The combination, substantially as hereinbefore set forth, of a series of insulated metallic segments, a traveler and means for causing the same to pass over and make contact successively with each segment of the series, a main line extending to the distant station, a main battery, a traveler, a pole-changer whereby the polarity of the battery with reference to the main line is reversed when the traveler passes from one of the segments of the series to the next succeeding one, a rotating arm rigidly connected with the traveler, a key-lever momentarily actuated by said rotating arm at the same point in each successive revolution, a main line extending to the distant station, and a second main battery which is connected with said line by said key-lever when the latter is momentarily actuated by the rotating arm.

4. The combination, substantially as hereinbefore set forth, of a key-board having its keys arranged in three rows, a main battery, a main line extending to the distant station, a local battery, two electro-magnets, a conductor connecting said magnets with the key-board and including said local battery, and a key-lever actuated by said key-board and capable of being placed in three positions, of which the first position connects the positive and the second the negative pole of the main battery to the line, while the third disconnects the battery from the line.

5. The combination, substantially as hereinbefore set forth, of two rigidly-united type-wheels, a platen, mechanism substantially such as described for causing said platen to oscillate so as to print from one or the other of said type-wheels, an electro-magnet for impelling said platen toward the type-wheels, and an independent electro-magnet for controlling the lateral movement of the oscillating platen.

6. The combination, substantially as hereinbefore set forth, of two rigidly-united type-wheels, a platen, mechanism substantially such as described for causing said platen to oscillate so as to print from one or the other of said type-wheels, an electro-magnet for impelling said platen toward the type-wheel, a polarized armature for controlling the lateral movement of the oscillating platen, and an independent electro-magnet for actuating said polarized armature.

7. The combination, substantially as hereinbefore set forth, of two rigidly-united type-wheels, a laterally-oscillating platen having a convex or curved face, and mechanism substantially such as described for controlling the lateral oscillation of said platen.

8. The combination, substantially as hereinbefore set forth, of two rigidly-united type-wheels, a platen capable of three positions, mechanism substantially such as described for oscillating said platen, and an armature for controlling the lateral oscillation of the platen which is capable of three positions corresponding to the respective positions of the platen.

9. The combination, substantially as hereinbefore set forth, of two rigidly-united type-wheels, a laterally-oscillating platen, and a clutch-lever substantially such as described for controlling the lateral position of the oscillating platen with reference to the plane of the type-wheels.

10. The combination, substantially as hereinbefore set forth, of a type-wheel or type-wheels, a platen, a paper-feeding mechanism actuated by the mechanism which moves the platen, and mechanism substantially such as described for arresting the movement of the platen, whereby the paper-feed may be actuated at any point in the revolution of the type-wheel without bringing the platen into contact with said type-wheel.

11. The combination, substantially as hereinbefore set forth, of a type-wheel or type-

wheels, a platen, mechanism for impelling said platen toward the type-wheel or type-wheels, a clutch, and mechanism substantially such as described for interposing said clutch between the platen and the type-wheel or type-wheels, whereby the movement of the platen may be arrested and its contact with the type-wheel or type-wheels prevented.

12. The combination, substantially as hereinbefore set forth, of a type-wheel axis, a sleeve mounted upon said axis, a type-wheel or type-wheels and a toothed wheel rigidly mounted upon said sleeve, a yielding mechanical connection between said sleeve and the type-wheel axis, a platen, and a corrector or projection rigidly affixed to the printing-lever for locking the type-wheel or type-wheels by engaging with said toothed wheel while the platen remains in contact with the type-wheel.

13. The combination, substantially as hereinbefore set forth, of a type-wheel axis, a rotating unison-stop fixed upon said axis, a clutch-lever, a pin on said clutch-lever normally projecting into the path of the rotating unison-stop, an electro-magnet for actuating said clutch-lever and withdrawing said pin from the path of the unison-stop, a rotating arm upon the transmitting-axis, and a key for transmitting a momentary current through said electro-magnet once during each revolution of the transmitter and type-wheel axis when said key is actuated by said rotating arm.

In testimony whereof I have hereunto subscribed my name this 7th day of September, A. D. 1881.

HENRY VAN HOEVENBERGH.

Witnesses:
CYRUS TAYLOR,
PHINEAS TAYLOR.