(No Model.) 7 Sheets—Sheet 1.

C. L. BUCKINGHAM.

PRINTING TELEGRAPH.

No. 487,982. Patented Dec. 13, 1892.

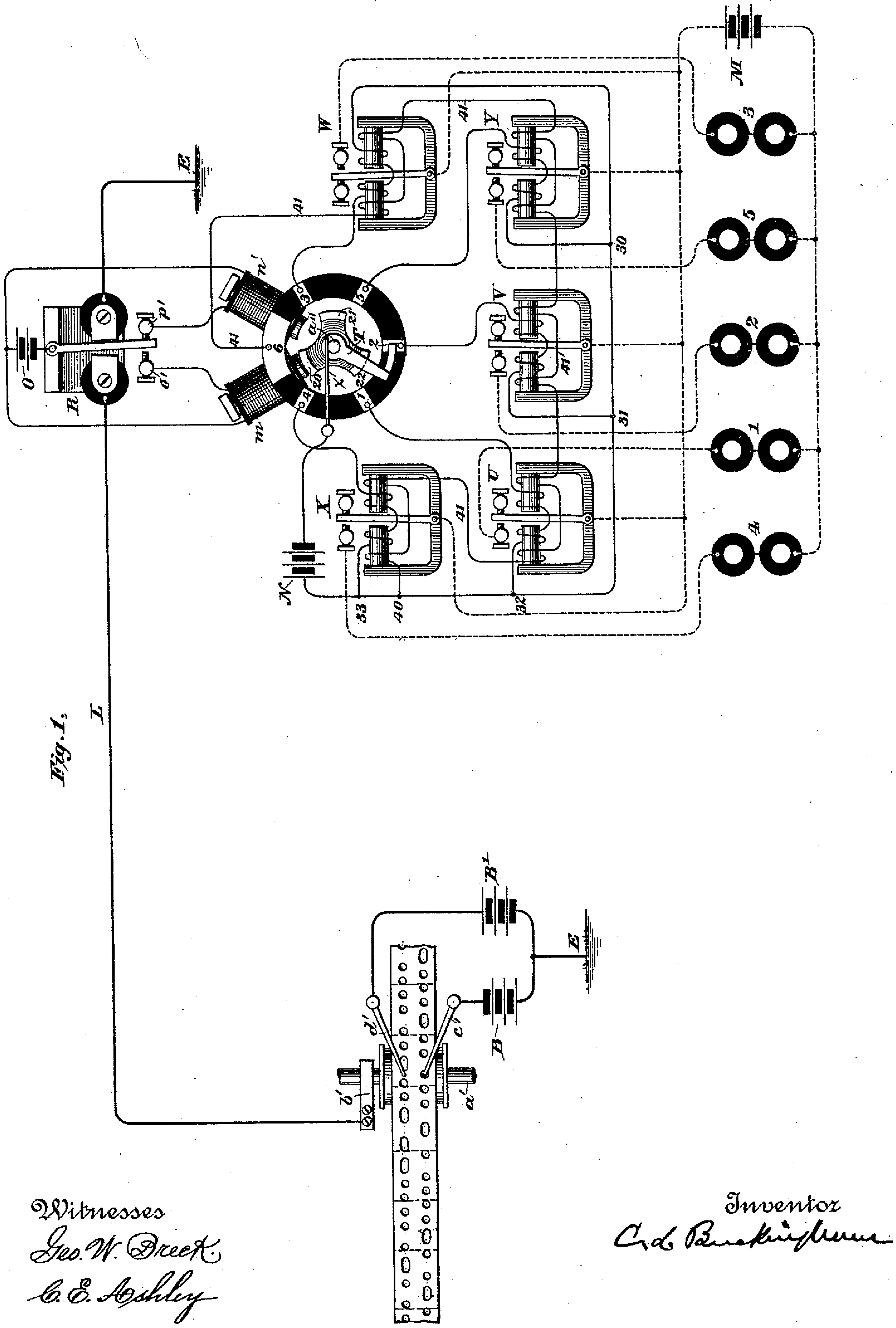

Fig. 1.

Witnesses
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C. E. Ashley

Inventor
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 7 Sheets—Sheet 2.

C. L. BUCKINGHAM.
PRINTING TELEGRAPH.

No. 487,982. Patented Dec. 13, 1892.

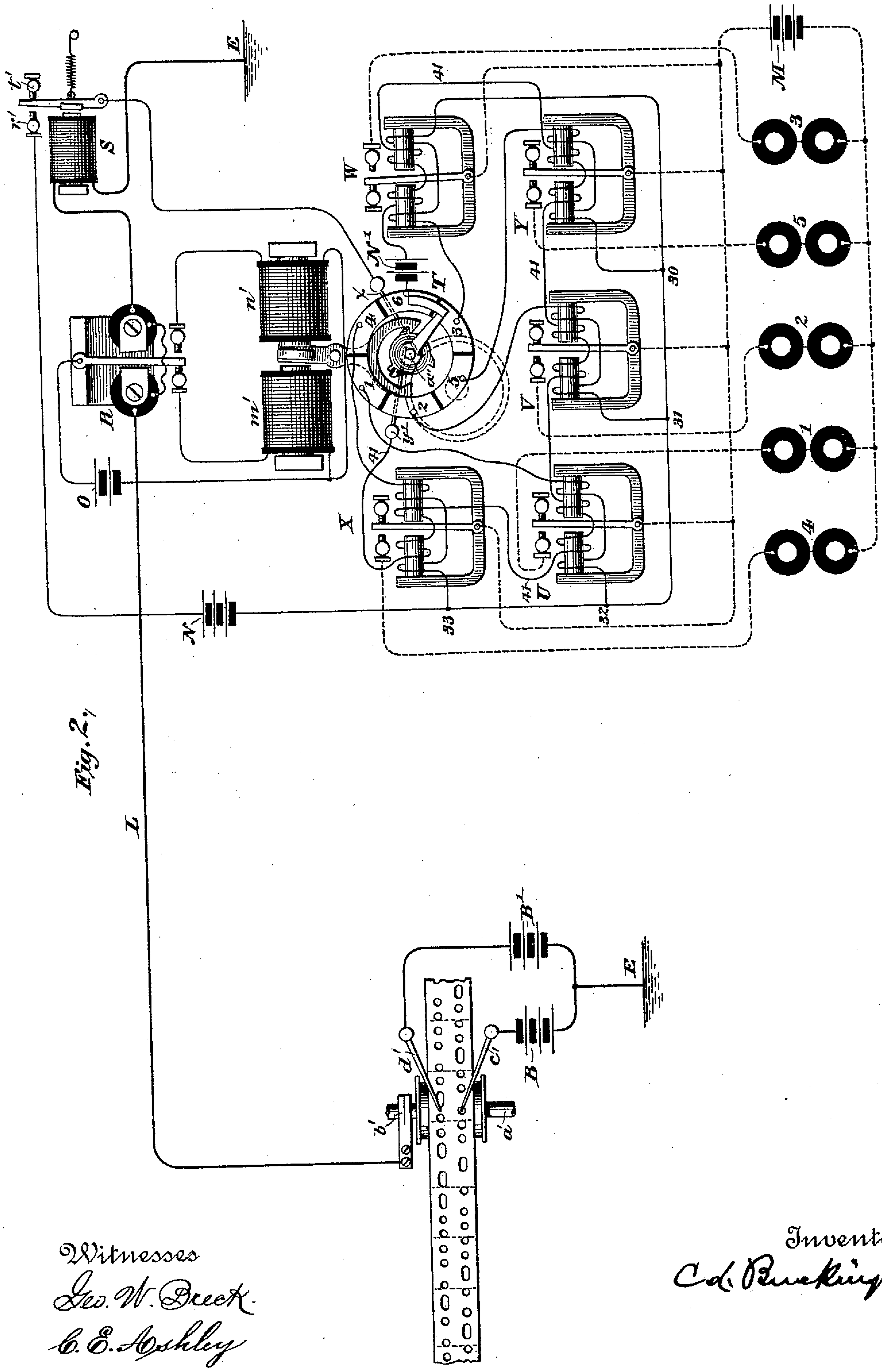

Fig. 2.

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(No Model.)

7 Sheets—Sheet 3.

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PRINTING TELEGRAPH.

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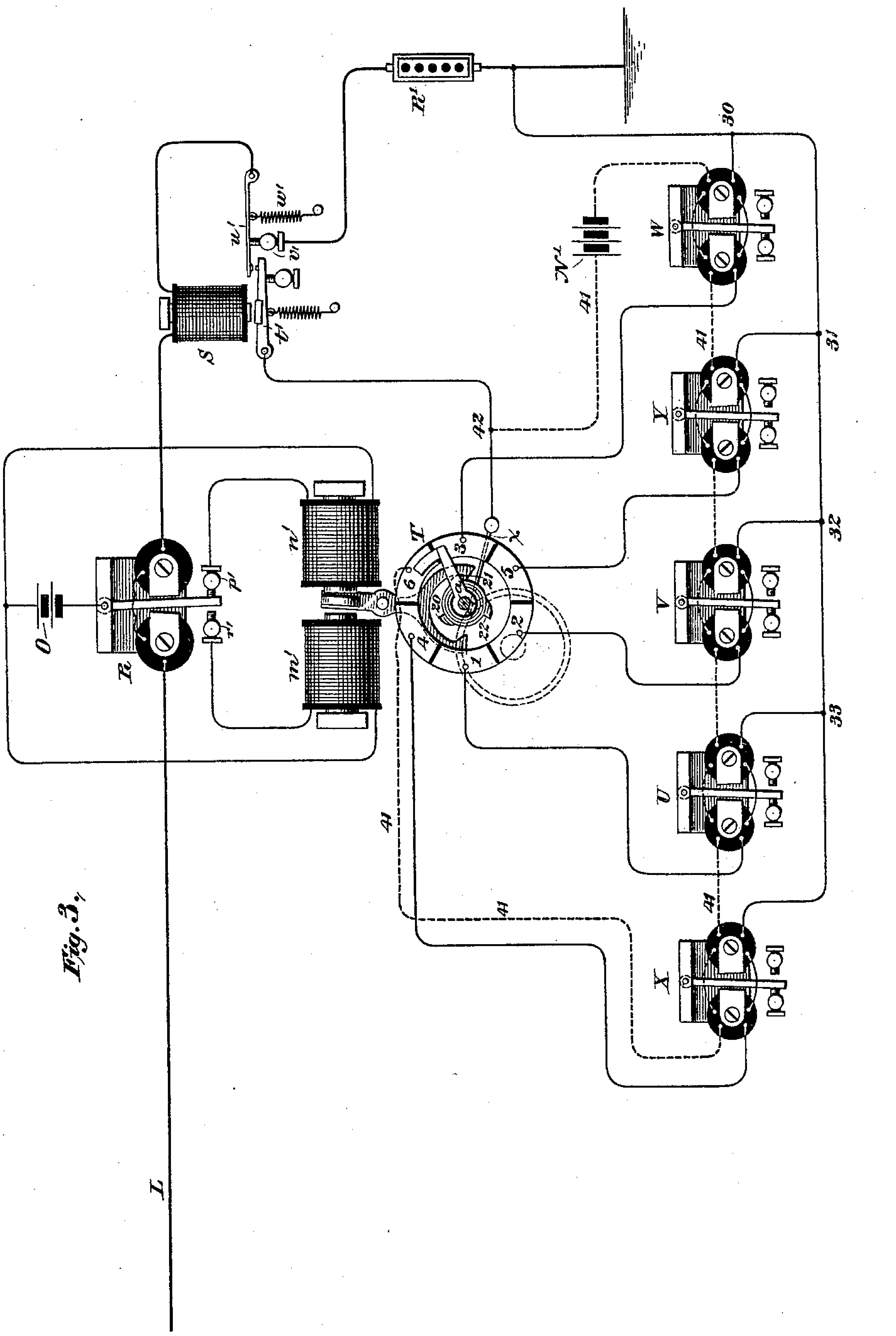

Witnesses
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(No Model.)

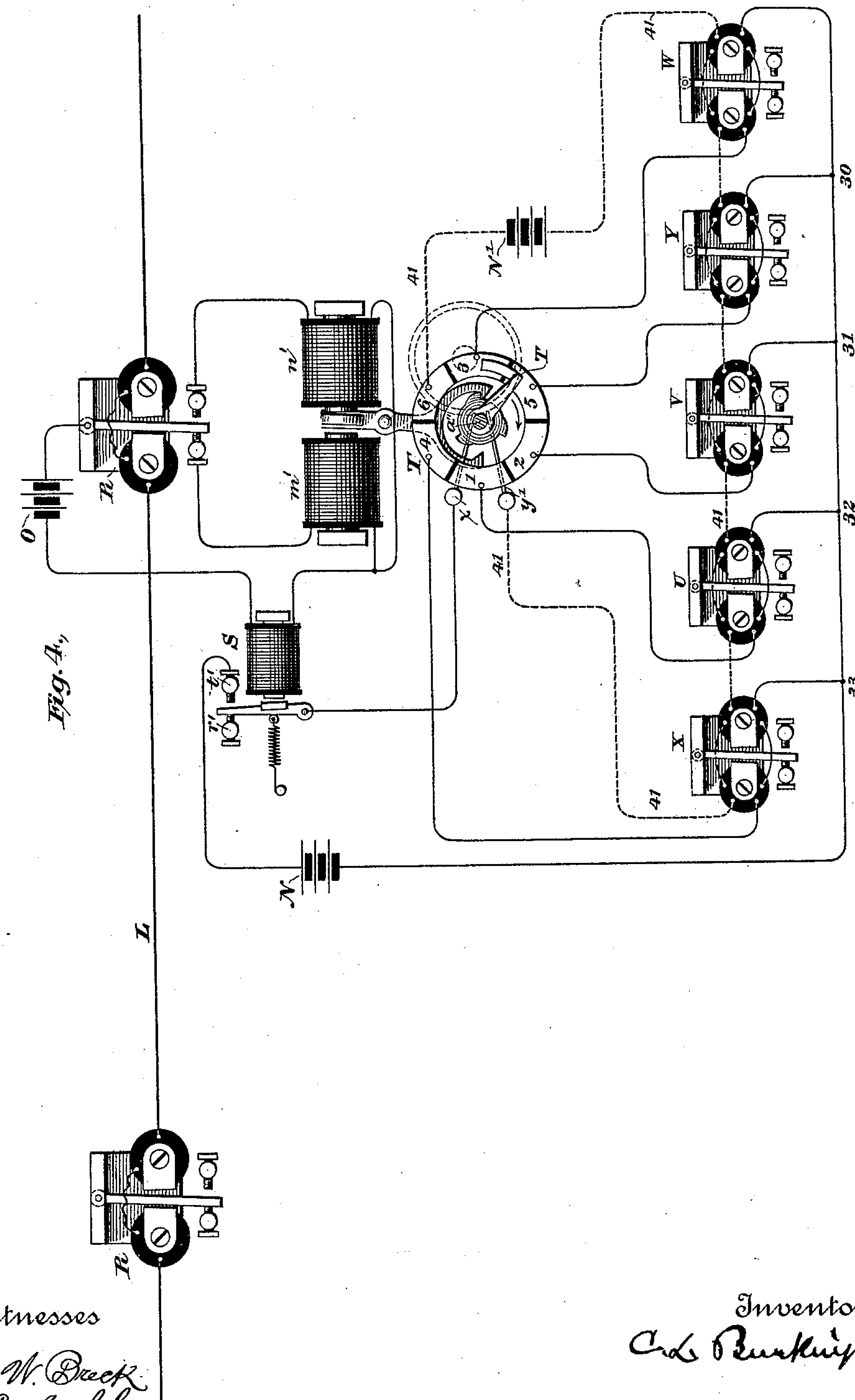
7 Sheets—Sheet 4.

C. L. BUCKINGHAM.

PRINTING TELEGRAPH.

No. 487,982.

Patented Dec. 13, 1892.



Witnesses

Geo. W. Breck

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Inventor

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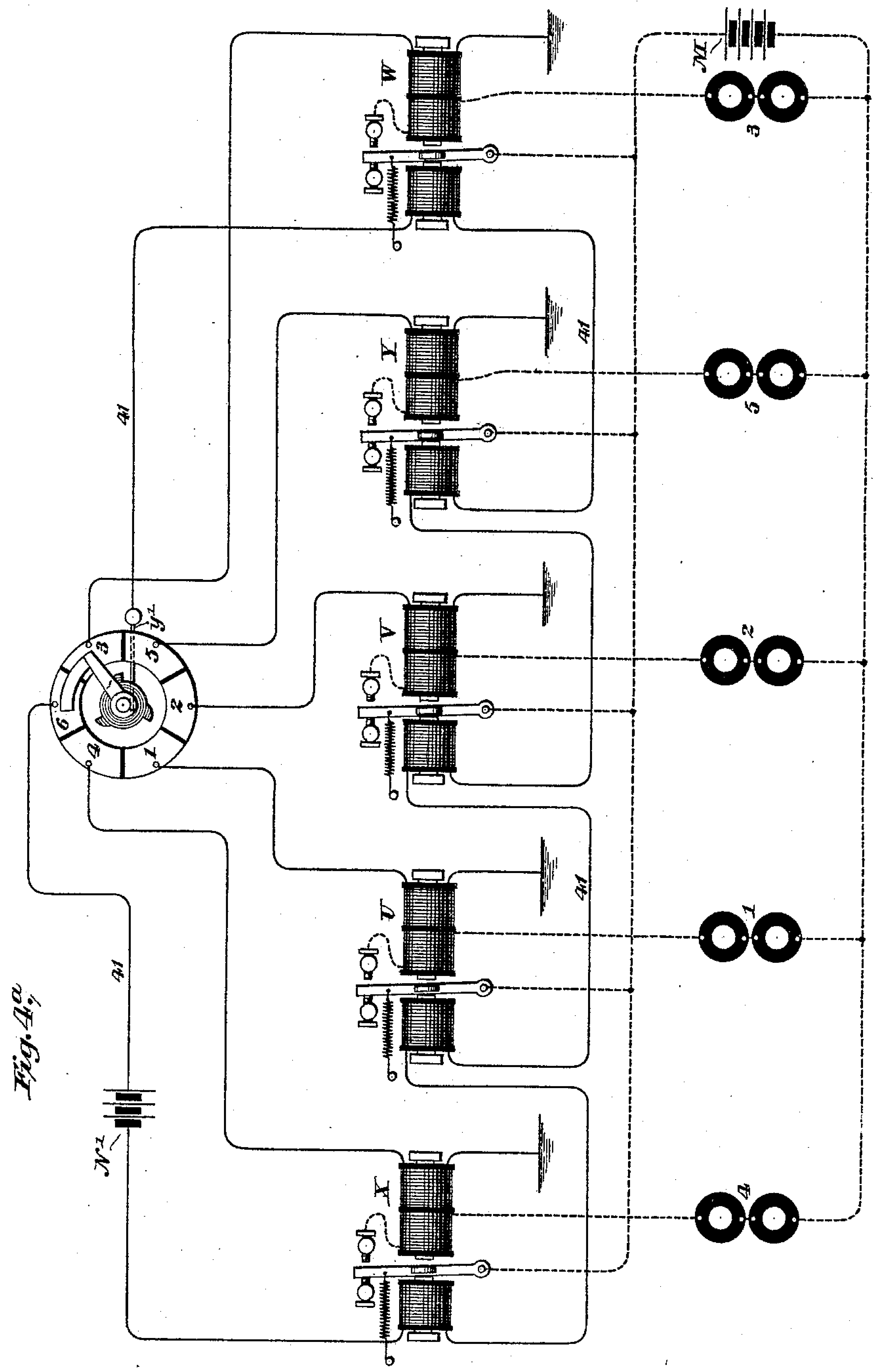
(No Model.)

7 Sheets—Sheet 5.

C. L. BUCKINGHAM.
PRINTING TELEGRAPH.

No. 487,982. Patented Dec. 13, 1892.



Witnesses
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 7 Sheets—Sheet 6.

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PRINTING TELEGRAPH.

No. 487,982. Patented Dec. 13, 1892.

Fig. 5.

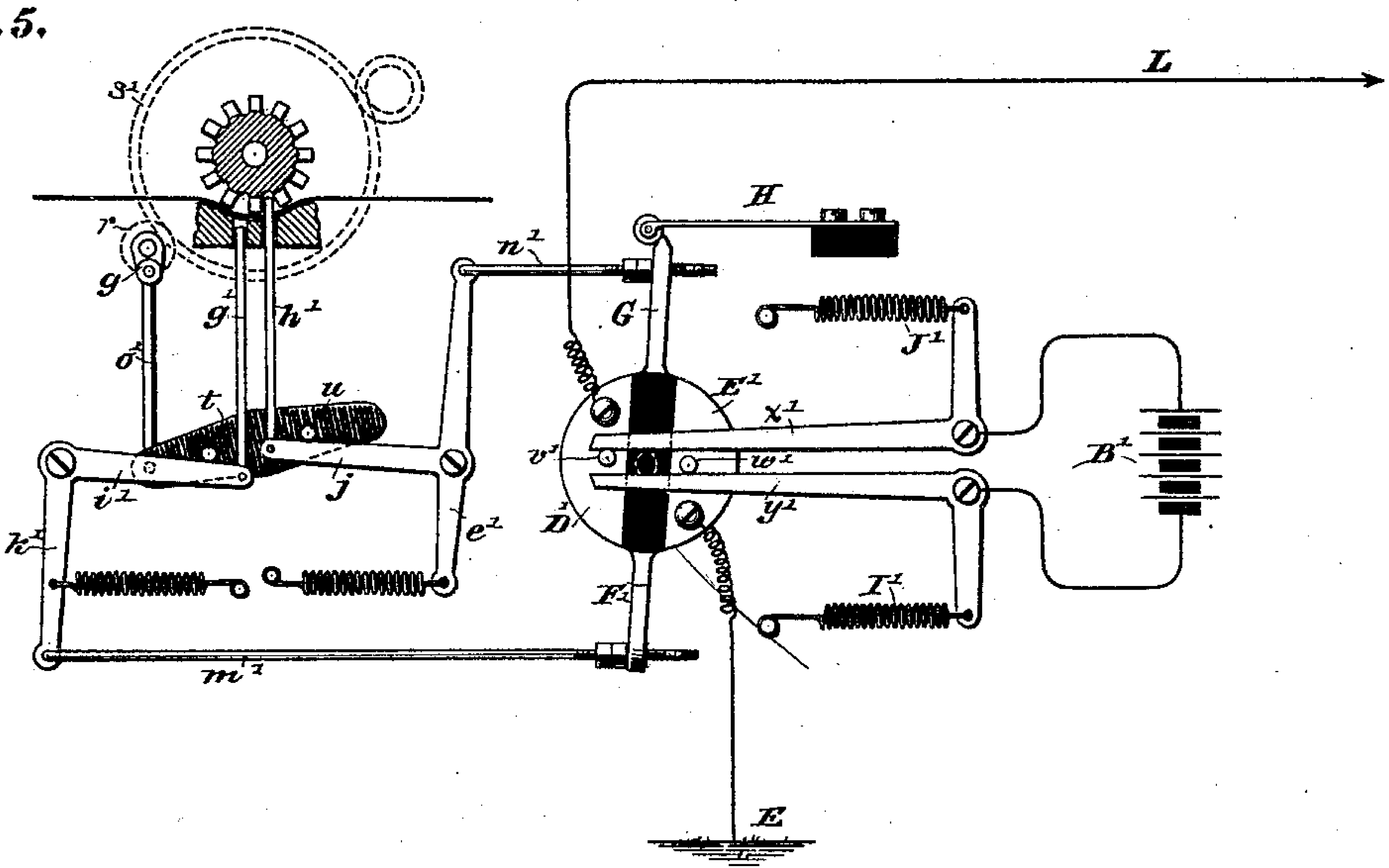


Fig. 6.

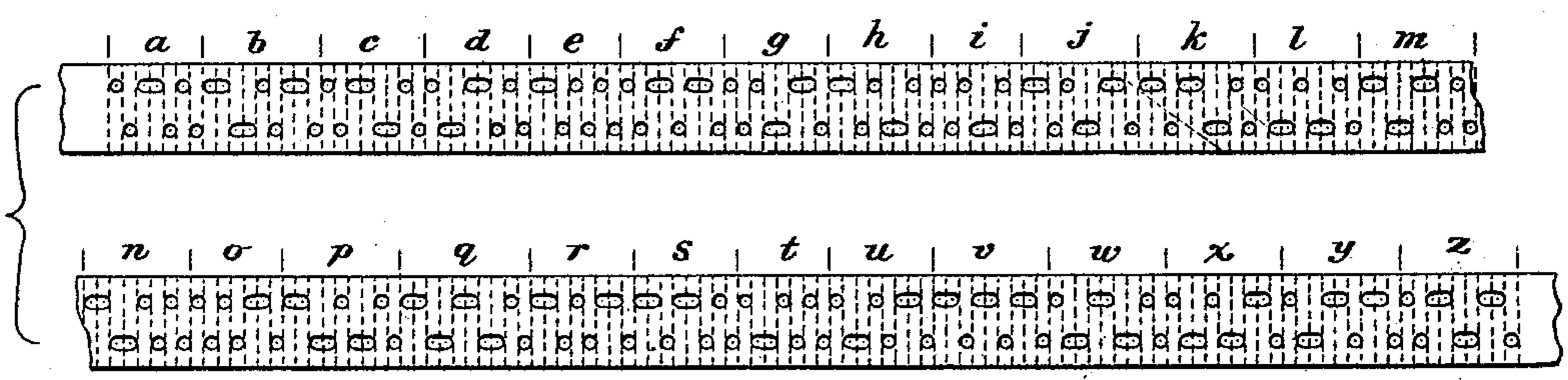
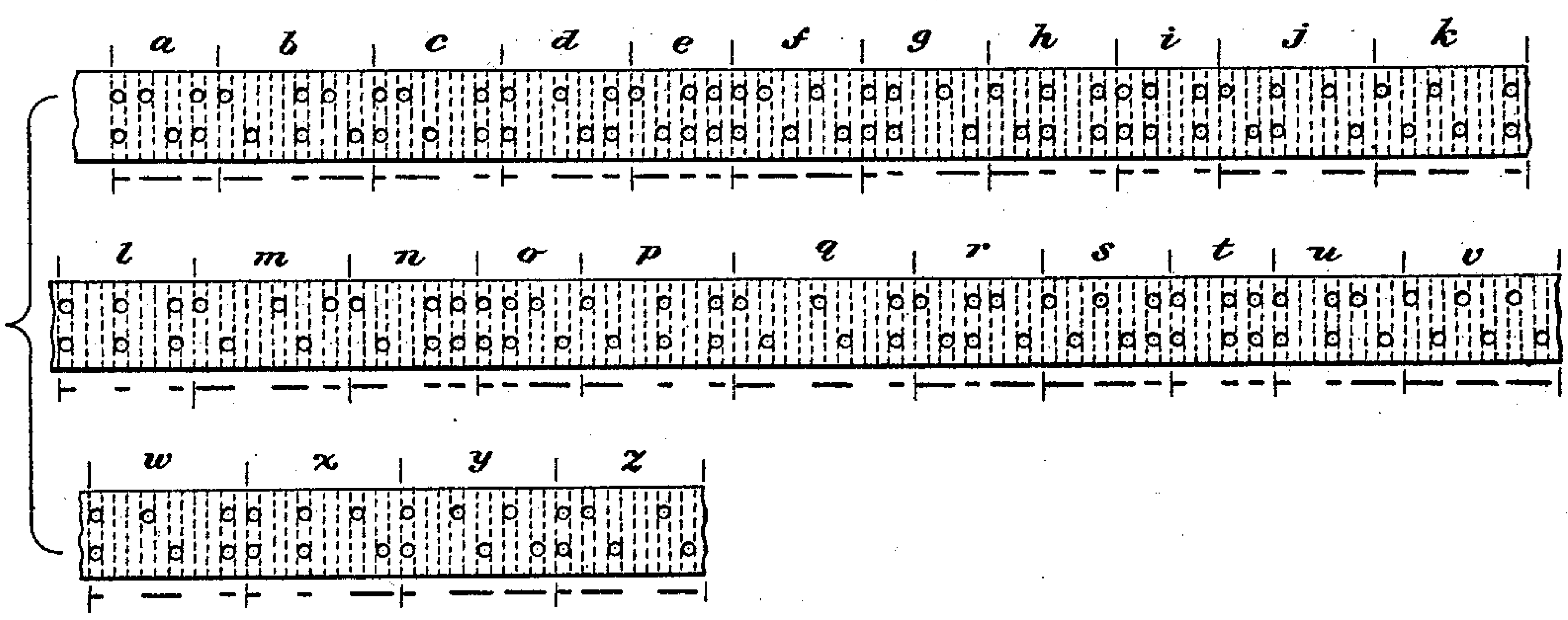


Fig. 7.



Witnesses
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(No Model.) 7 Sheets—Sheet 7.

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PRINTING TELEGRAPH.

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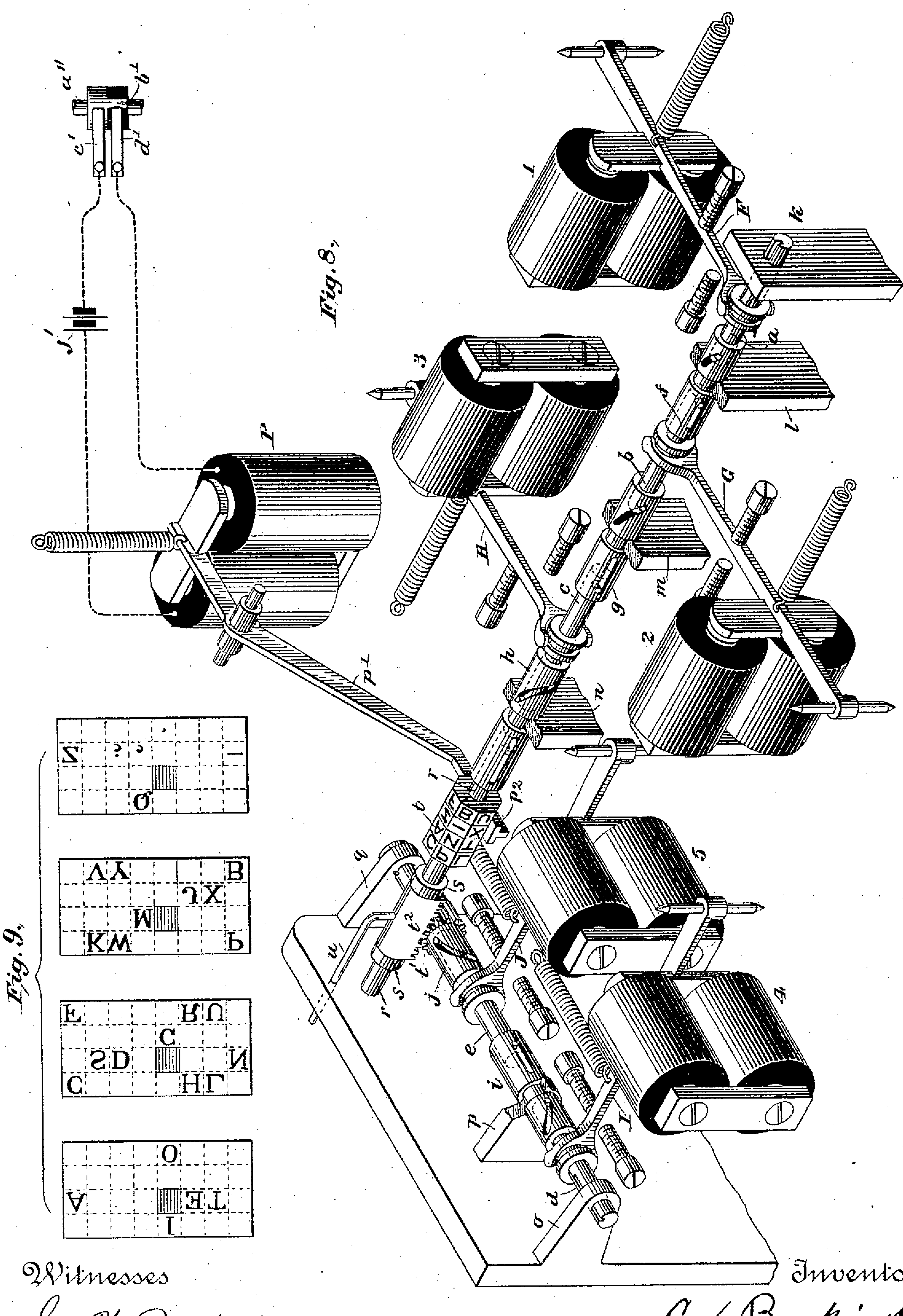

Witnesses
Geo. W. Breck.
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Inventor
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UNITED STATES PATENT OFFICE.

CHARLES L. BUCKINGHAM, OF NEW YORK, N. Y.

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 487,982, dated December 13, 1892.

Application filed April 24, 1890. Serial No. 349,209. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. BUCKINGHAM, a citizen of the United States of America, residing in the city, county, and State of New York, have made a new and useful Improvement in Long-Line Printing-Telegraphs, of which the following is a specification.

The object of my invention is to reproduce messages in print as rapidly as they have heretofore been recorded in dots, dashes, and spaces by the Wheatstone or other similar methods and by the employment of only about the same number of main-line pulses.

In the Wheatstone system positive and negative currents are alternately and automatically sent over the line and at the receiving-station a polarized electro-magnet under the influence of positive pulses causes the point of an ink-marker to be brought against a moving band of paper, while by a negative pulse the pen is raised and the mark terminated. Like Wheatstone, I prefer to employ positive and negative pulses and a polarized receiving electro-magnet, though, as will be hereinafter seen, currents of one polarity only and a neutral receiving-magnet might be used instead. In the alphabets of both systems dots, dashes, and spaces are employed, but in mine every letter requires the transmission of the same number of pulses, and if a Wheatstone ink-writer were placed in the main line of my system it would record three ink-marks to the letter. In sending six reversals, however—three positive pulses and three negative for each letter—my system would seem to be at a disadvantage, for Wheatstone is obliged to transmit only two pulses in some cases and four in others. An average, however, shows little advantage in favor of either system, for oftentimes Wheatstone must transmit twelve and fourteen reversals in sending a letter. A comparison shows that all Wheatstone letters requiring six reversals have the same elements as certain letters in my alphabet and that a divergence between the two only occurs where Wheatstone employs more or less than six.

In another application which I am about to file I have described a multiple synchronous system by which the adjusting-magnets of the printer are operated by bringing the corresponding branches at each station successively into connection with the main line, while in other applications now pending I show a harmonic multiple system. In all multiple systems where there are simultaneous transmissions confusion arises that does not exist where pulses one following another are employed. To avoid the many difficulties common to all multiple systems, I have adopted the order of currents used in the Wheatstone system, a positive pulse always following a negative. By this means I am not only able to utilize the Wheatstone automatic transmitter and perforating mechanism, but an unbroken main line may be substituted for the one which is broken at each end many times a second where the multiple synchronous system is used. Even in my receiving-instrument I need no other main-line relay or electro-magnet than the one with which Wheatstone operates his ink-marker.

I will now describe my invention by reference to the accompanying drawings.

Figure 1 is a diagram of one form of my system, representing the transmitter and the relay arrangement of the receiving-instrument. Figs. 2, 3, 4, and 4^a are modifications of the system shown in Fig. 1. Fig. 5 is a diagram of the Wheatstone transmitter. Fig. 6 represents my alphabet in such manner as to clearly show the sequence of currents employed. Fig. 7 shows my alphabet transformed to meet the requirements of the Wheatstone transmitter and the Wheatstone perforating mechanism. Fig. 8 shows the form of printing-instrument which I perfer to use in my improved system. Fig. 9 is a development of the surface of my type-wheel, showing what letters are brought to position to be printed by calling the adjuster-magnets into action one at a time, two at a time, three at a time, and four at a time, respectively.

Referring to Fig. 8, it is seen that the type-wheel is controlled by five adjuster-magnets and that it may be thrown into any required position by the adjusters when brought into action singly or together in any one of many possible combinations. Magnets 1 2 3 4 5 control armature-levers F G H I J, the latter at their free ends being provided with forks, the prongs of which work within circumferential grooves of the rods *a b c d e*. Rods *a* and

d are incapable of rotation, owing to feathered bearings in supports k and o; but they may be freely moved along their axes. Rods b, c, and e, however, are capable both of rotary and longitudinal movement, and each of the latter is provided at either end with a pin, one of which plays in a straight slot in a sleeve at one side, while the other works in a spiral groove in a second sleeve on the other side. The purpose of the straight slots and spiral grooves in sleeves f g h i j is apparent, it being understood that the sleeves are capable only of rotation, they being collared or journaled in supports l m n p q, as shown. Shaft r, upon which type-wheel t is fixed, is provided at one end with a radial pin, which slides within the straight slot in the outer end of sleeve h, while at the opposite side of the wheel rod r is provided with two collars s s, which inclose the ends of the rack-bar t^2. It will now be seen that as t' rotates it will move t^2 and that the latter by pressing against collars s s carries the type-wheel backward and forward along its axis without in any manner disturbing its circumferential position. Shaft r passes through rack-bar t^2; but rack-bar t^2 is held against rotation by guide-rod u, the latter being rigidly fixed to the bar, while it slides freely in an opening in the frame. Press-magnet P, bar p', and platen p^2 are actuated by a local battery J', the circuit of which is normally open. This circuit is automatically closed after the type-wheel has been set to position for printing by the rotating of metallic part b' of the circuit-closer under brush d', thereby establishing contact between c' and d'. The relation and purpose of shaft a'', upon which circuit-closer b' is placed, will hereinafter be more fully described. By actuating adjusting-levers F G H singly the type-wheel will be rotated one, two, and four spaces, respectively. By actuating bar I the left ring of type will be brought over the platen. Likewise by operating J the right ring will be moved to the same position, while the second type-ring from the right end of the wheel is brought over the press by the conjoint action of I and J. The wheel is provided with a blank space in the second type-ring from the left end, which normally rests over the platen. To avoid extreme movements of the type-wheel, it is never rotated more than half-way in either direction. This is rendered possible by arranging armature-lever H to act in a direction opposite to that of F and G, though the armatures might all be attracted in the same direction if the spiral groove in h were oppositely cut, as is the groove in j with reference to the groove in i.

For a more general description of a printing-instrument of this class reference may be had to my applications Serial No. 290,449, filed November 10, 1888, and Serial No. 333,308, filed December 11, 1889.

I do not desire to limit my invention herein claimed to the particular form of printing-instrument shown in Fig. 8, for many others may be used. In fact, I may use any form of printer in which a series of adjusters are employed whose limits of action, collectively, are commensurate with the maximum movement of the type-carrying apparatus. My invention, in part, is also applicable to an entirely-different class of printers.

Having referred to one form of printing mechanism adapted to my present invention, I will now describe the means by which I am enabled to bring into action to the exclusion of the others such of the adjuster-magnets as may be required by a series of electrical pulses, one following another, over a single main line.

In Figs. 1 and 2 I have shown at the transmitting-station a strip of paper having two rows of perforations passing over a rotating metallic drum mounted upon a shaft a', the latter being connected to main line L by means of a friction-brush b'. The negative pole of battery B is connected with conducting-stylus c', while the positive pole of B' is joined with a stylus d', the opposite poles being connected together and to earth E. It is thus seen that positive pulses are sent to line when the point of stylus d' falls within apertures of the upper row and that negative pulses are transmitted as c' falls within those of the lower row. Some of the perforations are elongated, and in all cases a hole in one row is opposite a space between holes in the other, so that as the paper strip is drawn over the drum positive and negative pulses are alternately transmitted to line.

The letters are represented by the six perforations between the transverse dotted lines.

At the receiving-station in Fig. 1, R is a polarized relay, the armature of which vibrates between conductors o' p' and alternately connects battery O through electro-magnets m' n'. A shaft a'', under the action of any suitable motor, (not shown,) tends to rotate in a direction with the hands of a clock, and upon this shaft are also mounted three armature-bars 20 21 22 and a rotating arm T, carrying a conductor, which sweeps over a circular series of contacts 3 5 2 1 4 6, commonly called a "sunflower," the latter segment being much larger than the others. By this means arm T is caused to advance one-sixth of a rotation each time the current of battery O is changed from magnet m' to n' by relay R, the armatures 20 21 22 and magnets m' n', serving as a step-by-step escapement in a manner well understood in the electro-mechanical arts. It is thus seen that the trailer makes a complete rotation for every six reversals sent over the main line, this being the number required to effect adjustment of the type-wheel to print any desired character. The employment of this particular number of pulses to transmit a letter presupposes thirty-two type-wheel characters or spaces. If, however, a type-wheel with a larger or a smaller number were used, more or less perforations for each letter or character would be required.

A series of polarized electro-magnets W Y V U X, which I term "selecting relays," they being respectively connected with contacts 3 5 2 1 4, are provided with two sets of opposing coils, each relay-coil of one set being separately included in one of the multiple branches leading from battery N to contacts 3 5 2 1 4, as shown. All of the other set—that is to say, the opposing coils—are included in a single branch 41, which leads from contact 6 to point 40, and thence to battery N. The other pole of this battery is connected with the trailing-conductor through friction-brush x and arm T, and thus it is as the trailer revolves battery N is successively connected through the first set of relay-coils and then simultaneously through all of the second set. Normally the armatures of the selecting-relays W Y V U X rest at back contact, nor are they moved so long as the trailer is kept in rapid rotation. If, however, a main-line pulse be momentarily prolonged or strengthened by the passage of an elongated aperture under either stylus c' or d' at the transmitter, the trailer will be arrested sufficiently long to permit battery N to throw the armature of the corresponding selecting-relay to front contact, and in this manner any one or more of the polarized selecting-relays may be brought into action during each rotation of arm T to in turn actuate the adjuster-magnets 3 5 2 1 4, also shown in Fig. 8. The latter are placed in multiple circuit with local battery M. When the trailer reaches the No. 4 contact, the type-wheel will have been adjusted to a position dependent upon the number of times and the position where it has been arrested, and at this moment the rotating circuit-closer b' on shaft a'' closes the local circuit of battery J′ through the coils of press-magnet P, thereby causing a paper tape to be struck against the type-wheel. The trailer next arrives at the long contact 6 and directs a current through all of the second set of polarized relay-coils, which are so wound as to produce a contrary magnetic effect, and to thus return the armature-tongues to back contact preparatory to the transmission of second character. Obviously I must employ such selecting-relays that when once drawn to front contact the armatures will remain there, even though the current be continued only for a moment. To this end I have selected the polarized form, in which the armature has a bias towards its back contact, though many other forms of apparatus having this capacity well known in the art may be adopted. A device having this capacity is also shown in Fig. 4ª. In this case when the armature is brought to front contact it closes a local circuit, which retains a neutral armature until a second circuit is closed, the latter being employed to withdraw all of the armatures and to break the locals first established.

Instead of a local circuit and resetting-coils on the selecting-relays, brought into action at the end of a rotation of the trailer, many other mechanisms may be employed—such, for example, as mechanical means actuated by the motor which rotates the trailer.

The contact-segments of the sunflower are given the numbering here shown in order that the adjusters having the longest movement may have more time than the others in which to act. The selecting-relay joined to segment 3 controls adjuster No. 3, which has the greatest distance to move, and by this arrangement it is seen that the adjuster need not complete its action until the time of printing—that is, until the trailer has reached the No. 4 segment. The other adjusters require less time to act, and are consequently placed in a more advanced position.

To avoid actuating the polarized relays, except when a prolonged pulse is sent over the line, it will be found necessary to make the contacts 3 5 2 1 4 very narrow and to rotate the arm T very rapidly. Even then other forms will be found more satisfactory. To avoid this difficulty, I have shown a main-line neutral relay S, whose armature normally rests at back contact, thus leaving all of the branches to contacts 3 5 2 1 4 broken when only short pulses are sent over the line. The armature of S rests at back contact t'; but when a prolonged or strengthened current is transmitted the armature is drawn to r', thus closing the circuit of battery N through that one of the segments or contacts upon which the trailer may happen to be arrested and through the corresponding selecting-relay. A prolongation of main-line current which will close the local circuit of N will also through relay R and escapement-magnets m' n' arrest the trailer, thus simultaneously closing the circuit of N at two points.

In Fig. 2 I have also shown a modification, which consists in an independent battery N′ and a separate local circuit leading from contact 6 to friction-brush y', its purpose being to return the armatures of the selecting-relays to back contact after the printing of a character. In this and other figures instead of the electro motor-escapement of Fig. 1 I have shown an ordinary ratchet step-by-step releasing device. A variety of devices for this purpose readily suggest themselves.

Fig. 4 shows a modification in which relay S has been removed from the main line and placed in the local circuit controlled by relay R. In this case the armature of S will be drawn to t' whenever the tongue of R is arrested at one side or the other, for then the local circuit of O will have sufficient time to overcome the inertia of S. Obviously S must be more sluggish than m' or n'.

This system is as well adapted to way-station service as is the Wheatstone, and any number of relays may be placed in one circuit. Two such stations are also shown in Fig. 4.

In Figs. 1, 2, and 4 I have employed branches of an independent local circuit within which to place the setting-coils of the selecting-rays W Y V U X; but this is not indispensable as main-line branches, as is shown in Fig. 3, may be used. In this case the main line while only short pulses are passing is closed through spring u', contact v', and resistance R′. When, however, a prolonged current is sent, armature t' breaks the circuit through R′ and closes it to brush x, and through the various branches joining contacts 3 5 2 1 4 with the relays. These branches merely form main-line shunts around resistance R′.

In Fig. 4ª for convenience of illustration I have omitted the use of a neutral relay; but with the form of sunflower here shown such a relay is as necessary as it is in Figs. 2 and 4.

From the foregoing it is seen that my letters are formed by prolonging, strengthening, or otherwise modifying some one or more of the six pulses required to transmit and record a letter and that the character of currents employed is precisely the same as in the Wheatstone system.

While Wheatstone for many characters employs more or less than six pulses, he, however, always uses an even number for each character, and a positive pulse on the line is always followed by a negative. In both systems these transmissions when reproduced by an ink-writer occur as dots and dashes and as spaces between the ink-marks, and thus it is that my messages may be perforated by the Wheatstone punchers now commonly used and transmitted through the Wheatstone sender without the slightest modification.

Fig. 6 shows my alphabet with elongated holes, the perforations in one row alternating with those in the other. This form might be used in practice. I prefer, however, to transform this arrangement into that shown in Fig. 7, the latter being adapted to the Wheatstone transmitter without change.

In Fig. 7 two perforations in a vertical line represent a dot, while beginning with an upper perforation and passing diagonally downward to the right across one space to a second perforation is a dash, representing a prolonged positive current. Likewise beginning with a perforation in the lower row and passing diagonally upward to the right across three spaces to a second perforation is a space, or what is effected by a prolonged negative current. Where two perforations are in the same transverse line, a positive current is first sent by the upper hole and a negative current next by the lower—a result which arises from the fact that the needle or pin passing over the upper row of holes is in advance of the other by about the width of a perforation.

Fig. 5 shows the ordinary form of Wheatstone transmitter, in which battery B′ is rapidly reversed through arms x' y', pins v' w', and disks D′ E′, while a strip of perforated paper, like that of Fig. 7, is constantly passing between the upper ends of needles g' h' and a toothed wheel. A rocking beam having pins u t is vibrated by a link O′ and a crank g, the latter being revolved by a pinion gearing with a wheel s'. It is seen that pins t u serve to alternately depress levers i'' j' and to thus move arms k' and e' and rods m' n', the latter being attached to arms F′ G; but these pins do not press the pins upward. The springs attached to k' e', however, exert considerable force, tending to raise pins g' h', and this they accomplish whenever apertures in the paper pass above their ends, but not otherwise. The arm G is held at one side or the other by a jockey-wheel mounted upon a spring H, and by this means the battery is never reversed after a pulsation has been begun until an opposite perforation has come into position over its pin. While a pin is pressing against the paper, the vibrations of the walking-beam will not reverse the battery. It is due to this fact that circular perforations, all of one size, as shown in Fig. 7, may be employed, even where some of the pulses are to be prolonged.

It is apparent that only currents of one polarity need be used, thus enabling relay R to be made neutral, and, as is well known, the Wheatstone system is capable of this modification. In such a case the upper holes in the paper would merely serve to begin a pulse, while the lower ones would only act to discontinue it without sending a current of opposite polarity.

In practice the prolongation of pulses will be found to be superior to all others in this system, for by this means the current at a distant station is more effectually strengthened than by merely adding more battery. It is obvious that a series of main-line pulses may also be modified in many ways other than by adding battery. Certain pulses might be omitted or be given a harmonic character. A large variety of modifications of this class may be found in the art of printing telegraphy, and do not here require further notice.

What I claim, and desire to secure by Letters Patent, is—

1. In a telegraph system, the combination of a main line, an automatic transmitter of the Wheatstone type by which each letter or character is transmitted by a series of pulses succeeding one another, a printing-instrument, a series of type-controlling magnets, and a series of adjusting devices whose limits of action collectively are commensurate with the entire range of type-wheel movement.

2. In a telegraph system, the combination of an unbroken main line, a main-line relay at the receiving-station, an automatic transmitter by which each letter or character is transmitted by a series of pulses succeeding one another, and a printing-instrument having a series of type-adjusters whose limits of action collectively are commensurate with the entire range of type-wheel movement.

3. In a printing-telegraph, the combination of a dot-and-dash alphabet, a single main line, a main-line relay at a receiving-station, a series of selecting-relays controlled by the

main-line relay, a series of adjusting-magnets, and a printing-instrument having a series of adjusters whose range of action collectively is commensurate with the maximum movement of the type-carrying apparatus.

4. The combination, in a printing-telegraph in which messages are transmitted by a series of pulses one following another over a single main line, of an automatic transmitter, a main-line relay at a receiving-station, a series of selecting-relays, a series of adjusting-magnets, and a printing-instrument having adjusting mechanisms whose limits of action collectively are commensurate with the maximum range of movement of the type-carrying mechanism.

5. In a printing-telegraph, the combination of an automatic transmitter in which there are for each letter or character sent a series of pulses succeeding one another, a main-line relay or relays at a receiving-station, controlling a series of selecting-relays, and a printing-instrument in which a series of type-carrying adjusters have limits of action collectively commensurate with the maximum range of type-wheel movement.

6. In an automatic telegraph system, the combination of a transmitter, an alphabet formed by perforations or embossures by which an equal number of successive pulses is transmitted for each letter or character, the transmission being determined by spaces between pulses or by prolonging or otherwise modifying one or more of the pulses transmitted, a main line, and a receiving-instrument having a series of adjusters separately responsive, as described, whose range of action collectively is commensurate with the maximum movement of the type-carrying apparatus, said adjusters corresponding in arrangement with the perforations forming each and every letter or character transmitted.

7. In an automatic printing-telegraph system, the combination of a transmitter employing a paper tape provided with perforations or embossures by which an equal number of alternately positive and negative pulses is transmitted for each letter or character, the transmission being determined by prolonging or otherwise modifying one or more of the pulses transmitted, a main line, and a receiving-instrument having a series of adjusters separately responsive to such prolonged or modified pulses, whose range of action collectively is commensurate with the maximum movement of the type-carrying apparatus, said adjusters corresponding in arrangement with the perforations forming each and every letter or character transmitted.

8. A telegraph-alphabet in which each of its letters is formed by a definite number of transmitted pulses, the character of the letters being determined by prolonging, strengthening, or otherwise modifying one or more of said pulses.

9. In a printing-telegraph system, an alphabet in which each of its letters is formed by a definite number of transmitted pulses, the character of the letters being determined by prolonging some one or more of said pulses.

10. In a printing-telegraph system, an alphabet in which each of its letters is formed by a definite number of alternately positive and negative pulses, the character of the letters being determined by prolonging some one or more of said pulses.

11. In an automatic printing-telegraph system, a perforated or embossed strip of paper for transmitting the message in which each letter or character is represented by an equal number of apertures or embossures adapted to send a succession of pulses the same in number for all letters or characters transmitted.

12. In an automatic printing-telegraph, the combination of a transmitting-tape in which the letters transmitted are distinguished from one another by variations in the number and position of perforations or embossures, and a receiving-instrument having a series of selecting-magnets corresponding in number to the number of different positions which said perforations or embossures may have in a letter-space and adapted to be brought into action one after the other in regular order or succession by the actuating-pulses which are sent by the said distinguishing perforations or embossures.

13. In an automatic printing-telegraph system, the combination of a transmitter employing a paper tape, each letter being represented by an equal number of perforations or embossures and transmitted by an equal number of succeeding pulses, a main line, a relay or relays at a receiving-station, a series of selecting-relays controlled by said main-line relay or relays, a printing-instrument, and a series of type-controlling magnets which are brought into action by said selecting-relays.

14. In an automatic printing-telegraph system, a perforated strip of paper for transmitting the message, having two rows of apertures, one for transmitting positive and the other for transmitting negative pulses, in which each letter is represented by a definite number of apertures, while the character of the letters is determined by the length of the intervening spaces.

15. In a printing-telegraph system, the combination of a single main line, a relay, a sunflower, a rotating arm controlled by said relay, a series of selecting-relays having coils joined with the respective segments of the sunflower, an opposing coil for each relay, all being included in an independent local circuit for resetting the tongues of the selecting-relays, a series of adjusting-magnets, and a type-printer having a series of adjusters whose limits of action are collectively commensurate with the maximum range of movement.

16. In a printing-telegraph system, the combination of a main line, a relay, a sunflower,

a rotating arm controlled by said relay, a series of selecting-relays having coils which are brought into action when a pulse is prolonged, strengthened, or modified, resetting-coils which are brought into action during each rotation of the sunflower-arm, a printing-instrument, and a series of adjusting electro-magnets.

17. In a printing-telegraph system, the combination of a main line, a relay, a sunflower, a rotating arm controlled by said relay, a series of selecting-relays, each of which is provided with a resetting-coil, a printing-instrument, a series of type-adjusting magnets, and a press mechanism which is operated simultaneously as or before the operation of resetting occurs.

18. In a printing-telegraph system, the combination of a main line, a polarized relay which is responsive to positive and negative currents, a sunflower, a rotating arm which is controlled by said relay, a series of selecting-relays, each of which is provided with a coil in a branch leading to a sunflower-segment, a second relay which is responsive only to prolonged, strengthened, or modified pulses, which serves to close said sunflower branches when brought into action, a resetting-circuit, a printing-machine, and a series of type-adjusting devices.

19. In a printing-telegraph system, a main line, a polarized relay, a sunflower, a rotating arm controlled by said relay, a second relay, a series of selecting-relays, a printing-machine, and a series of type-adjusting devices.

20. In a printing-telegraph system, an automatic transmitter, a perforated or embossed strip of paper by which a definite number of positive and negative pulses are transmitted for each letter, some of the pulses being prolonged, strengthened, or modified, a polarized and a neutral relay at a receiving-station, a sunflower, a rotating arm controlled by said polarized relay, a series of selecting-relays the circuits of which are closed by the neutral relay when brought into action, a printing-machine, and a series of type-adjusting devices.

21. In a printing-telegraph system, a main line, a polarized relay, a sunflower, a rotating arm, an electromotor-escapement controlled by said relay for actuating said arm, a series of selecting-magnets separately joined with corresponding segments of the sunflower, a resetting-circuit, a printing-machine, and a series of type-adjusters.

22. In a printing-telegraph system, a main line, a polarized and a neutral main-line relay at each station, a sunflower, a rotating arm and a ratchet-escapement controlled by the polarized relay, a series of selecting-relays, each having two coils, one opposing the other, a printing device, and type-adjusters.

23. In a printing-telegraph system, a main line, a polarized relay, a local circuit operated by said relay for controlling the rotation of a sunflower-arm, a series of selecting-magnets having two sets of coils, a neutral relay placed in the local circuit, controlled by the polarized relay, it being adapted to close the branches from the sunflower-segments to the selecting-relays, a printing-machine, and a series of type-adjusting devices.

24. In a telegraph system, a main line, a relay, a sunflower, a rotating arm, a series of selecting-relays which are brought into action by prolonging or otherwise modifying main-line pulses, and local branches leading from said selecting-relays to the sunflower.

25. In a telegraph system, a main line, a polarized relay, a sunflower, a rotating arm, a series of selecting-relays, a series of main-line branches for joining the selecting-relays with the sunflower, and a neutral relay for directing main-line currents through said branches.

26. In a printing-telegraph system, a main line, a polarized relay, a sunflower, a rotating arm, a series of selecting-relays formed of polarized magnets, each having two sets of coils, a printing-machine, and a series of type-adjusters.

27. In a printing-telegraph system, a main line, a polarized relay, a sunflower, a series of selecting-relays, each of which is formed of neutral cores, a coil in a local circuit for holding the armature at front contact, and a second auxiliary coil for resetting the tongues, a printing-machine, and a series of type-adjusters.

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Witnesses:
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