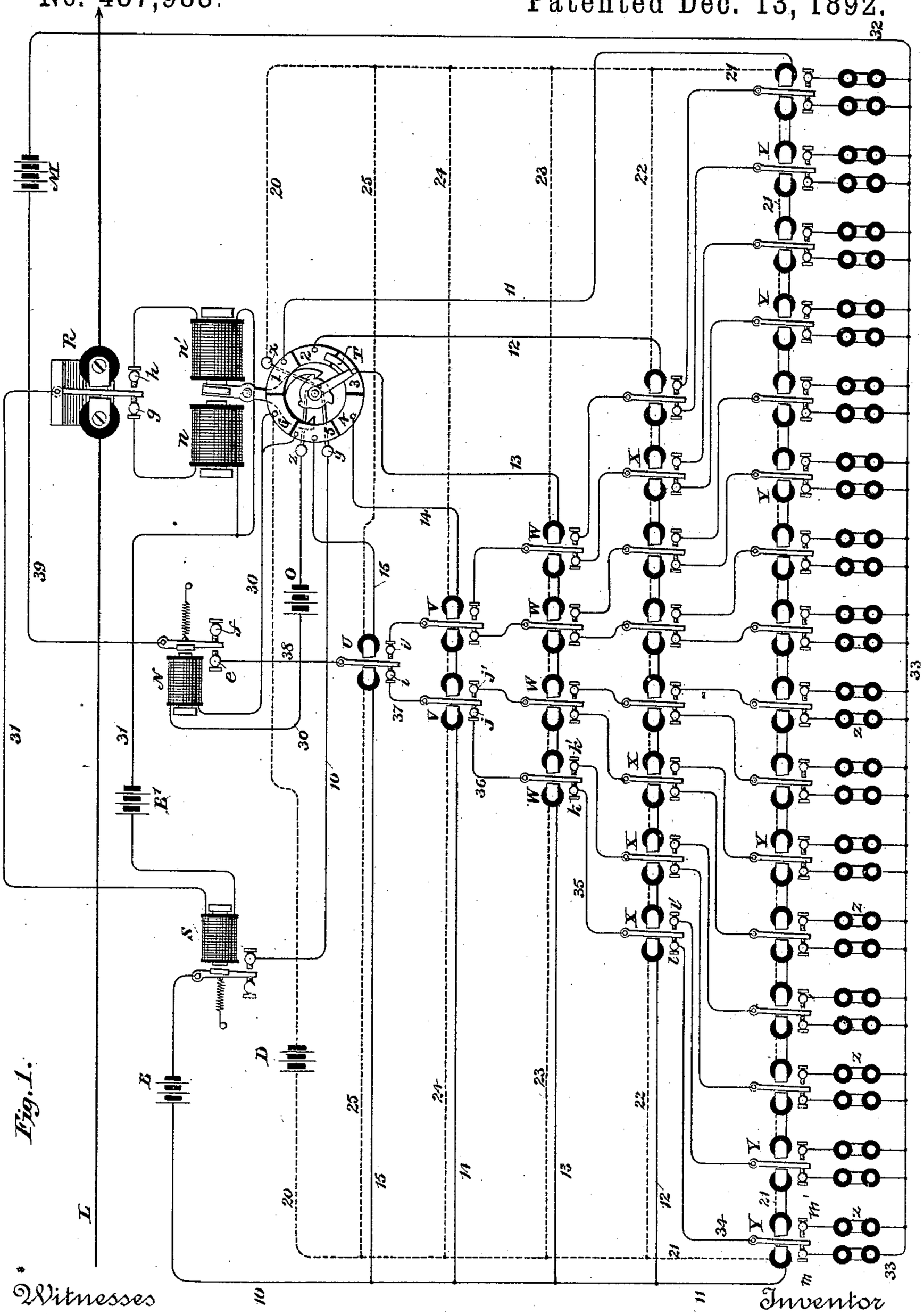
(No Model.) 3 Sheets—Sheet 1.

C. L. BUCKINGHAM.

PRINTING TELEGRAPH.

No. 487,983. Patented Dec. 13, 1892.



(No Model.) 3 Sheets—Sheet 2.

C. L. BUCKINGHAM.

PRINTING TELEGRAPH.

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Fig. 2

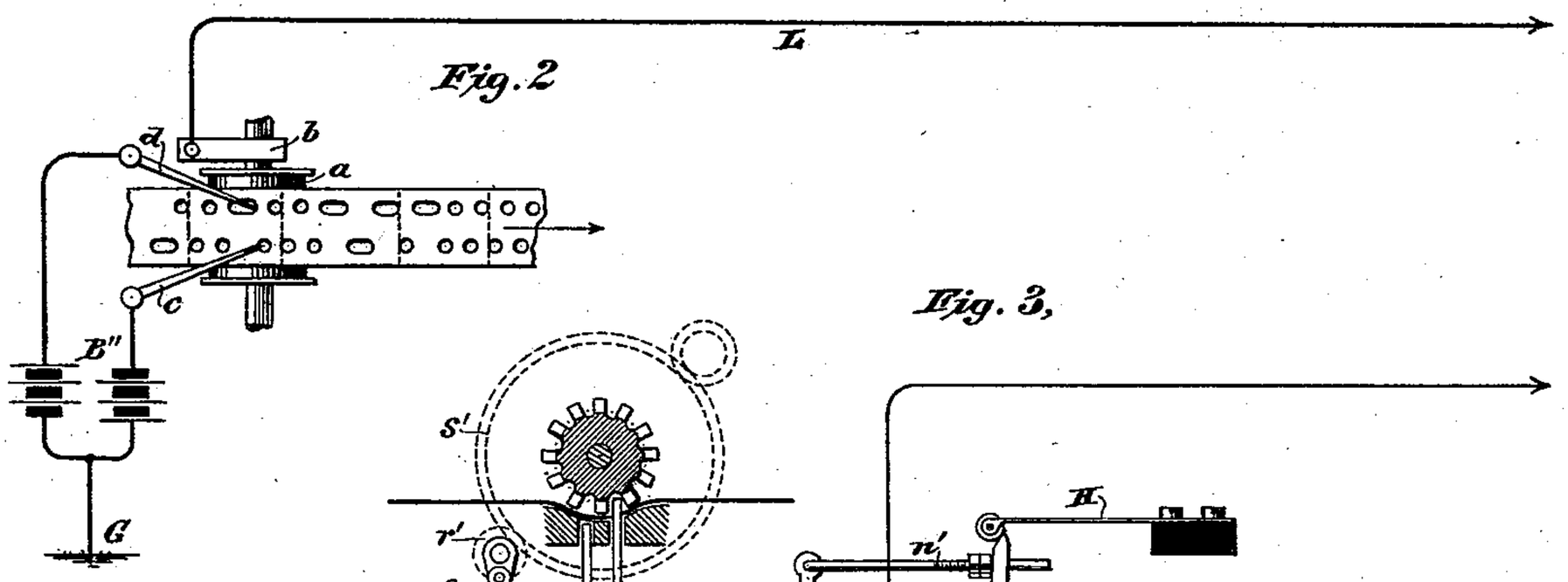


Fig. 3,

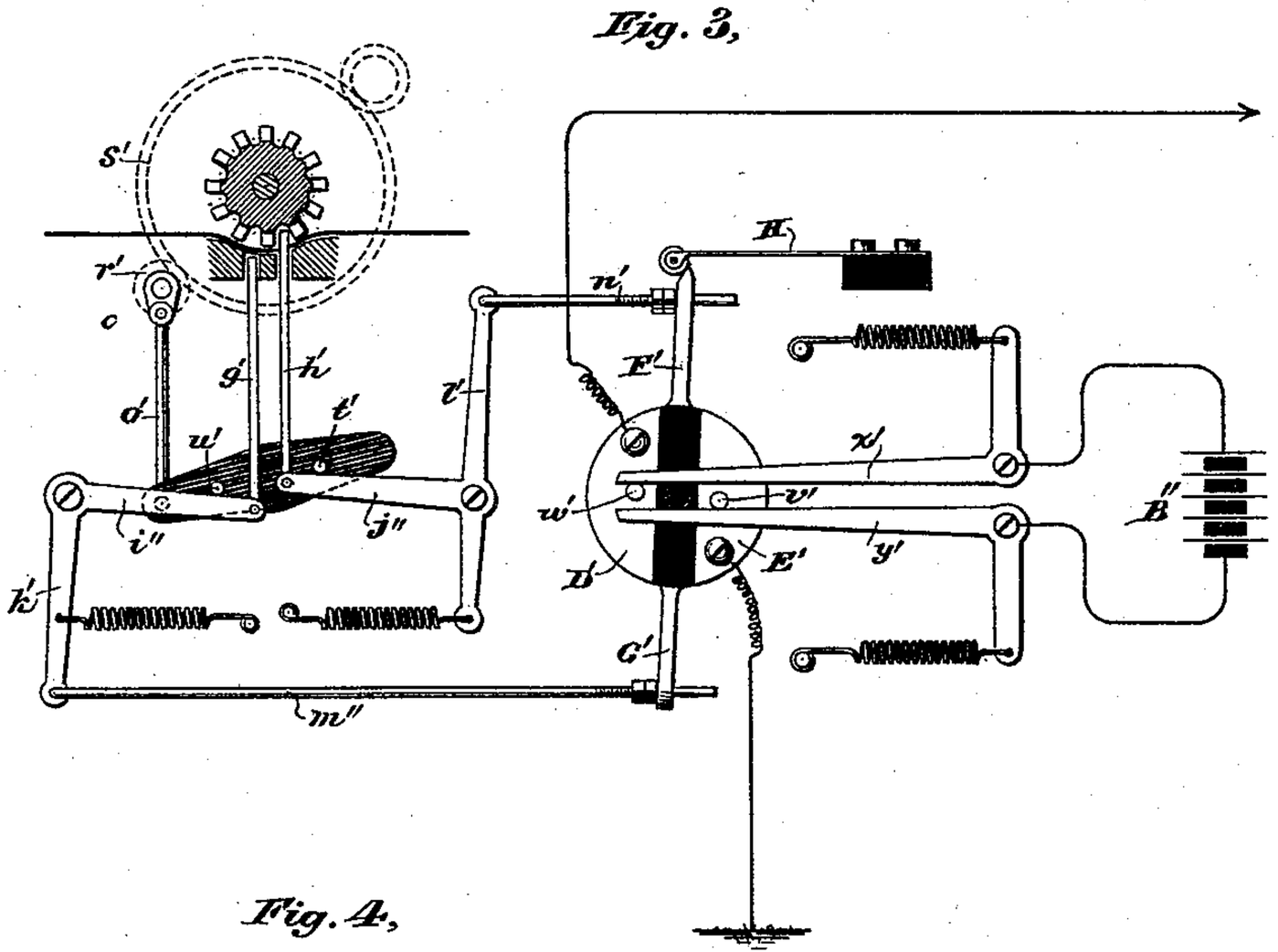


Fig. 4,

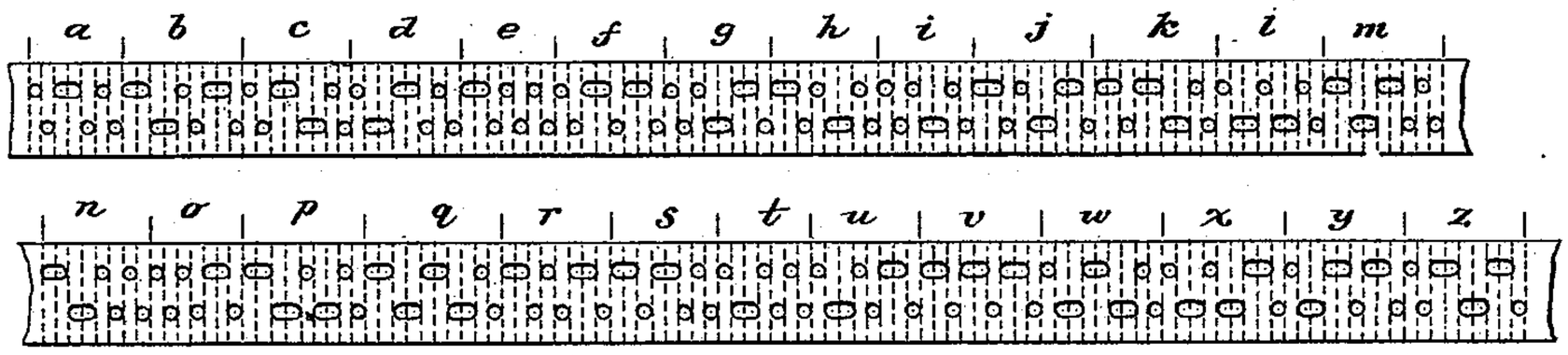
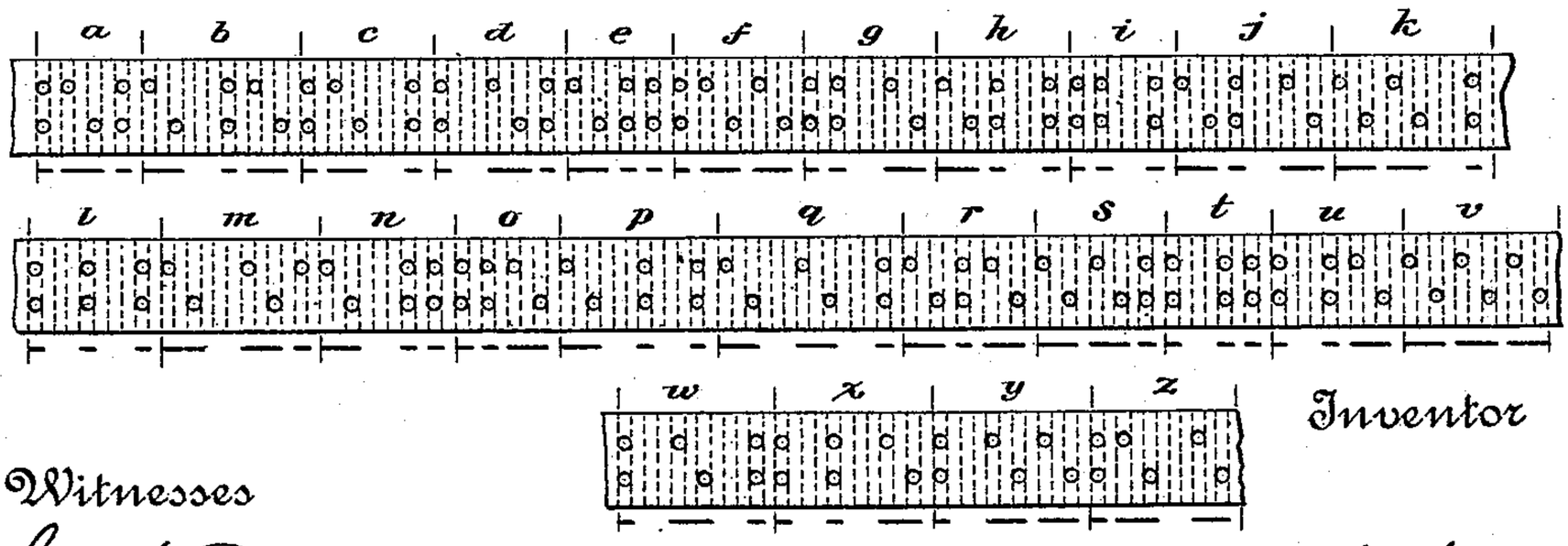


Fig. 5,



Witnesses
Geo. W. Breck.
C. E. Ashley

Inventor
C. L. Buckingham

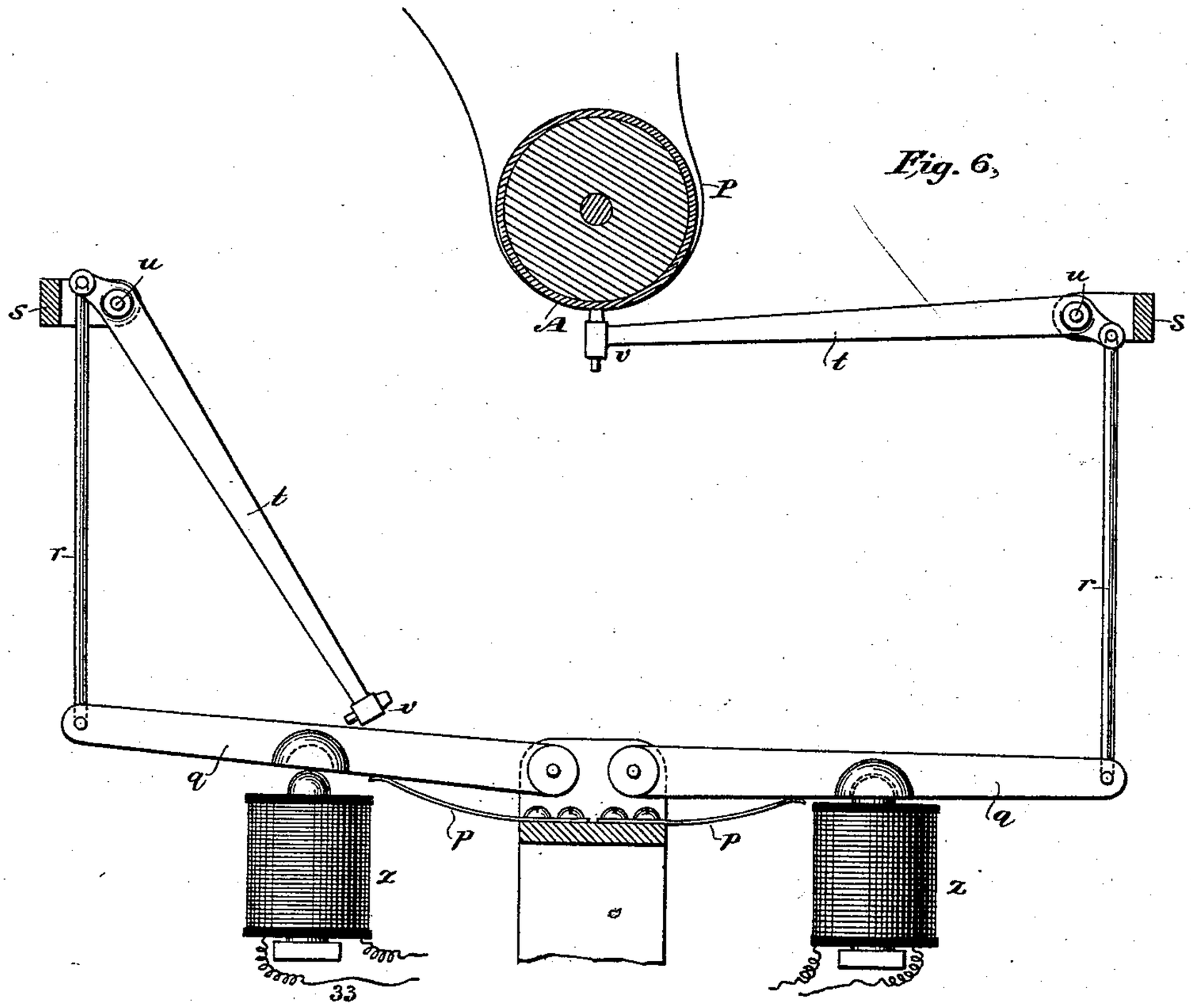
(No Model.) 3 Sheets—Sheet 3.

C. L. BUCKINGHAM.

PRINTING TELEGRAPH.

No. 487,983. Patented Dec. 13, 1892.

Fig. 6.



Witnesses
Geo. W. Breck.
John C. Sanders.

Inventor
C. L. Buckingham

UNITED STATES PATENT OFFICE

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

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 487,983, dated December 13, 1892.

Application filed April 29, 1890. Serial No. 349,877. (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. Instead of employing a series of adjusters capable of being brought into action one or more at a time to move a type-carrier to any desired position, my present improvement contemplates the use of as many type-levers and type-lever magnets as there are characters to be printed. In other words, I propose to adapt the type-writer to a single-line telegraph in such manner that each letter is transmitted by a series of pulses, one following another.

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

Figure 1 is a diagram showing the arrangement of electrical devices employed at a receiving-station. Fig. 2 is an illustrative diagram of my transmitter. Fig. 3 is a diagram of the Wheatstone transmitter. Fig. 4 is a diagram of my alphabet, showing the sequence of currents employed. Fig. 5 represents my alphabet, shown in Fig. 4, transformed to meet the requirements of the Wheatstone transmitter and the Wheatstone perforating mechanism. Fig. 5 also shows my alphabet when reproduced by the Wheatstone ink-writer. Fig. 6 is a diagram showing a fragment of an ordinary type-writer and electro-magnets for operating the type-levers.

In Fig. 2 I have shown at the transmitting-station a strip of paper having two rows of perforations passing over a rotating metallic drum *a*, the shaft of which is connected with the main line L by means of a friction-brush *b*. The negative pole of one battery is connected with a stylus *c* and the positive pole of a second battery with a stylus *d*, while the two opposite battery-poles are joined together and to earth G. 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 in each case between the transverse lines.

At the receiving-station, Fig. 1, R is a polarized relay, the armature of which vibrates between contacts *g h* and alternately connects battery B′ through escapement electro-magnets *n n′*. A shaft under the action of any suitable motor (not shown) tends to rotate in the direction of the hands of a clock, and upon this shaft is fixed an escapement-wheel

having three teeth, together with a trailing arm T, carrying a conductor which sweeps over a sunflower consisting of a circular series of segmental contacts numbered from "1" to "6." By this means arm T is caused to advance one-sixth of a rotation each time relay R changes battery B′ from magnet *n* to *n′*, and vice versa. It is thus seen that the trailer makes a complete rotation each time six reversals are sent over the main line, this being the number required to transmit and print each letter. The employment of this number of pulses to send a letter presupposes the use of thirty-two or some less number of type-levers. If, however, less than sixteen or more than thirty-two type-levers were used in a receiving-instrument, only four perforations in one case would be required, while eight would be necessary in the latter.

Branches 11 to 15 are connected with the first five segments of the sunflower, and they include a combination of polarized electro-magnets U V W X Y, which I term "selecting-relays," there being sixteen Y's in 11, eight X's in 12, four W's in 13, two V's in 14, and one U in 15. These branches are connected by wire 10 in multiple circuit with battery B, one pole of which is joined to the armature-bar of relay S, while the front contact is connected with a circuit-brush *y*, bearing upon the shaft of trailer T. The short currents sent over the main line are insufficient to attract the armature of relay S, although they serve to actuate the escapement which controls the sunflower trailer's rotation. If, however, a main-line pulse were prolonged, the trailer would be arrested and the armature of relay S would be attracted to front contact, thus closing battery B through one of the several branches containing the selecting-relays, and the armatures of the selecting-relays in such branch would be thrown to the right or against the front contacts. In like manner, if the trailer were successively arrested in passing from segment to segment in the course of a rotation the tongues of all the selecting-relays would be actuated. In transmitting a letter its character is determined by the particular pulse or pulses which are prolonged, and, as will be seen by referring to my alphabet, Fig. 4, some one or more of the six apertures for each letter are elongated. As the trailer rotates over the sunflower it will be arrested upon segments corresponding with the elongated apertures in the letter being transmitted.

In Fig. 1 I have represented a series of thirty-two magnets Z for separately actuating the type-writer, and only one of these magnets can be brought into action at a time, whatever the movements of the armatures of the selecting-relays. The terminals of magnets Z are connected on one side in multiple circuit by wire 32 with battery M, while upon the other side they are connected with contacts *m m′* of selecting-relays Y. Likewise the tongues of relays Y are joined with contacts *l l′* of X, the armatures of relays X with contacts *k k′* of W, the armatures of relays W with contacts *j j′* of V, and the armatures of relays V with contacts *i i′* of relay U. At all times a circuit will be formed from wire 38 through some one of the type-magnets. This circuit, however, is normally broken at the tongue of relay N, which rests at back contact *f*. When, however, the trailer has reached the No. 5 segment, it closes local circuit 30, including relay N and battery O. One terminal of 30 is joined with segments 5 and 6 and the other with brush Z, the latter bearing upon the shaft of the trailer. The necessity for relay N is apparent. Without it a circuit from battery M would at all times be formed through some one of the type-magnets Z, and a new circuit would thus be formed upon operating the relays in any one of the selecting branches, thus causing one or more false impressions in the transmission of each letter. By connecting local circuit 30 with segments 5 and and 6 it is obvious that all of the circuits through the type-magnets will remain open until the required ones of the selecting-relays have been set, because the setting of the selecting-relays precedes the operation of relay N. After the selecting-relays have been set and printing effected by the completion of some one of the many printing-circuits the armatures of the selecting-relays or such of them as have been moved must be returned or reset to their back contacts. This I can accomplish preferably by providing the selecting-relays with opposing coils or other suitable devices connected in multiple branches 21 to 25 with a local battery placed in wire 20. At the sunflower the resetting-circuit is formed by brush *x* through the trailer and segment 6. The tongues of the selecting-relays have a bias toward back contact, and when brought to front contact by a pulse they will remain in such position until retracted, although the current by which they have been moved has ceased.

It is apparent that neutral as well as polarized magnets may be used for selecting-relays and that any suitable mechanical means might be employed to reset their tongues while trailer T is passing over segment 6.

Fig. 6 represents two printing-magnets Z of the series shown in Fig. 1. The type-levers *t* are pivoted at *u* upon supports *s* and are joined by short arms to links *r*, which form connections with armature-levers *q*, the latter being normally held in an upper position by spring *p*. The type-levers carry type *v*, which are struck against a sheet of paper P, extending under an impression-drum A to print a message.

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 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, 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. The alphabet with prolonged holes, as shown in Fig. 4, might be used in practice. I prefer, however, to transform this arrangement into that shown in Fig. 5, the latter being adapted to the Wheatstone transmitter without change. In Fig. 5 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 produced 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. 3 shows an 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. 5, 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 o, the latter being revolved by a pinion r, 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' l' and rods m'' n'', the latter being passed through arms F' G; but these pins do not press needles g h upward. The springs attached to k' l', however, exert considerable force, tending to raise needles 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 printing-telegraph, the combination of a single main line, a main-line relay, a sunflower, a series of sunflower branches containing selecting-relays, one or more of said relays being brought into action for each character transmitted, a type-writing printer, and a series of printing-circuits, one for each type-character, said printing-circuits being separately selected in each case by one or more of said selecting-relays.

2. In a printing-telegraph, the combination of a single main line, a main-line relay, a sunflower, a series of sunflower branches containing selecting-relays, a type-writing printer, a series of printing-magnets, and a series of printing-circuits, one for each character, joining the printing-magnets one at a time, which are formed through the tongues of the selecting-relays, substantially as described.

3. In a printing-telegraph, the combination of a main line, a relay, a sunflower, a series of sunflower branches containing selecting-relays, a series of actuating-magnets, and a series of circuits formed through the tongues of the selecting-relays, by which the actuating-magnets may be brought into action one at a time to actuate printing-levers.

4. In a printing-telegraph system, the combination of a telegraph-line, a main-line relay operated by alternately positive and negative currents, a series of branches controlled by said relay, which include selecting-relays, one or more of said relays being brought into action for each character transmitted, through whose tongues, taken in series or tandem, are successively formed a series of local circuits, and a series of electro-magnets controlled thereby.

5. The combination of a telegraph-line, a relay, a sunflower, and mechanism for actuating a moving arm, a series of multiple branches or circuits containing selecting-relays, substantially as described, a series of branches

formed by the tongues of the selecting-relays, the path of each branch including a series or tandem arrangement of said tongues, and a series of electro-magnets controlled thereby.

6. In an automatic printing-telegraph system, the combination of a transmitter employing a paper tape upon which each letter or character is represented by an equal number of perforations or embossures and which is transmitted by an equal number of succeeding electrical pulses, a single main line, a main-line relay, a series of selecting-relays controlled by the main-line relay, a series of type-magnets, and a series of circuits, one for each type-magnet, formed by the selecting-relays, by which the actuating-magnets may be brought into action one at a time to actuate a corresponding series of printing-levers.

7. The combination of a telegraph-line, a relay, a sunflower, and mechanism for actuating a moving arm, a series of multiple branches or circuits containing selecting-relays, substantially as described, a relay for closing said branches or circuits, a series of multiple branches or circuits formed by the tongues of the selecting-relays, a relay for closing said circuits, controlled by the sunflower, and a series of electro-magnets controlled thereby.

8. In an automatic printing-telegraph, 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, strengthening, or otherwise modifying one or more of said pulses, a single main line, a relay at the receiving-station, a sunflower or equivalent device, a series of multiple branches or circuits containing selecting-relays, substantially as described, a series of multiple branches or circuits formed by the tongues of the selecting-relays, a type-writing machine, and a series of actuating electro-magnets Z, as and for the purpose set forth.

9. In an automatic printing-telegraph, 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, strengthening, or otherwise modifying one or more of said pulses, a single main line, a relay at the receiving-station, a sunflower or equivalent device, a series of multiple branches or circuits containing selecting-relays, substantially as described, a resetting circuit or circuits, a series of multiple branches or circuits formed by the tongues of the selecting-relays, a type-writing machine, and a series of actuating electro-magnets Z, as and for the purpose set forth.

10. In an automatic printing-telegraph in which messages are transmitted by an alphabet in which each letter is formed by a definite number of transmitted pulses, the character of the letters being determined by prolonging, strengthening, or otherwise modifying some one or more of said pulses, the combination of a single main line, a polarized relay R, a sunflower, a series of branches 11 to 15, including selecting-relays, a relay S, a series of actuating-magnets, and circuits formed by the tongues of the selecting-relays, including said actuating-magnet, a relay N, a series of resetting branches or circuits 21 to 25, and a type-writing machine, substantially as described.

11. The combination of a single main line, a polarized relay, a sunflower, a series of branches 11 to 15, including selecting-relays, a relay S, a series of resetting-coils or equivalent devices, a series of actuating-magnets, circuits formed by the tongues of the selecting-relays, including said actuating-magnets, a relay N, and a type-writing machine, substantially as described.

Signed April 26, 1890.

CHARLES L. BUCKINGHAM.

Witnesses:

JOHN C. SANDERS,

C. W. CONKLIN.