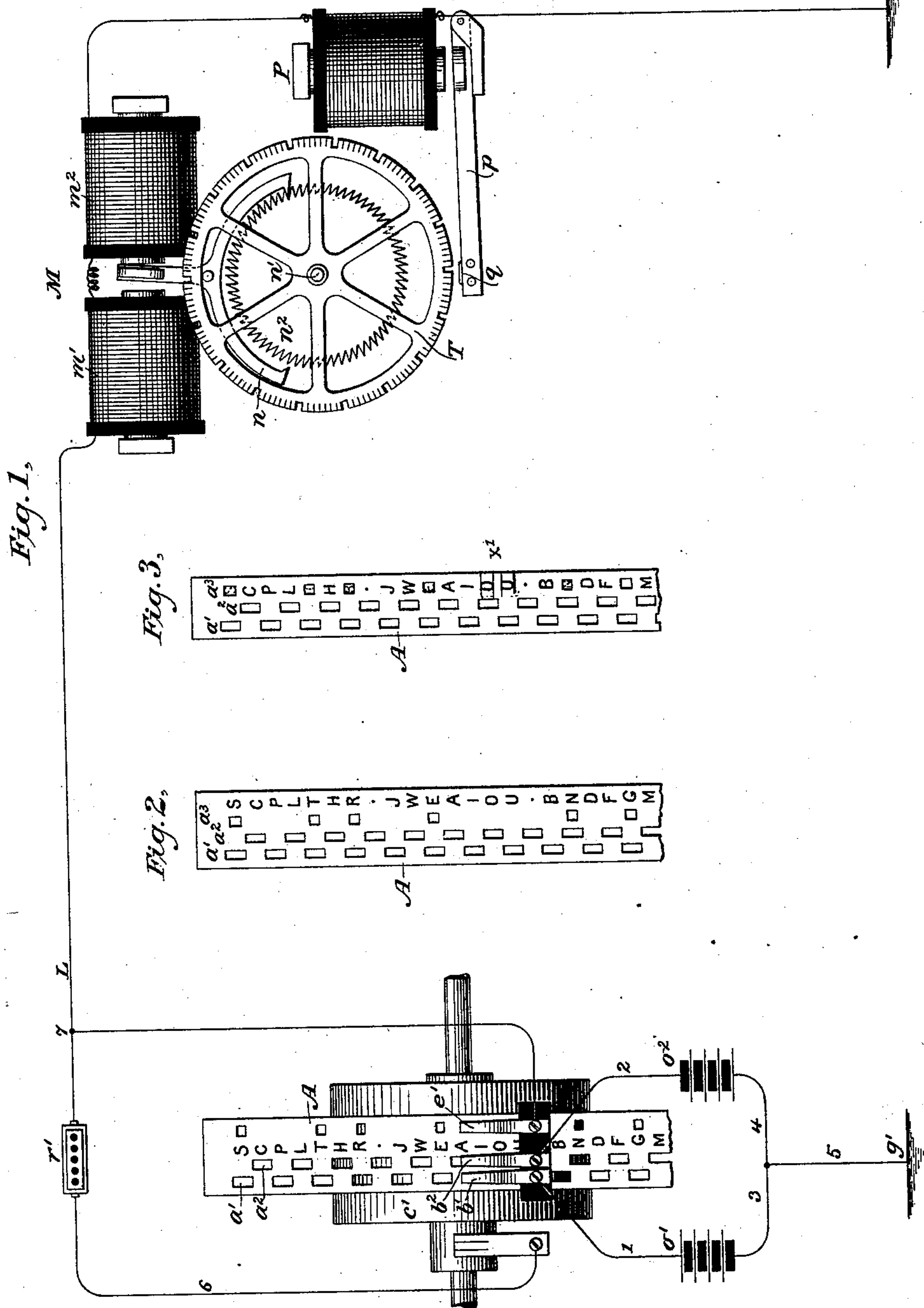


C. G. BURKE.

AUTOMATIC PRINTING TELEGRAPH.

No. 360,994.

Patented Apr. 12, 1887.



Witnesses

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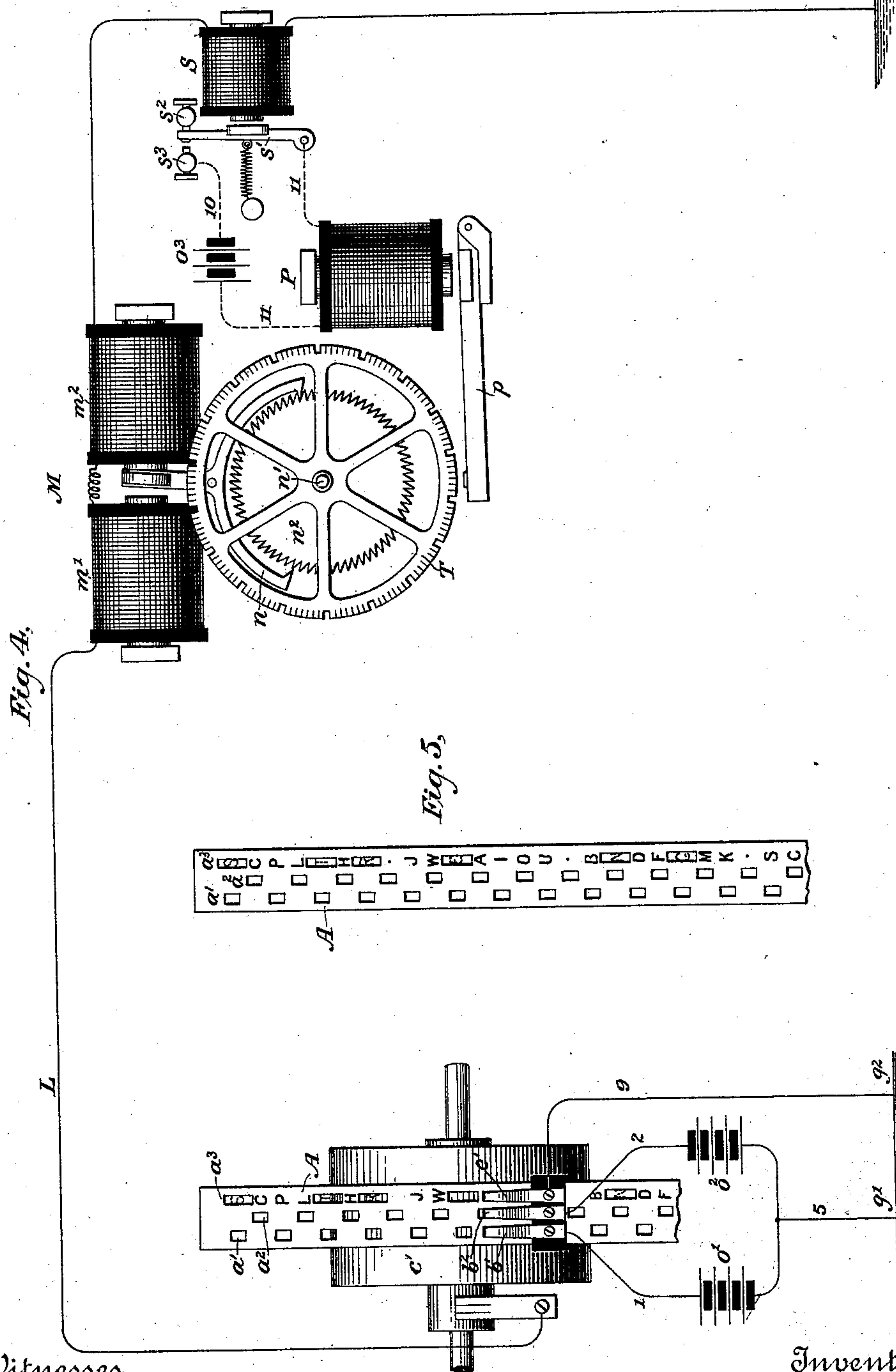
Inventor  
Charles G. Burke,  
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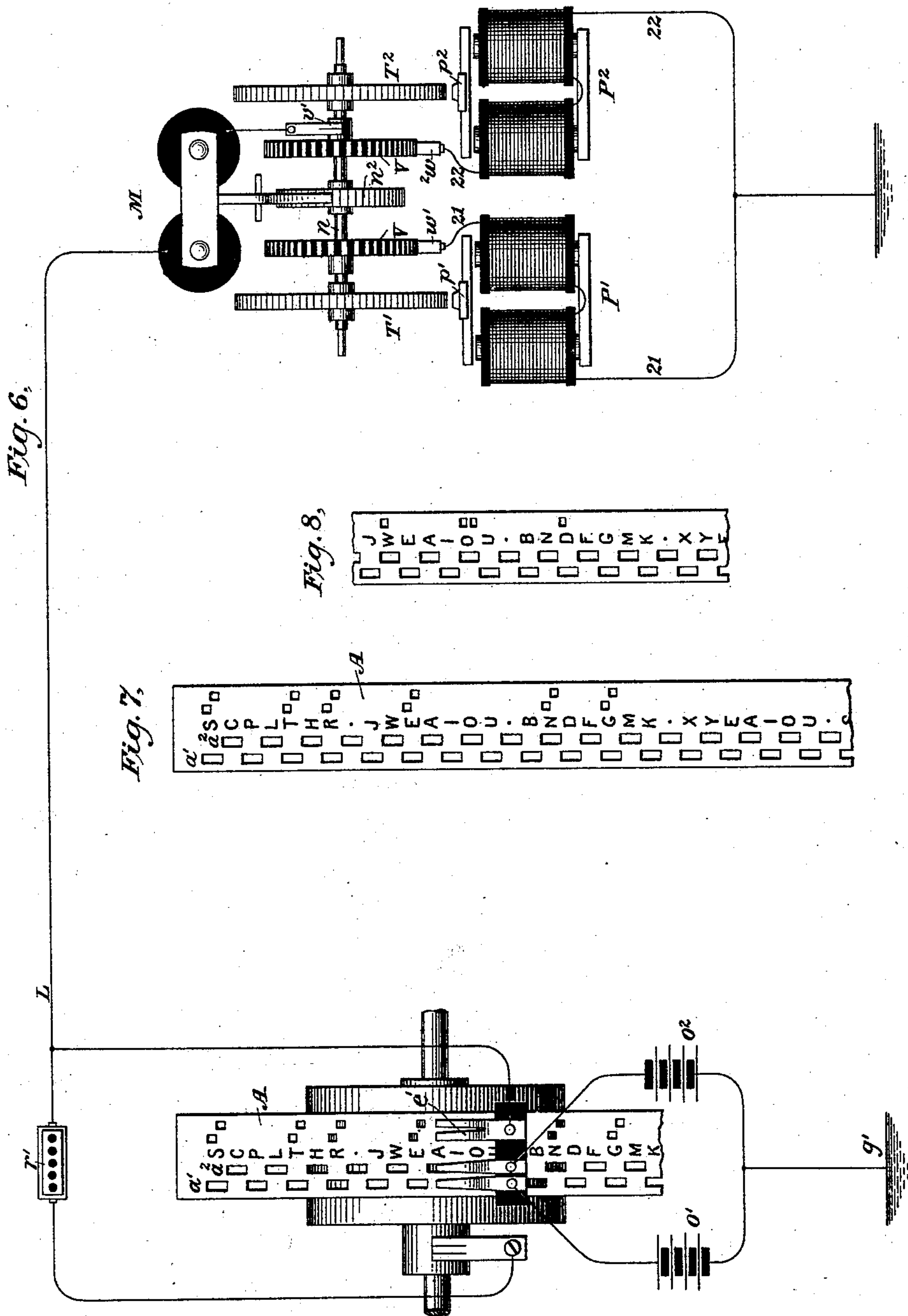
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Robert Edgcomb



# UNITED STATES PATENT OFFICE.

CHARLES G. BURKE, OF RICHMOND HILL, NEW YORK.

## AUTOMATIC PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 360,994, dated April 12, 1887.

Application filed December 15, 1884. Renewed July 20, 1886. Serial No. 209,251. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES G. BURKE, a citizen of the United States, residing at Richmond Hill, Queens county, and State of New York, have invented certain new and useful Improvements in Automatic Printing Telegraphy, of which the following is a specification.

The invention relates to the class of printing-telegraphs in which a type-wheel is employed for effecting a record of the characters embodying telegraphic messages and dispatches, and in which the proper electric currents and impulses for operating the receiving-instrument are transmitted over a telegraphic main line.

The object of the invention is to provide means for automatically transmitting the necessary impulses and currents; and it consists, generally, in employing a strip of paper or equivalent material, which, when passed through a suitable transmitting-instrument, causes the proper currents and impulses to be transmitted. The transmitting-slip is provided with two series of perforations, those in one series alternating with those in the other. These perforations are employed for transmitting alternating currents for actuating the type-wheel. The paper is also printed throughout its length with the letters of the alphabet, and, also, if it is so desired, with numerals and marks of punctuation. The characters are designed to be punched out in preparing the paper for transmitting the message, the successive characters embodying the same being punched from the paper as they occur thereon. The perforations obtained by punching out the printed characters serve to transmit, at the proper moments, the requisite currents or impulses for actuating the impression-lever. It is designed that the last-named perforations be so located that the printing-currents will be transmitted thereby during the transmission of one of the alternating impulses.

Instead of punching out the characters upon the strip, perforations may be made at one side of the same, the place where such perforations shall be made being indicated by the position of the printed characters.

A suitable receiving-instrument provided with a type-wheel is employed at the remote

terminal of the line. This type-wheel is engraved with characters occurring in the same sequence as the characters printed upon the transmitting-slip. The paper, when it has been thus prepared, is passed through a suitable transmitting-instrument, and alternating impulses are continually sent to line by the passage of the alternating perforations. The alternating impulses serve to revolve the type-wheel, and at the moment one of the character-perforations passes a suitable transmitting stylus or point a printing-current is sent to line, which causes the printing-lever of the receiving-instrument to be actuated and an impression to be effected of the character upon the type-wheel which is presented to the platen, in the usual manner.

The transmitting-slip is started in unison with the type-wheel, and as the successive characters on the slip pass the transmitting-stylus the corresponding characters upon the type-wheel are presented to the printing-platen, and the character printed will therefore correspond to the character on the slip which has been perforated.

It is preferred to arrange the characters upon the paper and the type-wheel in a sequence and to have them recur with a frequency dependent upon the order and frequency with which they are found to occur in average composition. To more perfectly accomplish this, it is found necessary to construct the type-wheel with more than the usual number of characters upon its periphery. In practice a type-wheel having one hundred and twenty-six characters is found to afford very satisfactory results. Each letter of the alphabet, whether consonant or vowel, is thus repeated a number of times, proportionate to the number of times it is ordinarily employed in every one hundred and twenty-six letters of average composition, and they are arranged to correspond as nearly as possible in succession to the actual succession in which they are found to be most commonly employed. The characters having been thus arranged in the proper sequence are, for convenience, divided into groups, and certain of the groups thus formed are themselves repeated. Careful study has shown the following arrangement or suc-



cession of letters to conform very nearly to the requirements.

5 B N D F G M K. V W E A I O U.  
J Y E A I O U. B N D F G M K.  
S C P L T H R. J Y E A I O U.  
V W E A I O U. S C P L T H R.  
S C P L T H R. Q W E A I O U.  
Q W E A I O U. B N D F G M K.  
B N D F G M K. Z Y E A I O U.  
10 X Y E A I O U. S C P L T H R.  
S C P L T H R. X W E A I O U.

It will be observed from an inspection of this series of letters that the letter "A" occurs nine times, and the same is true of the principal vowels. Likewise the principal consonants are repeated a number of times proportionate to the frequency of their employment. Thus the letter "R" occurs five times and the letter "M" four times, while the letter "Z" is employed but once. The arrangement of letters in groups may, however, be somewhat varied as found expedient for the different classes of work.

For the purpose of preparing the strip for transmission, it is designed to employ a suitable mechanical instrument adapted to punch the paper as it is caused to pass before the eye, the successive letters which are to be transmitted being punched out, or else a perforation made by the side of the same as they occur. After a message has been thus stenciled upon a strip it is ready for transmission. In some instances it may be found desirable to interrupt the currents sent to line for the purpose of printing, and in other instances a prolonged current may be employed. Either of these methods may be employed, as found convenient.

It has been proposed to employ for telegraphic transmission a slip having alternating perforations; but, so far as I am aware, they have not been arranged to form a continuous series of equidistant perforations throughout the length of the strip.

45 In an application filed February 9, 1883, there is described and claimed an apparatus in which a transmitting-sheet of non-conducting material having lines of characters printed thereon is placed upon a transmitting-cylinder, and a stylus is caused to traverse its surface in a spiral line. The type-wheel from which the impressions are taken is in that instance controlled by a commutator independent of the sheet, though moving therewith. 50 The characters are arranged upon the type-wheel in groups of consonants and vowels.

In the accompanying drawings, Figures 1 and 4 are diagrams illustrating the general organizations of the apparatus employed for transmitting and receiving by two different methods. Figs. 2 and 3 illustrate two kinds of transmitting-strips. Fig. 5 illustrates a form of the strip adapted to transmit a prolonged current for actuating the printing-lever. Figs. 6 and 7 illustrate the application of the invention to duplex telegraphy.

Referring to the figures, A represents a

transmitting-slip having formed at one side two parallel series of perforations,  $a'$  and  $a^2$ . The perforations in the series  $a'$  alternate with those in the series  $a^2$ . These series of perforations are respectively designed to be passed beneath two suitable circuit-closing brushes,  $b'$  and  $b^2$ . The brush  $b'$  is connected by a conductor, 1, with the positive pole of the battery  $o'$ . The brush  $b^2$  is connected by a conductor, 2, with the negative pole of a corresponding battery,  $o^2$ . The remaining poles of these batteries are connected by conductors 3 and 4, respectively, with a conductor, 5, leading to the earth at  $g'$ . The drum  $c'$ , upon which the strip is passed, is connected with the main line L through a resistance,  $r'$ , by a conductor, 6. It is evident that when the drum  $c'$  is revolved and the strip of paper is passed over the surface of the same the brushes  $b'$  and  $b^2$  will be brought into contact with the surface of the cylinder  $c'$  alternately, and alternating impulses will be transmitted to the line. The impulses thus transmitted are caused, at the remote terminal of the main line, to traverse the escapement-magnets  $m'$  and  $m^2$  of a receiving-instrument, M. An escapement-anchor,  $n$ , is impelled in one direction and the other through the influence of these currents, in the usual manner.

The type-wheel T of the receiving-instrument is carried upon a shaft,  $n'$ , and this shaft also carries an escapement-wheel,  $n^2$ . The movements of the escapement-anchor permit a step-by-step movement of the type-wheel, causing it to successively present the type engraved upon its periphery to a platen,  $q$ . The platen  $q$  is carried upon a lever,  $p$ , which is designed to be actuated by means of an electro-magnet, P. The lever is not, however, actuated by currents of the strength employed for impelling the escapement-anchor.

For the purpose of producing an impression it is necessary that the electro-magnet P should be vitalized by a current of increased strength. For the purpose of doing this at the proper moments for effecting the required impressions from the type-wheel it is necessary that the strength of the impulse transmitted at the moment that the type corresponding to any desired character is above the platen should be increased in strength. To accomplish this it is designed that for each character to be printed the transmitting-slip should be perforated opposite the particular perforation in the series  $a'$  or  $a^2$  which serves to bring the required type above the platen. For the purpose of readily determining where such perforations should be made it is necessary that some designation should be applied to each of the alternating perforations, such designations serving to indicate the position in which the type-wheel will be placed at the moment the perforation is passing beneath the transmitting-brush  $b'$ . To this end the strip is printed throughout its length with the characters occurring in the same sequence as they occur upon the type-wheel; and it is evident there-



fore that if the type-wheel be advanced a distance corresponding to one type for each alternating impulse transmitted, then the precise position of the type-wheel may be known by the characters printed upon the transmitting-slip.

For the purpose of occasioning the desired increase in the strength of current, a second contact-brush or transmitting-stylus,  $e'$ , is employed. This stylus follows the line in which the character-perforations are formed, and it is connected with the main line  $L$  at a point, 7, beyond the resistance  $r$ . The effect therefore of the passage of a perforation in the transmitting-slip beneath the brush  $e'$  is to shunt the resistance, and to thereby cause an increase in the strength of the current reaching the line.

The arrangement of the type upon the type-wheel and the transmitting-slip which is preferred has already been explained. The different groups are preferably separated from each other a distance corresponding to one type, and these separations are employed for spacing between words and sentences.

A particular position of the type-wheel is selected as the unison position, and any suitable form of unison device is employed for placing the wheel in this position whenever it is desired. In commencing to transmit a message it is only necessary to start the slip in the proper position relative to the type-wheel.

In Fig. 3 a transmitting-slip is shown in which it is designed that the character-perforations shall be made by punching out the printed letters instead of making them on the line  $a^3$  at one side of the printed letters. The prepared message may, however, be more easily read by an experienced operator if the form of strip shown in Figs. 1 and 2 be employed.

In Fig. 4 a modification in the organization of the apparatus is shown, by means of which the character-perforations are employed for interrupting the type-wheel-actuating impulses, thereby serving to actuate the press-lever. The alternating impulses are transmitted to line by the perforations  $a'$  and  $a^2$  in precisely the same manner as described with reference to Fig. 1, although the artificial resistance  $r'$  may be omitted. The contact-brush  $e'$  is connected directly with the earth at  $g^2$  by a conductor, 9. The effect, therefore, of a perforation in the line  $a^3$  is to short-circuit the battery which is connected with the drum  $c'$ , and to thus produce a momentary interruption in the currents sent to line.

At the receiving-station the alternating impulses are caused to traverse the coils of a relay-magnet,  $S$ , as well as the type-wheel-actuating magnets  $m'$  and  $m^2$ . The armature  $s$  of the magnet  $S$  responds quickly to the alternating impulses, and is caused thereby to remain toward its front contact-stop,  $s^2$ . The back-stop  $s^2$  is connected through the coils of the press-magnet  $P$  and with one pole of a local battery,  $o^3$ , by means of a conductor, 10. The remaining pole of this battery is connected by

a conductor, 11, with the armature-lever  $s'$ . So long as the alternating impulses are sent continuously over the line the armature  $s'$  either remains in contact with its front contact-stop or else touches the back-stop for so short a turn that the press-magnet  $P$  will not respond. When, however, the alternating impulses are interrupted by a character-perforation, then the armature falls against the stop  $s^3$ , closing the local circuit and causing the electro-magnet  $P$  to be vitalized.

The third method of printing is carried out by means of a transmitting-slip of the character illustrated in Fig. 5. The alternating perforations of the series  $a'$  and  $a^2$  are in this instance separated from each other, so that after a perforation in the one series has passed its brush a short interval will elapse before a perforation in the other series will reach its brush. In other words, the alternating impulses, instead of being continuations, will be separated from each other. The object of this is to permit the transmission of prolonged impulses for printing. The character-perforations are therefore punched in the transmitting-slip in the manner already described; but they are of greater length than the perforations in the series  $a'$  and  $a^2$ , as shown at  $a^5$ . When a slip of this character is employed in the apparatus illustrated in Fig. 1, the prolonged currents sent to line are relied upon for actuating the printing-magnet instead of the increase in strength. The artificial resistance may therefore be dispensed with. When the slip is employed in connection with the apparatus shown in Fig. 4, the prolonged character-perforations insure that the local circuit shall remain closed a sufficient time to actuate the printing-magnet.

It may here be observed that among the other advantages derived from the several systems which have been described are these: The moments at which the character impulses or interruptions occur with reference to the alternating impulses are uniformly correct, and even though the transmitting-strip should be upon the drum, or the drum should revolve with varying rapidity, nevertheless the printing-lever would be operated at the proper times for effecting the desired characters, whereas if the alternating currents were sent by a pole-changer constructed upon the drum any movement of the transmitting-slip independently of the drum would throw it out of unison with the receiver. The characters may be embossed upon the strip instead of being printed, and, if it is so desired, instead of perforating the series  $a'$  and  $a^2$ , these may be embossed and the alternating currents sent to line thereby in any well-known manner. The precise points to be perforated may be indicated by lines, as shown at  $x'$  in Fig. 3.

In a patent issued to me October 7, 1884, No. 306,056, an organization of printing-telegraph apparatus is shown, by means of which two messages may be sent in the same direction over a single main line, the currents em-



employed for effecting the impressions of the one message being transmitted at different moments from those employed for effecting impressions from the other type-wheel. In Fig. 6 there is shown an organization of apparatus and a form of transmitting-slip which is adapted to operate according to this same general principle. The receiving-instrument is provided with two type-wheels,  $T'$  and  $T''$ . These type-wheels are mounted upon the same shaft,  $n$ , and they are advanced step by step through the movements of the escapement-anchor acting upon the scape-wheel  $n''$ . The type-wheels are provided with two platens,  $p'$  and  $p''$ , respectively. These platens are so placed with reference to their respective type-wheels that when a type upon one wheel is presented to its platen the space between the type will be presented to the other platen, and vice versa. Two press-magnets,  $P'$  and  $P''$ , are respectively applied to the press-levers  $p'$  and  $p''$ , and their two magnets are respectively included in conductors 21 and 22. A suitable circuit-controlling device,  $V$ , is employed for connecting the main line  $L$  alternately with the conductors 21 and 22. This device consists of a segmental wheel, and is provided with two alternating series of conducting and non-conducting segments. Two brushes,  $w'$  and  $w''$ , respectively, follow these series, and these brushes are connected with the conductors 21 and 22, respectively. The main line is connected through the escapement-magnets with  $v'$ . During the movement of the escapement-anchor between its limits of vibration the main line is thus connected first through one and then through the other of the press magnets. These magnets are designed to effect impressions according to either of the methods already described herein. If, therefore, the proper impulse or interruption be occasioned when the magnet  $P'$  is in circuit, then an impression will be taken from the wheel  $T'$ ; but if the magnet  $P''$  be in circuit, then will the impression be taken from the type-wheel  $T''$ . This organization of receiving apparatus is described in the patent referred to.

The transmitting apparatus which I now propose to employ is essentially the same as described with reference to Figs. 1 and 4. The transmitting-slip, however, is provided with two places for character-perforations opposite each of the alternating perforations. These may be designated, as in the drawings, Figs. 6 and 7, by two characters. These are preferably the same, though different ones may be employed, provided the type-wheels be arranged to correspond. The contact-brush  $e'$  may be constructed of sufficient width to follow two lines of character-perforations, or the character-perforations for the two type-wheels may be placed in the same line, if it is so desired.

It will be understood that the first portion of an alternating impulse will be transmitted

while one of the type-wheels— $T'$ , for instance—is in position to print, while the second type-wheel is in like position during the latter portion of the impulse. If, therefore, a character-perforation be placed opposite the first portion of the type-wheel-actuating perforation, it will cause a corresponding character to be printed from the type-wheel  $T'$ , and if opposite the latter portion an impression will be effected from the type-wheel  $T''$ . The two series of impressions thus made may be employed for embodying two different messages; or, if it is so desired, the first portion of a message may be printed by the one type-wheel and the latter portion meanwhile printed from the second type-wheel. The type-wheels of the receiver may for this purpose be located in such proximity that the two lines of the message may be printed upon the same strip of paper. It is usually preferable, however, to print the message upon two different strips, for the reason that the spacing for the words printed from one type-wheel might lead to confusion by separating the letters of the words printed by the second type-wheel.

Referring again to the single-type-wheel system, it will be observed that by the organization in Fig. 1, when it is necessary to print any given letter twice in succession, it is necessary to advance the transmitting-slip until a perforation corresponding to that particular letter again passes the stylus. For the purpose of rendering it possible to print the same letter twice, it is evident that it is only necessary that the printing-lever should be actuated twice while the type-wheel remains in such position as to present that type to the platen—that is to say, before the movement of the type-wheel shall have carried the type beyond the field of the platen. For the purpose of readily accomplishing this, a transmitting-slip similar to that shown in Fig. 7 may be employed in transmitting to a single wheel. This strip, however, should be then constructed with the printing-perforations somewhat less in length than one-half the length of the type-wheel-actuating perforations, so that two of the short perforations may be placed opposite one of the longer perforations, and these two separated from each other a sufficient distance to permit the printing-lever to fall away from the type-wheel preparatory to printing the same type a second time. Such a form of transmitting-slip is illustrated at Fig. 8.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of a printing-telegraph receiving-instrument, two circuit-closing brushes, a transmitting-slip having two series of regularly-recurring equidistant alternating perforations, a third circuit-closing brush adapted to follow a third series of perforations, and circuit-connections, substantially such as described, whereby the escapement of the receiving-instrument is actuated through the instrumentality of the two first-named brushes



and the impression device through the instrumentality of the third brush.

2. A transmitting-slip for telegraphy, having a continuous series of regularly-recurring equidistant alternating perforations formed therein and an arbitrary succession of characters repeated thereon throughout its length, which characters indicate points, with reference to the perforations, at which perforations may be made to embody a message.

3. A transmitting-slip for telegraphy, having two continuous series of equidistant alternating perforations extending throughout its length, an arbitrary succession of characters repeated thereon in a line parallel to said perforations, which characters indicate points with reference to the perforations at which perforations may be made to embody a message, and other perforations at various of the points so indicated.

4. A transmitting-slip for telegraphy, having two series of equidistant perforations, the length of each perforation in either series being approximately equal to the space between two adjacent perforations in the other series, a series of characters represented throughout its length, and perforations at points indicated by certain of the characters, which perforations are of less length than the first-named perforations and represent messages to be transmitted, substantially as described.

5. A transmitting-slip for telegraphy, consisting of a strip of paper or equivalent material having two series of equidistant alternating perforations, one or more lines of characters, and perforations opposite the characters embodying telegraph-messages.

6. The combination, substantially as hereinbefore set forth, of a type-wheel, an escapement therefor, a press-lever, and a transmitting-slip having two series of equidistant alternat-

ing perforations, whereby a continuous series of alternating electric impulses may be transmitted for actuating said escapement, and other perforations whereby said press-lever may be actuated.

7. The combination, substantially as hereinbefore set forth, of a type-wheel having upon its periphery characters representing letters of the alphabet arranged in groups, the alternating groups being essentially consonants and vowels, and a transmitting-slip bearing characters in groups corresponding to the groups upon said type-wheel.

8. The combination, substantially as hereinbefore set forth, of a type-wheel bearing characters arranged in groups and repeated a number of times proportionate to the frequency of their employment, means for actuating said type-wheel, a transmitter, and a transmitting-slip bearing characters corresponding in arrangement to the characters upon the type-wheel.

9. The combination, substantially as hereinbefore set forth, of two type-wheels, means for revolving the same, two press-magnets respectively applied to said type-wheels, means for placing the same alternately in circuit, and a transmitting-slip having alternating perforations, whereby currents are transmitted for actuating the type-wheels and spaces opposite each of said alternating perforations, which spaces are indicated by characters representing the letters upon said type-wheels, respectively.

In testimony whereof I have hereunto subscribed my name this 13th day of December, A. D. 1884.

CHARLES G. BURKE.

Witnesses:

RALPH W. POPE,  
CHARLES A. TERRY.