(No Model.)

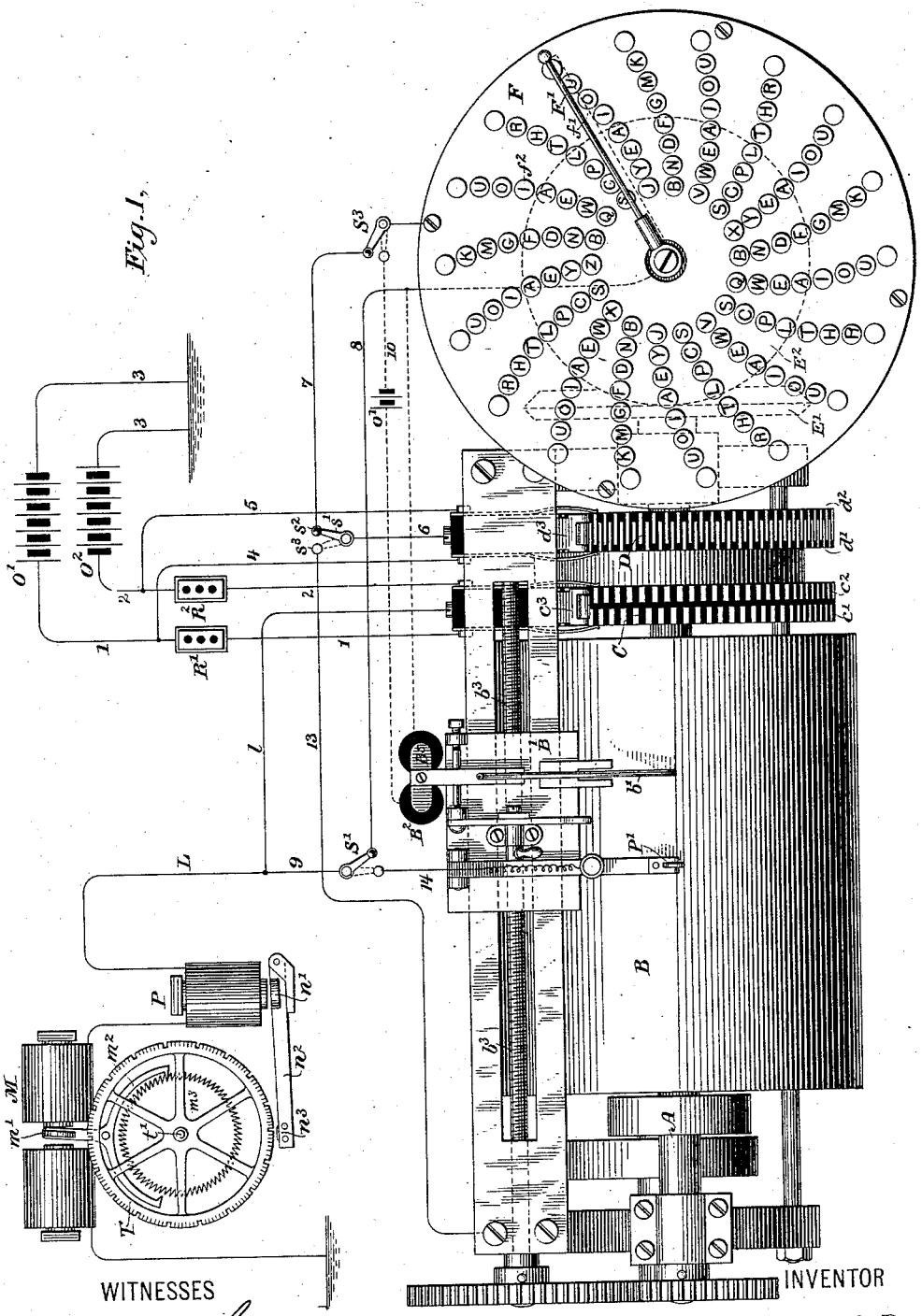
2 Sheets—Sheet 1.

C. G. BURKE.

PRINTING TELEGRAPH.

No. 306,055. Patented Oct. 7, 1884.

Fig. 1.



WITNESSES

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(No Model.) 2 Sheets—Sheet 2.

C. G. BURKE.

PRINTING TELEGRAPH.

No. 306,055. Patented Oct. 7, 1884.

Fig. 2.

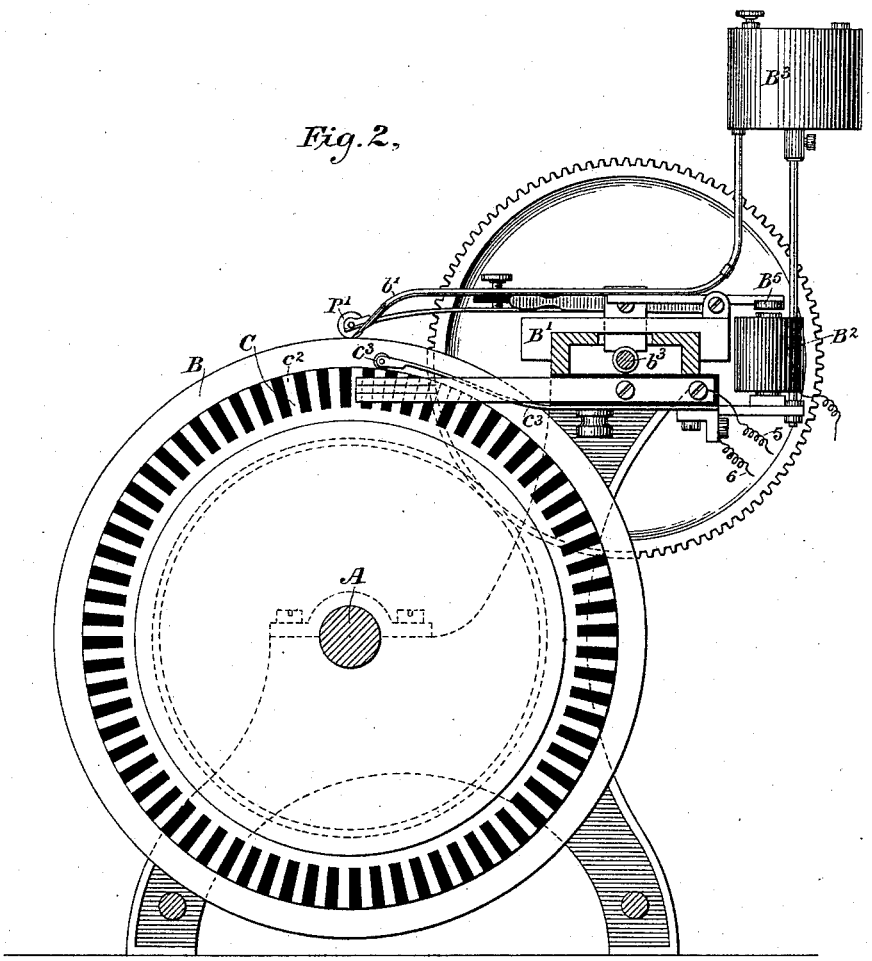
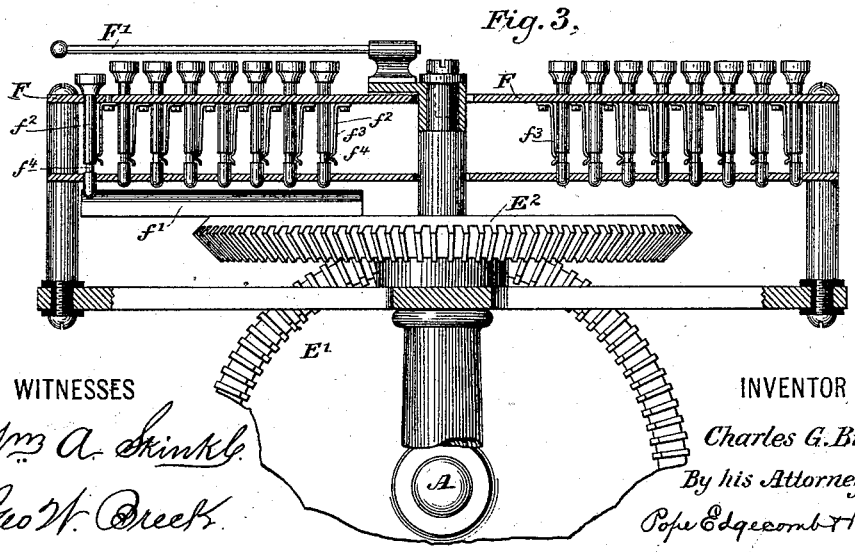


Fig. 3.



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UNITED STATES PATENT OFFICE.

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

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 306,055, dated October 7, 1884.

Application filed November 16, 1883. (No model.)

To all whom it may concern:

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

My invention relates to certain improvements in apparatus for transmitting upon a telegraphic main line electric impulses adapted to print from a revolving type-wheel impressions of characters constituting a record of the dispatch or telegraphic message; and it also relates to the construction of the apparatus whereby said characters are recorded.

The object of the invention is to provide means whereby the dispatch which it is desired to transmit may be recorded upon a transmitting-cylinder in such a manner as to render it capable of being automatically retransmitted therefrom, if desired, or the requisite impulses may be transmitted directly to the receiving-instrument.

The invention also comprises certain improvements in the construction of the receiving-instruments, whereby dispatches may be recorded with greater rapidity than has heretofore been found practicable.

The invention consists in constructing the apparatus substantially in the following manner: The transmitting key-board is circular in form, and is provided with more than one key corresponding to the letters of the alphabet most commonly employed—that is to say, each letter or character is provided with a number of keys proportionate to the frequency of its employment in ordinary use. The keys are also arranged in such a manner that each and every key falls in a different radial line of the circular key-board. Beneath these keys is rotated a contact-arm, which is designed to form an electrical connection with any key which may be depressed, and also to raise such key and restore it to its normal position upon making such contact. The keys themselves constitute one terminal of an electric circuit, and the revolving arm the other; hence, by the contact of the arm with one of the keys an electric circuit is completed, which may be employed either for actuating a message-preparing device or for directly actuating a receiving-instrument having upon the periphery of its type-wheel a series of characters corresponding to the keys of the transmitter. Considering, first, the means of preparing or stereotyping the message for subsequent automatic transmission, a cylinder may be employed for receiving the message, which is rotated by mechanical means, and which imparts a corresponding movement to the revolving arm. The cylinder is provided with an inking-pen, which is caused by the revolution of the cylinder to describe a helical line of non-conducting ink upon its surface. This inking-pen is, however, controlled by an electro-magnet which, when vitalized, raises the pen from the surface of the cylinder, thereby producing a break in the line of non-conducting ink, the length of which is determined by the time during which the pen remains thus raised. When it is desired to charge the cylinder with a message, this electro-magnet is included in a circuit capable of being completed by the circuit-closing arm, so that each time this arm makes contact with one of the depressed keys the electro-magnet will be vitalized and a corresponding interruption of the line of non-conducting ink will be produced. As the movement of the arm is coincident with that of the cylinder, the angular position upon the cylinder of the interruption thus occasioned will correspond precisely to the position of the key by means of which the interruption was occasioned. The cylinder having been thus prepared, a transmitting arm or stylus, which, by similar mechanical means, is caused to follow the line of non-conducting ink upon its surface, is employed for transmitting impulses from a main battery upon the main line by its successive contacts with the metallic cylinder at the point of interruption of the line of non-conducting-ink. The cylinder is provided with means for transmitting upon the main line electric impulses of alternating polarity of such character as to advance the type-wheel of the receiving-instrument step by step in a manner well understood. By revolving the cylinder as rapidly as may be desired a series of alternating impulses for actuating the type-wheel of the receiving-instrument are transmitted to line, and at the moment the transmitting-stylus makes contact with the cylinder a current corresponding in polarity to the impulse last

transmitted, but having an additional strength sufficient to actuate the printing mechanism of the receiving-instrument, is transmitted to the main line. The intervals at which such impulses will be transmitted are primarily determined by the relative angular positions of the keys through the instrumentality of which the interruptions were occasioned. The number of pole-changing segments employed for actuating the type-wheel of the receiving-instrument is equal to the number of keys upon the key-board. The number of impulses, therefore, which will be transmitted to line by means of this pole-changer between any two successive impulses of increased strength will be equal to the number of keys intervening upon the key-board between the two keys by means of which the two interruptions were occasioned, and the type-wheel will be advanced one character for each such impulse. By means of the stronger impulses impressions will therefore be taken from the type-wheel corresponding to the keys by means of which the open spaces upon the transmitting-cylinder were occasioned. When, however, it is desired to transmit from the key-board directly to the main line without the intervention of the cylinder, this may be accomplished by connecting the source of the stronger currents directly with the transmitting key-board and substituting for the electro-magnet employed for actuating the inking-pen the electro-magnet of the receiving-instrument, which may of course be placed at any distance from the transmitter. The receiving-instrument is constructed in essentially the same manner as other well-known receiving-instruments for printing-telegraphs, with this exception: the type-wheel, instead of having a single series of characters corresponding with the alphabet, is provided with a number corresponding to those employed upon the key-board, and preferably this number is one hundred and twenty-six. This series is broken by eighteen blanks or spaces interposed at regular intervals upon the periphery of the type-wheel. The type-wheel is also, for the double purpose of rendering it as light as possible and of making its characters more sharp and distinct than those of the ordinary type-wheel, constructed of aluminum.

The invention also embodies certain details of construction, which will be hereinafter fully described.

Referring to the accompanying drawings, which illustrate my invention, Figure 1 is a plan view of the transmitting key-board and revolving cylinder, showing also in diagram the construction of the receiving-instrument and its circuit connections. Fig. 2 is a side elevation of the transmitting-cylinder, and Fig. 3 is a side elevation, partly in section, of the key-board, showing the mechanical connection between the same and the axis of the cylinder.

Referring to these drawings, A represents a shaft which is mechanically revolved by any suitable means, and is preferably so arranged as to be capable of being driven at a speed which may be varied at will. Upon this shaft is carried a transmitting-cylinder, B, and also two pole-changing devices, C and D, which will be hereinafter fully described.

At the extremity of the shaft A is a vertical beveled gear-wheel, E′, which engages with a horizontal beveled gear-wheel, E^2, of the same size, and having an equal number of teeth. Each revolution, therefore, of the shaft A will cause a single revolution of the wheel E^2.

Upon the wheel E^2 is carried a revolving circuit-closing arm, f', the function of which is to complete the connections of an electric circuit by making contact with the lower extremity of any one of a series of circuit-closing keys, f^2, which extend downward through a key-board, F, above the circuit-closing arms. The keys f^2 are normally held up out of the path of the circuit-closing arm f' by means of friction-springs f^3, each one of which is adapted to enter an annular groove, f^4, formed near the lower extremities of the respective keys. Any one of the keys, however, may be depressed a sufficient distance to carry the groove beyond the reach of the spring and bring its lower extremity into the path of the circuit-closing arm f'. The lower extremities of the keys are preferably rounded or beveled, as shown in Fig. 3, in such a manner that the contact of the arm f' therewith will force them upward, and thus restore them to their normal position.

The keys on the key-board are preferably arranged in the manner indicated in the drawings, in eighteen curved rows radiating from the center of the circular key-board, and each key occupies an angular position or falls upon a radial line of the key-board differing from every other key, so that the revolving contact-arm f' can strike against but one key at a time. At some convenient point, and preferably at the outer end of each of the eighteen series of keys thus formed, is placed a key designed to correspond with a blank or space upon the type-wheel of the receiving-instrument. The remaining keys each correspond to a letter of the alphabet or with a numeral. Each radial series is preferably further designated as being essentially a consonant series and a vowel series, a series of vowels intervening between each series of consonants.

Each letter of the alphabet, whether consonant or vowel, is repeated upon the key-board 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. After a careful study I have found the following arrangement or succession of letters to conform most nearly to such requirements: BNDFGMK—JYEAI

OU—SCPLTHR—VWEAIOU—SCPLTHR--QWEAIOU—BNDFGMK—XYEAIOU—SCPLTHR—VWEAIOU—BNDFGMK—JYEAIOU—SCPLTHR—QWEAIOU—BNDFGMK—ZYEAIOU—SCPLTHR—XWEAIOU. It will be observed from an inspection of this series of letters, and also from an examination of the key-board as illustrated in Fig. 1, that during a single revolution of the circuit-closing arm there are nine different points at which a contact may be made with a key designated by the letter A, and the same is the case with the other principal vowels. Likewise the principal consonants are repeated a number of times proportionate to the frequency of their employment. Thus the letter R is represented five times and the letter M four times, while the letter Z is employed but once, and letter Q but twice.

Above the key-board F extends an arm or index, F′, which is carried upon the arbor of the beveled gear-wheel E^2. This index is exactly above and moves in unison with the circuit-closing arm f', and serves to indicate to the operator the precise position of that arm. The transmitting-operator may thus, in preparing his message, depress his keys as rapidly as possible, each key remaining depressed until the contact of the circuit-closing arm forces it upward again, the only requisite on the part of the operator being that he depress the keys in their proper succession, and that he does not pass around the key-board more than once for each revolution of the circuit-closing arm. There may, however, it is evident, be as many as eighteen or twenty, or even more, keys depressed at a time in their proper succession, and these keys will be successively struck by the circuit-closing arm, which thereupon restores them one by one to their normal position, passing on to the next key. In practice I have found that an average of three words may be transmitted by a single revolution of the circuit-closing arm f'.

The key-board which has been described may be employed for transmitting directly to the main line the impulses occasioned by the circuit-closing arm, or it may be employed for preparing the cylinder B with a series of conducting-surfaces or interruptions of a non-conducting line upon a conducting-surface, which interruptions succeed each other at the proper intervals to correspond with the impulses which are transmitted from the key-board.

The method of transmitting the impulses directly to the receiving-instrument will first be described.

The pole-changing device C upon the shaft A consists of two series of alternating conducting-segments, c' and c^2. The series c' are all in electrical connection through a conductor, 1, including an artificial resistance, R′, with one pole, say the positive, of a battery, O′, and the series c^2 are in like connection through a conductor, 2, including a similar resistance, R^2, with the negative pole of a battery, O^2, corresponding in electro-motive force to the battery O′. The remaining poles of each of these batteries are connected with the earth by a conductor, 3. A contact-brush, c^3, resting upon the surface of the disk C, is brought by the revolution of the shaft A successively into contact with the alternating segments c' and c^2. This contact-brush c^3, which is connected through a conductor, l, with a main line, L, leading to the receiving-instrument, is thus put alternately in communication with the batteries O′ and O^2, and a series of positive and negative impulses are transmitted to line. The number of contacts thus made by the brush during a single revolution of the shaft A is equal to the whole number of keys employed upon the key-board—that is to say, one hundred and forty-four—and these impulses preferably succeed one another each immediately upon the interruption of the preceding impulse. There will thus be transmitted to the main line during a single revolution of the shaft A one hundred and forty-four impulses, seventy-two being of positive polarity and seventy-two of negative, and these impulses will alternate with each other. Such impulses are employed for imparting to the type-wheel T of the receiving-instrument one revolution for each complete revolution of the shaft A without actuating the printing mechanism.

The second pole-changing device, D, is precisely similar in its construction to the pole-changer C. It is provided with two series of conducting-segments, d' and d^2, which are respectively connected directly with the positive and negative poles of the two batteries O′ and O^2, around the resistances R′ and R^2 by conductors 4 and 5, respectively. The currents from these batteries, when not forced to traverse the resistances R′ and R^2, have sufficient strength to actuate the printing device of the receiving-instrument. The contact-brush d^3 of the pole-changing device D is connected through a conductor, 6, with a switch, s', which may be placed in contact with a point, s^2 or s^3. The contact-point s^2 is connected through a conductor, 7, with the key-board F, and thus with all the keys f^2, while the contact-arm f' is connected through a conductor, 8, and a switch, S′, with a conductor, 9, leading to the main line L. It will be seen, therefore, that the circuit of the batteries O′ and O^2 around the resistances R will normally be open at the transmitting key-board, even while the connections are complete through the contact-brush d^3. When, however, one of the keys f^2 is depressed, the contact of the arm f' therewith will cause the circuit-connections of the particular battery O′ or O^2, which chances to be connected, through the pole-changing device D, with the brush d^3, to be completed around the corresponding resistance, so as to short-circuit or shunt it, and an impulse of increased strength will be transmitted to the main line. The two pole-chang-

ing devices are so applied to the shaft A and the brushes are so adjusted that this increase in strength of current will commence after the same battery has been connected to line through the corresponding resistance, R, and will be interrupted before that connection has been interrupted, so that the printing-platen of the receiving-instrument will have been actuated and returned to its normal position before the interruption of the current or impulse, by means of which the type-wheel is actuated. The movements of the type-wheel will, therefore, be practically uninterrupted, inasmuch as the impressions will be taken between its successive steps. The contact of the arm f' with a key, f^2, which is depressed, will not only cause the strong current or impulse to be transmitted, but will immediately raise that key to its normal position, and move forward without interruption to the next succeeding depressed key. There will thus be practically no detention of the circuit-closing arm.

Considering, now, the operation of the receiving-instrument, the alternating impulses from the batteries O′ and O² are caused to traverse the coils of a double electro-magnet, M, having a vibrating polarized armature, m', mounted between the confronting poles. This armature carries an anchor-escapement, m^2, engaging the teeth of a ratchet-wheel, m^3, carried upon a type-wheel shaft, t'. The alternating impulses cause the armature m' to be thrown to and fro between the confronting poles of the electro-magnet M in a manner well understood, and its movements serve to permit the advance of the ratchet-wheel step by step in response to the constant force exerted thereupon by a weight or spring applied thereto in the usual manner.

Upon the shaft t' is mounted a type-wheel, T, which has engraved upon its periphery a series of characters corresponding both in form and order of succession to the characters upon the transmitting key-board F, and it is also provided with a space intervening between each successive seven letters corresponding with the respective outer keys of the key-board. The type-wheel is necessarily of a larger circumference than those of ordinary construction, and, for the purpose of rendering it as light as possible, and at the same time making the characters more sharp and distinct than those upon the ordinary type-wheel, I prefer to construct it of aluminum, as I have found that this metal will excellently serve both requirements. An electro-magnet, P, which is included in the circuit of the main line, is provided with an armature, n', fixed upon a lever, n^2, which carries a printing-platen, n^3, for taking impressions from the type-wheel T. The parts are, however, so adjusted that the armature n' will not respond to electric impulses of a strength no greater than is required for actuating the escapement device—that is to say, to currents transmitted from the batteries O′ O² by means of the pole-changing device C—but only to impulses of greater strength, such as are transmitted by means of the pole-changer D. It will be seen thus that for each alternating impulse which is transmitted by the pole-changer C the type-wheel T will be advanced one letter or space corresponding to a key upon the transmitting key-board, and that for each revoluion of the arm f' or shaft A there will take place one revolution of the type-wheel, so that if an impulse of increased strength be at any moment transmitted by the contact of the arm f' with a key, f^2, the electro-magnet P will be vitalized and the platen n^3 will take an impression upon paper from the type-wheel of the type corresponding to the key with which the contact was made, provided that the type-wheel and transmitting apparatus are in unison with each other. For insuring that such unison shall exist, any well-known suitable form of unison device may be employed.

Referring now to the method of preparing the messages upon the cylinder B and transmitting therefrom automatically instead of transmitting directly from the key-board F, the cylinder B is provided with an inking-pen, b', which is supported upon a carriage, B′, together with an electro-magnet, B², and ink-reservoir B³. The carriage B′ is supported upon the frame of the machine, and is driven laterally by means of a screw-threaded rod, b^3, extending parallel with the cylinder B. The rod b^3 is actuated by the revolution of the cylinder, and hence if the inking-pen b' rests upon the cylinder a continuous helical line will be described upon its surface. A suitable non-conducting ink is supplied to the pen from the reservoir B³, and this ink is applied to the cylinder so long as the pen remains in contact therewith. The electro-magnet B², however, acts to raise the pen from the surface of the cylinder whenever an electric circuit is completed therethrough by reason of the attraction it exerts upon an armature, B⁵, carried upon one arm of the lever supporting the pen. This electro-magnet is included in the circuit of a local battery, O′, the circuit of which may in turn be completed in the following manner: One pole of the battery O′ is connected through conductor 10 with a switch, S³, which, when in the position shown in dotted lines, continues the connections of the battery to the key-board F. The remaining pole of the battery O′ is connected through the coils of the electro-magnet B² with the circuit-closing arm f'. When this battery is thus connected with the key-board F, the switches s' and S′ may be opened, unless it is desired to transmit at the same time to the receiving-instrument, in which case they may remain in the same position as already described in connection with the batteries O′ and O². When, therefore, the arm f' makes contact with any depressed key f^2, an impulse will be transmitted from the battery O′ through the coils of the electro-magnet B², and the pen b' will be

raised from the surface of the cylinder, thereby causing an interruption of the continued line of non-conducting ink at a point corresponding to the point at which the key is located, by means of which the impulse is transmitted—that is to say, if two keys upon the key-board be depressed, the number of impulses which will be transmitted by means of the pole-changing device C during the passage of the intervening section of non-conducting ink past a given point when the cylinder is employed for transmitting will correspond to the number of keys which have been passed by the circuit-closing arm in moving from the first-named key to the second key which was depressed. When the cylinder B has been thus charged or prepared with messages for transmission, it is employed for automatically retransmitting those messages in the following manner: Upon the carriage B′ is supported a transmittting-stylus, P′, which, during the preparation of the message has been raised from contact with the cylinder. When, however, it is desired to transmit, the carriage B′ is moved to its starting-point, and this arm is allowed to rest upon the cylinder while the inking-pen is raised therefrom. A conductor, 13, leading from the switch-point s^3, is employed for substituting for the connection of the brush d^3 with the key-board F a like connection with the cylinder B when the switch s' is in the position shown in dotted lines. The switch S′ is also moved into position shown in dotted lines, thereby substituting for the connection from the circuit-closing arm f' a connection through the conductor 14 with the transmitting-stylus P′. If then the cylinder be revolved, the series of alternating impulses from the batteries O′ O^2 will be transmitted to line through the resistances R in precisely the same manner as already described with reference to the key-board F. Instead, however, of the impulses of increased strength being transmitted directly from the key-board, corresponding impulses will be transmitted at the proper intervals by means of the stylus P′, and these impulses will cause the printing-magnet to be actuated in precisely the same manner as described with reference to the key-board F.

I have described the key-board as having seven letter-keys and one space-key in each series; but in some instances it may be found desirable to increase the number of series, and to correspondingly lessen the number of keys in each series, or vice versa.

The precise method which has been described of obtaining electric currents of different strengths is not essential, as it may be found desirable in some instances to employ some other well-known arrangement of batteries, and such change may readily be made by persons skilled in the art without departing in the least from the principle of the invention.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of a revolving shaft, two pole-changing devices, a main line with which one of said pole-changing devices is connected, a revolving circuit-closing arm, a series of keys so arranged that said circuit-closing arm passes beneath each of said keys in succession, and means, substantially such as described, whereby said keys may be manually depressed and automatically raised through the instrumentality of said circuit-closing arm, said arm and keys serving to connect the second pole-changing device with the main line.

2. A transmitting key-board provided with a series of keys arranged in curved rows converging toward the center of said board, each key being located in a different radial line from every other key.

3. The combination, substantially as hereinbefore set forth, with a series of keys arranged in curved series converging toward a common center, of a revolving circuit-closing arm into the path of which any or all of said keys may be projected.

4. The combination, substantially as hereinbefore set forth, with a series of keys arranged in curved series converging toward a common center, of a revolving circuit-closing arm into the path of which said keys may be projected, means, substantially such as described, for causing any one of said keys when depressed to remain so depressed until struck by said revolving circuit-closing arm.

5. In a printing-telegraph, the combination, substantially as hereinbefore set forth, with a key-board having its keys designated by characters in substantially the following sequence: BNDFGMK—JYEAIOU—SCPLTHR—VW EAIOU—SCPLTHR—QWEAIOU—BNDF GMK—XYEAIOU—SCPLTHR—VWEAIO U—BNDFGMK—JYEAIOU—SCPLTHR— QWEAIOU—BNDFGMK—ZYEAIOU—SC PLTHR—XWEAIOU—with a type-wheel having its periphery engraved with characters corresponding both in form and sequence to the characters upon said keys.

6. In a transmitting-instrument, a key-board having its keys arranged in groups or series, the characters represented in each alternate group or series being vowels and consonants.

7. The combination, substantially as hereinbefore set forth, with a vertically-movable key having an annular groove or indentation formed therein, of a friction-spring adapted to enter said groove when said key is in its normal position, and a revolving circuit-closing arm adapted to raise said key to its normal position.

8. The combination, substantially as hereinbefore set forth, with a revolving shaft and a cylinder carried upon said shaft, of an inking-pen normally resting on the surface of said cylinder, an electro-magnet adapted to raise said pen from said cylinder, a series of keys, a circuit-closing arm moving with said cylinder, and adapted to complete the connections of an electric circuit through said electro-

magnet when in contact with one of said keys.

9. The combination, substantially as hereinbefore set forth, of a revolving shaft, a cylinder moving with said shaft, means, substantially such as described, for applying a line of non-conducting material to the surface of said cylinder, with a series of keys, a circuit-closing arm revolving with said cylinder, and means, substantially such as described, for interrupting said line upon said cylinder when said contact-arm strikes against any one of said keys.

10. The combination, substantially as hereinbefore set forth, with a printing-telegraph receiving-instrument, of a moving conducting-surface, a pole-changing device moving therewith, a line of non-conducting material applied to said surface, leaving interposed sections of the same exposed, the distance between any two of which exposed sections corresponds to the distance through which it is necessary that said conducting-surface should move to cause said pole-changing device to transmit the requisite number of impulses for revolving the type-wheel of said receiving-instrument from the position which it occupies when printing a character corresponding to the first exposed section into the proper position to print the character corresponding to the succeeding exposed section.

11. The combination, substantially as hereinbefore set forth, of a revolving shaft, a cylinder moving with said shaft, two pole-changing devices, means, substantially such as described, for causing electric impulses of a given strength to be transmitted through one of said pole-changing devices to the said main line during the revolution of said cylinder, a transmitting-stylus moving over the surface of said cylinder and acting, when in contact with said cylinder, to transmit an impulse from the other of said pole-changing devices having the same polarity as the impulse last transmitted by the first-named pole-changer, but being of shorter duration.

12. The combination, substantially as hereinbefore set forth, in a printing-telegraph transmitting-instrument, of a pole-changing device for transmitting alternating electric impulses of determinate duration, and a second pole-changing device for transmitting at will an impulse of the same polarity as but of less duration than the impulse which is at the same moment being transmitted by the first-named pole-changer.

13. The hereinbefore-described method of actuating a printing-telegraph receiving-instrument, which consists in causing a series of type to be successively placed in a position to print through the agency of alternate electric impulses of a determinate duration and strength, and in effecting an impression from any type which is thus placed in position, through the agency of an increase in the strength of the impulse then being transmitted without prolonging the same, said increase being of less duration than said impulse and occurring after the commencement of the same.

14. The hereinbefore-described method of actuating a printing-telegraph receiving-instrument, which consists in causing a series of type to be successively placed in a position to print through the agency of alternate electric impulses of a determinate duration and strength, and in effecting an impression from any type which is thus placed in position through the agency of an increase in the strength of the impulse then being transmitted without prolonging the same, said increase being of less duration than said impulse.

In testimony whereof I have hereunto subscribed my name this 30th day of October, A. D. 1883.

CHARLES G. BURKE.

Witnesses:
DANL. W. EDGECOMB,
CHARLES A. TERRY.