(No Model.) 6 Sheets—Sheet 1.

E. POPE.

PRINTING TELEGRAPH.

No. 521,550. Patented June 19, 1894.

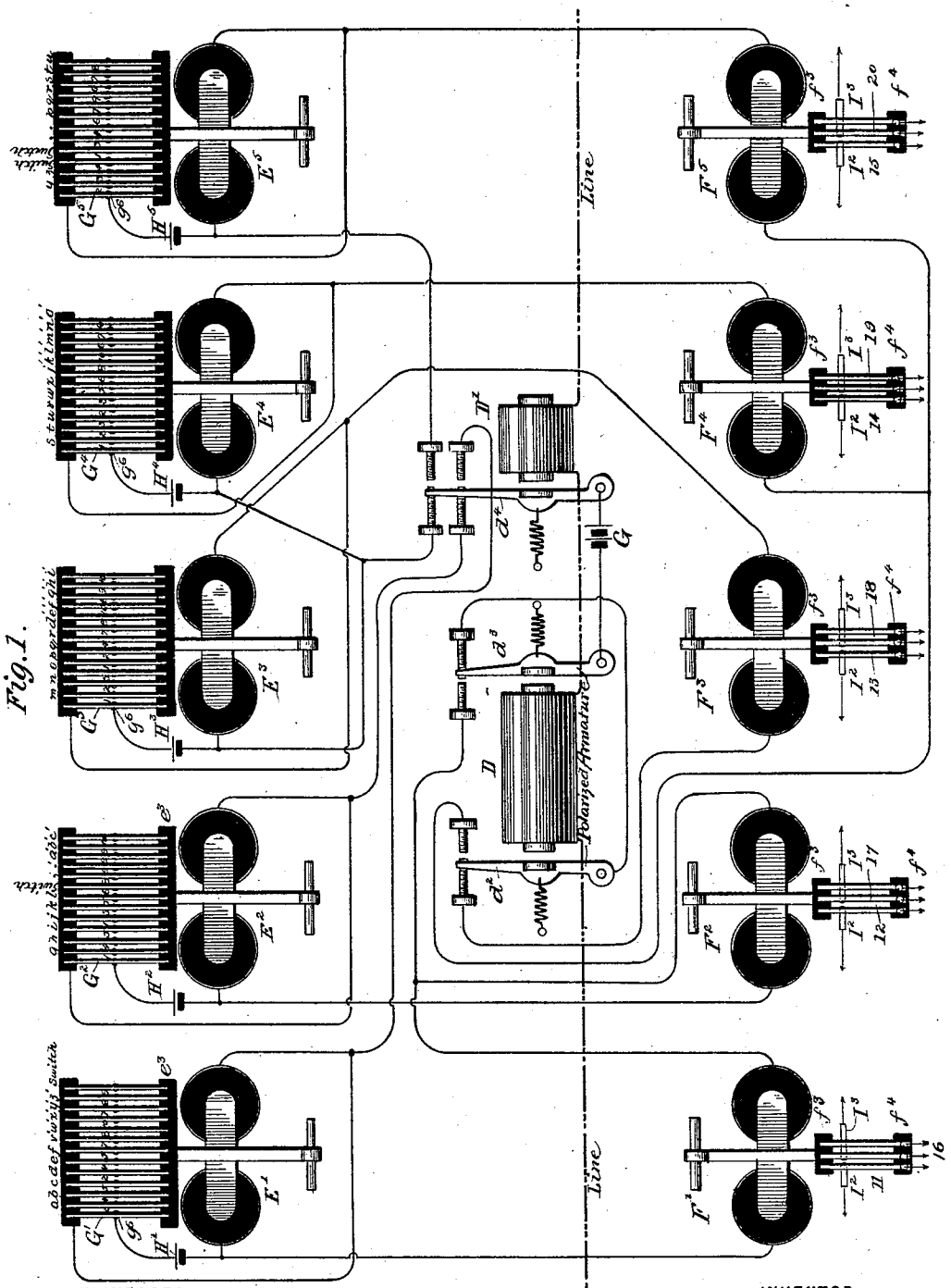

Fig. 1.

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(No Model.) 6 Sheets—Sheet 2.

E. POPE.

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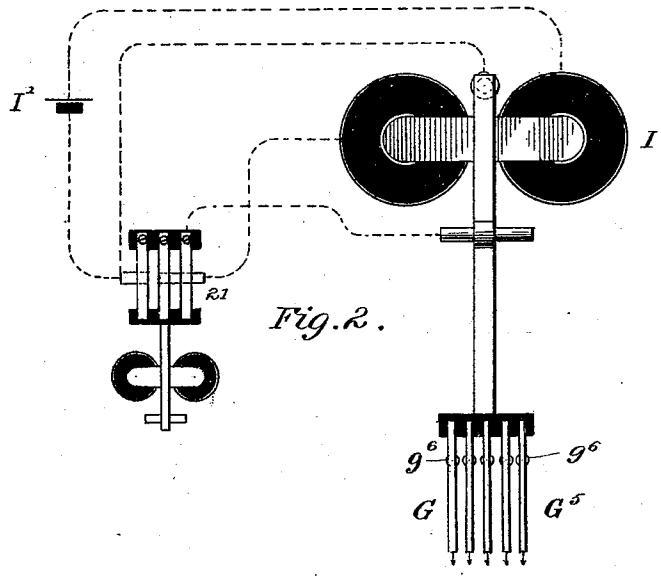

Fig. 2.

Fig. 3.

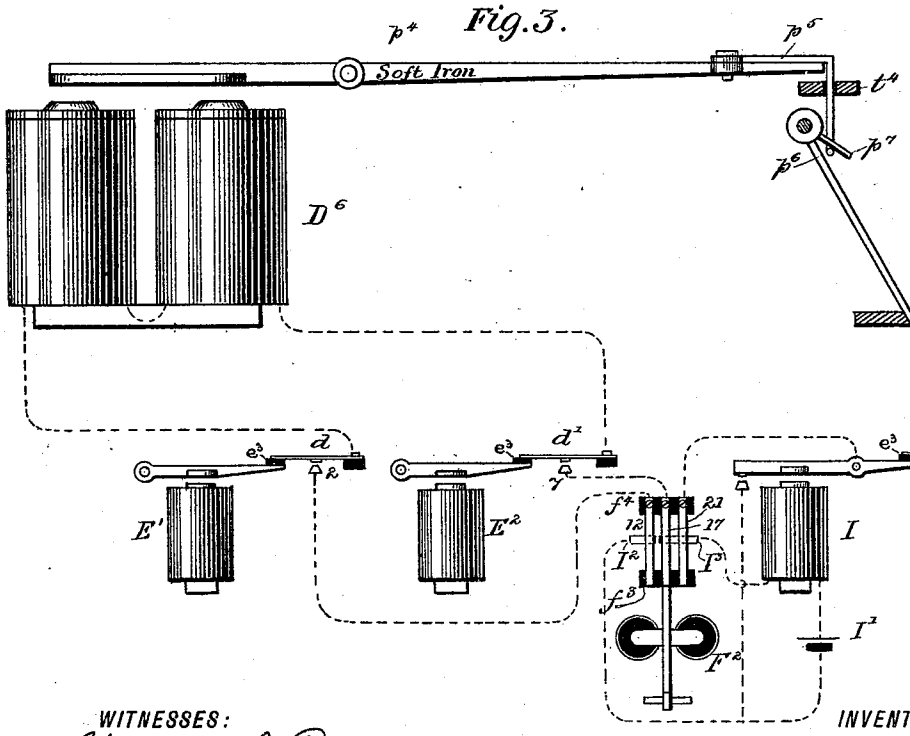

Fig. 4.

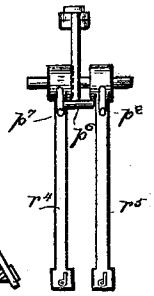

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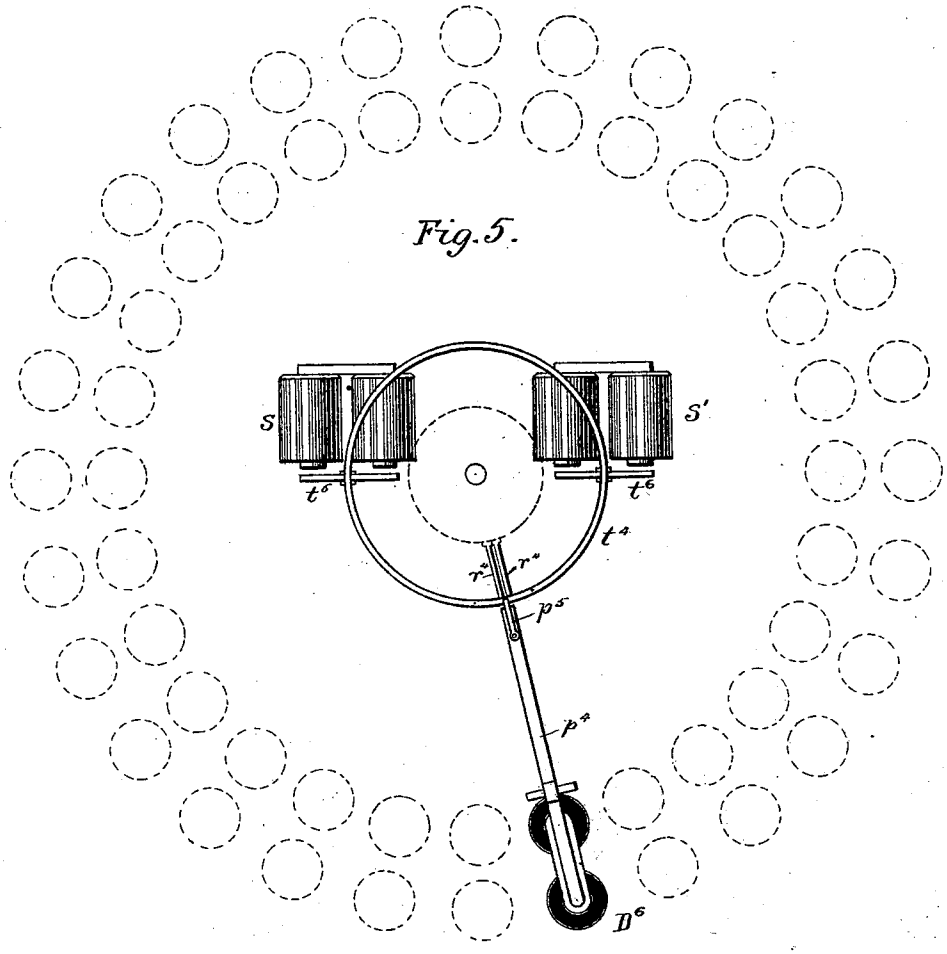
Fig. 5.



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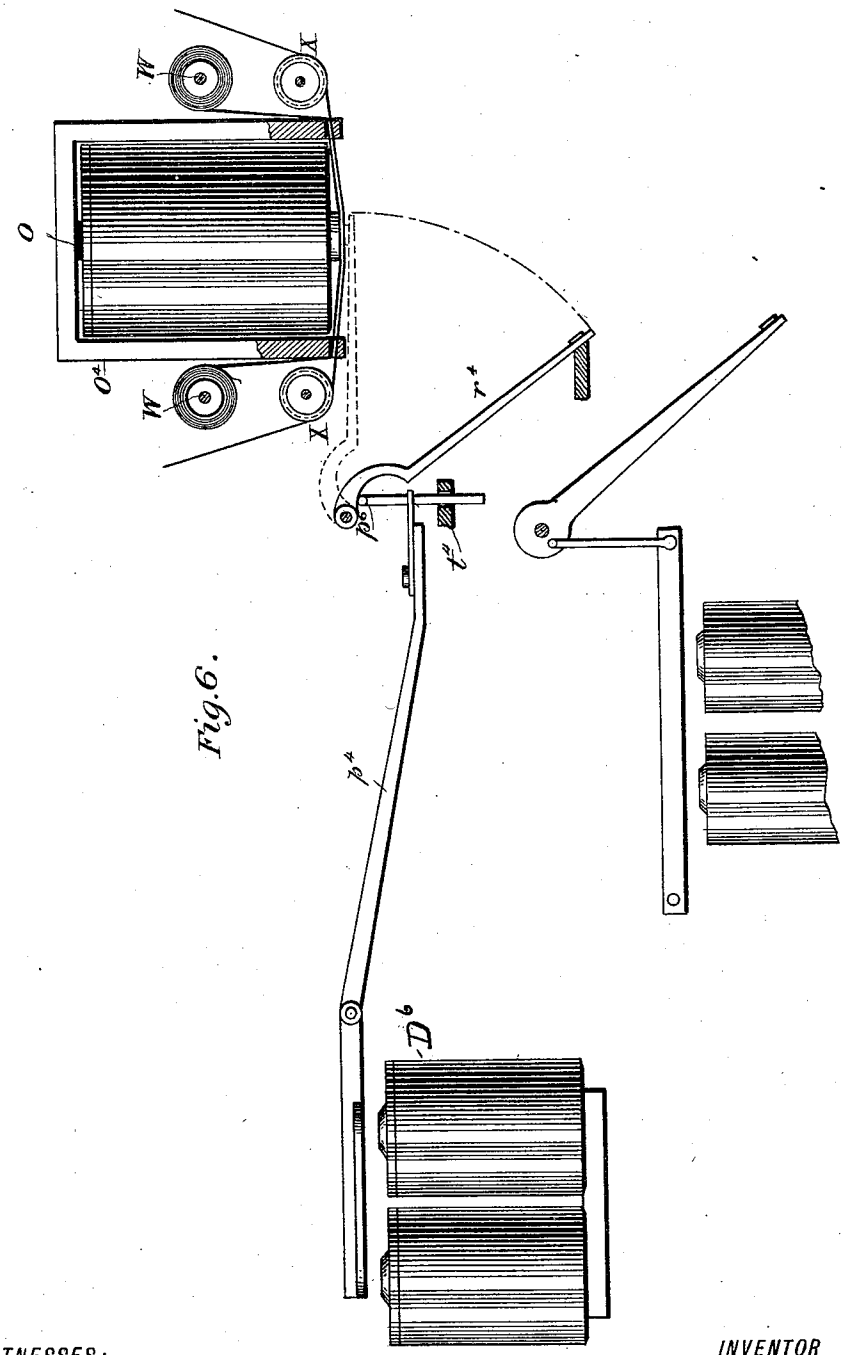

Fig. 6.

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(No Model.) 6 Sheets—Sheet 5.

E. POPE.

PRINTING TELEGRAPH.

No. 521,550. Patented June 19, 1894.

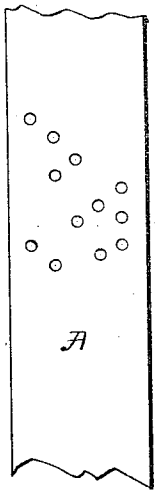


Fig. 7.

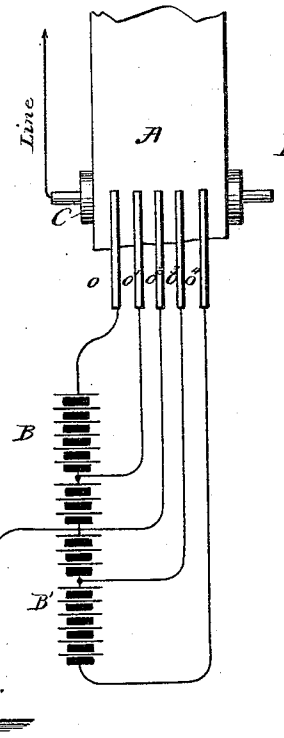


Fig. 8.

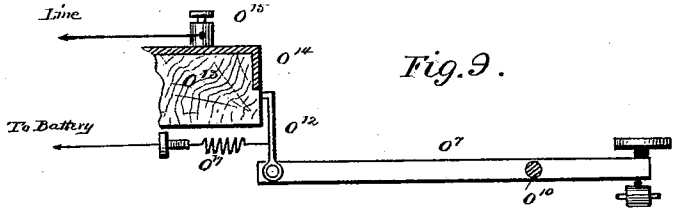
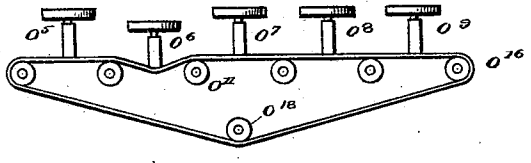


Fig. 9.

Fig. 10.



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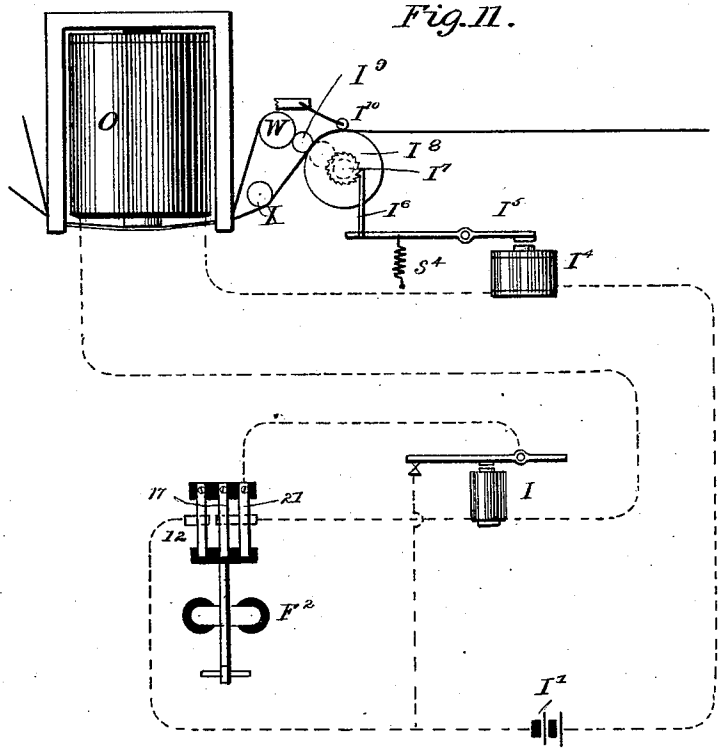
(No Model.) 6 Sheets—Sheet 6.

E. POPE.

PRINTING TELEGRAPH.

No. 521,550. Patented June 19, 1894.

Fig. 11.



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UNITED STATES PATENT OFFICE.

EDWIN POPE, OF QUEBEC, CANADA.

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 521,550, dated June 19, 1894.

Application filed June 20, 1890. Serial No. 356,117. (No model.)

To all whom it may concern:

Be it known that I, EDWIN POPE, a subject of the Queen of Great Britain, residing in Quebec, in the Province of Quebec, Canada, have invented certain new and useful Improvements in Printing-Telegraphs; and I do hereby declare that the following is a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in printing telegraphs, and consists in providing means whereby every letter or character within the capacity of the apparatus is printed by simple and direct movements of armature levers.

In carrying out my invention I provide a series of twenty-eight electro-magnets, each of which is capable of operating either of two different type levers, all the levers being arranged to strike a common center when operated. By this means, my apparatus is capable of printing fifty-six different characters. The number of magnets, however, and the number of characters capable of being printed do not form an essential part of my invention, and may be varied to suit different needs. Besides the twenty-eight printing magnets I provide two shifting or switching magnets, by means of which either of the type levers of any magnet is operatively connected with the armature of the said magnet at will.

For controlling the circuits of all of the type-writer magnets, I employ a series of relays at my receiving station, and actuate the said relays in every instance by three changes in the condition of the circuit. That is to say, in order to print any given letter or character at the receiving station, I cause at the transmitting station, successively, three changes of the circuit, and I print different letters at will by varying the character of the changes, or the order in which the changes occur. For example, I may send over the line a strong negative current, a weak negative current, a strong positive current, a weak positive current, or I may cause the line to be affected by no current at all. Now, each one of these conditions of the circuit affects different relays at my receiving station, and by joining them in groups of three in different orders and combinations I can operate any selected one out of my group of type writer magnets and print any character I choose within the capacity of my apparatus.

In order to enable others skilled in the art to make and use my invention I have illustrated it in the accompanying drawings, in which—

Figure 1 is a diagram of a portion of the circuits at my receiving station, some of the parts being shown in detail. Figs. 2 and 3 show portions of the circuits and connections at the receiving station not shown in Fig. 1, Fig. 3 also illustrating some of the details of my printing apparatus. Fig. 4 represents two of my type levers, and shows their connection with one of the operating magnets. Fig. 5 illustrates the arrangement of my twenty-eight printing magnets, and the switching or shifting magnets. Fig. 6 illustrates a modified construction of printing magnets. Fig. 7 shows a perforated transmitting strip. Fig. 8 shows the battery connections at the transmitting station. Figs. 9 and 10 represent the transmitting apparatus that is capable of being operated by hand, for causing the necessary changes of circuit; and Fig. 11 represents a continuation of Fig. 3 showing means for operating the printing and inking strips or ribbons.

Referring to Figs. 7, 8, 9 and 10, which illustrate the transmitting apparatus at the sending station, A is the perforated transmitting strip, such as is commonly used in automatic electrical transmission. In this instance, the strip is perforated so as to cause three successive changes of the circuit for each letter to be printed. The strip A is drawn along by suitable means over a contact roller C which is connected to line. Upon the strip and above the roller rest a series of springs o, o', o^2, o^3, o^4 each of which is adapted to come in contact with the roller C whenever a perforation passes beneath it. These springs are connected, as shown, with the grounded batteries B and B′ in such a manner that if contact were made successively from left to right between said springs and the roller there would be on the line, successively, a strong positive current, a weak positive current, no current, a weak negative current, and a strong negative current. It is obvious that by prop-

erly arranging the perforations upon the strip A any three of these various conditions of the circuit can be caused in any desired order. It is by causing these various effects in a variety of combinations that I am able to actuate at will any one of the printing magnets at my receiving station.

Fig. 10 represents a series of five hand keys o^5, o^6, o^7, o^8 and o^9, for changing the condition of the circuit, and Fig. 9 shows one of the said keys in detail. The keys are pivoted at o^{10} and their outer ends rest normally upon an endless cord or chain o^{16} which runs over a series of rollers o^{11}. At the inner end of each key is a metallic link o^{12}, and all the links are connected like the springs o, o', o^2, &c., with the batteries B and B'. Each link o^{12} is held by a spring o^{17} or other suitable means against a non-conducting strip o^{13} and just below a conducting plate o^{14} secured upon the said strip. The plate o^{14} is connected through a binding post o^{15} with the main line. As each key is depressed, its inner end is thrown upward and the end of its link o^{12} is pushed against the lower end of the plate o^{14}, being held thereto by the spring o^{17}. The outer end of the key remains depressed until it is thrown up by the cord or belt when another key is depressed. o^{18}, is an adjustable roller for regulating the play of the keys.

It is evident that the capacity of the apparatus illustrated in Figs. 9 and 10 is precisely the same as that of the apparatus first described. It is simply a manual apparatus which may be used as a substitute for the automatic apparatus shown in Figs. 7 and 8.

The above is a description of the transmitting apparatus at my sending station.

Coming now to describe my receiving apparatus, those parts of it which are directly affected by the action of the transmitter are the relays D and D', shown in Fig. 1 in the main line circuit. The relay D is provided with two polarized armatures d^2 and d^3, the former of which responds only to positive currents, and the latter to negative currents. The relay D' has a neutral armature which responds only to heavy currents of either polarity. The armatures are normally on their back stops. E', E^2, E^3, E^4, E^5, and F', F^2, F^3, F^4, F^5, are local magnets operated in pairs by a local battery G, whose circuit is controlled by the positions of the armatures d^2, d^3 and d^4. For example, a strong negative current on the main line operates armatures d^3 and d^4 and closes the circuit of battery G through E' and F'. A weak negative current operates armature d^3, and closes the local circuit through E^2 and F^2. No current leaves all the armatures on their back stops and keeps the local circuit closed through E^3 and F^3. A weak positive current operates the armature d^2 and closes the local circuit through E^4 and F^4. A strong positive current operates the armatures d^2 and d^4, and closes the local circuit through E^5 and F^5. The armature of each of the magnets E', E^2, &c., has upon its free end an insulated bar e^3, upon which rest the free ends of a series of springs or levers a, b, c, d, e, &c., the latter being in a circuit of magnets similarly lettered and capable of printing the various characters. I have designated the various springs or levers by the twenty-six letters of the alphabet, the period and the comma, and the same characters provided with "prime" marks. I have also marked one of the springs or levers with the word "switch" to indicate that through those letters connections are made for operating the two switch or shifting magnets before referred to. I may, of course, employ any other characters in place of all or a part of those which I show, such details being carried out in accordance with the needs or requirements of different kinds of service. Besides the lettered springs or levers there are connected with all the E magnets springs G', G^2, G^3 which form part of the circuit of local batteries H', H^2, H^3, &c., whose function is to hold the circuits of the E magnets closed after they have once been completed, until the said circuits are broken by positive action. The closing of the local circuits takes place when the armatures of the E magnets are attracted, and allow the springs G', G^2, &c., to fall upon stops g^6, which are connected to the different local batteries on the opposite side of the E magnets from the springs G', G^2, G^3, G^4, G^5.

The springs a, b, c, d, &c., are located above stops 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, but are normally held out of contact therewith by the insulating plates e^3, on the armatures of the E magnets. The said stops are connected by wires with a series of springs numbered 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, in such a way that stop 1 is inserted with 11, stop 2 with 12, stop 3 with 13, and so on. Now, there is no stop numbered 1 under the springs operated by magnet E', but there are two each of that number under the springs operated by the magnet E^2, and E^3, and one each under the springs operated by magnets E^4 and E^5. Similarly there are six stops numbered 2 arranged under the springs operated by different E magnets; likewise six numbered 3, six numbered 4 and so on. The springs 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, rest in groups of two upon insulating plates f^3 on the free ends of the armatures of the F magnets. As has been said, the stops 1 are connected to the spring 11, the stops 2 to the spring 12 and so on. The mode of connection is illustrated in Fig. 3 where the stop 2 is shown connected by a wire with spring 12, and the stop 7 is shown in circuit with spring 17.

It will be observed that the letter g, for example, is applied to a spring which stands over a stop numbered 1, and that the character g' is applied to a spring which rests over a stop numbered 6; in a similar way d and d' are employed to designate springs or levers which stand respectively over stops numbered 2 and 7, and so on. It will also be

observed that the springs 11 to 20 are arranged in groups of two as follows: 11 and 16, 12 and 17, 13 and 18, 14 and 19, 15 and 20. Now, the same magnet prints both characters *a* and *a'*, and another magnet prints *b* and *b'* and so on. Take the characters *d* and *d'* as examples, the magnet which prints *d* forms, when in operative condition, part of a circuit which includes both the stops 2 and 7 and the springs 12 and 17. (See Fig. 3.) The springs 12 and 17 are normally held insulated from each other by the plate f^3. The other groups of springs are insulated in the same manner. When, however, magnet F^2 is operated, the springs 12 and 17 fall upon conducting stops I^2, I^3. The former stop is connected as shown in Fig. 3 with one pole of a local battery I', the battery being joined by a derived wire with the front stop of the magnet I in the circuit of the said battery. The other stop I^3, is connected through the magnet I with the other pole of the local battery. At the same time that the magnet F^2 allows the springs 12 and 17 to fall upon the stops I^2 and I^3, it also lowers a third spring 21, upon the latter stop. The spring 21 together with the other two springs, is mounted upon an insulating plate f^4, and all are normally held up as already stated by the insulating plate f^3 on the free end of the armature. The same arrangement exists at all the F magnets. The spring 21 is electrically connected with the armature of magnet I.

The local battery I' is the battery which operates the printing magnets when the proper connections have been made. The circuit of every printing magnet is normally open at several points.

Suppose now I wish to print the character d by closing the circuit of the magnet D^6. The first operation will be to send a strong negative current to line, closing the local circuits of magnets E' and F'. This operation closes at a single point the circuits to the twelve magnets which are connected to the circuits of the twelve springs or levers operated by the magnet E'. The condition of the line is then changed so as to send no current. This opens the circuit of magnet F' and closes that of E^3 and F^3, as described above. The circuit of magnet E' also remains closed through spring G' and stop g^6. Now, if I send a weak negative current to line, F^3 will be opened, E^3 will remain closed, and a new circuit will be made through E^2 and F^2. Referring again to Figs. 1 and 3 it will be seen that by the first operation, contact was made between spring *d* and stop 2. By the second operation contact was made between spring *d'* and stop 7. By the third operation the springs 12 and 17 are caused to fall upon the stops l^2 and l^3, and a circuit for the battery I' is completed as follows: To the stop I^2, spring 12, stop 2, spring *d*, magnet D^6, spring *d'*, stop 7, spring 17, stop I^3, magnet I, and back to battery. Although during the operations before described, the circuits of magnets E', E^2, E^3 and F^2 are closed at the same moment, making partial connection to twenty-seven of the type-writer magnets, the connection is completed to the magnet D^6 alone.

The connections shown in Fig. 3 for the printing magnet D^6 are the same as those which exist for all the other printing magnets. In order to bring all the E magnets back into their normal condition, when a letter is printed, I provide a magnet I, which as shown in Figs. 2 and 3 when operated, breaks the local circuits of these magnets by lifting the springs G', G^2, G^3, &c., off the stops g^6. It will be understood that Fig. 1 represents the position of the same springs and stops diagrammatically, and not in actual position. The circuit of magnet I itself remains closed until a change in the condition of the line in beginning a new letter breaks its circuit by opening that of the last F magnet operated in the printing of the previous letter, as F^2 when the letter d is printed. Of course, the magnet I by opening the circuits of the local batteries H', H^2, &c., does not affect the condition of any magnet whose circuit may at that moment be closed by the operation of the relays D and D'.

From the above description it will be seen that each of the type writer magnets is operated by three successive changes in the condition of the line, a different combination being used for each. Turning to Fig. 1 it will be seen, for example, that the letter a is printed by operating successively the magnets E', E^2 and E^3. That is, by sending over the line, first, a strong negative current, then a weak negative current and then no current. b is printed by operating the magnets E', E^2 and F^4. That is, by sending over the line first strong negative current, then a weak negative current and then a weak positive current. The order in which the two first currents forming a letter are sent does not matter, and they are therefore made to suit the last current of the previous letter; thus, if a follows g which terminates with a strong negative current, then it must be sent in this order: a weak negative, a strong negative, and no current. Unison is insured or restored by repeating the first two currents forming any letter or character, thus, d would be sent as follows: a strong negative current, no current, a strong negative current, no current, and a weak negative current. The combinations in currents for each letter are not necessarily those to be used in actual work. Moreover, a smaller or greater number than five may be taken with corresponding modifications of the local magnets.

The details of the type-writing apparatus are best shown in Figs. 3, 4, 5, and 6. Fig. 5 shows the twenty-eight printing magnets arranged in a circle about a common center, and the two shifting or switching magnets S and S' in operative position near the center. The operation of the switching magnets will be described farther on. The printing mag-

nets are all constructed on the same plan and are similar to D^6, shown in Fig. 3.

It will be seen that an L shaped piece p^5 is pivoted to the outer end of the armature p^4, so as to be capable of being adjusted into different positions without affecting the movements of the armature. At its lower end, the L shaped piece is traversed by or formed into a pin or cross piece, p^6, which rests under one or the other of two pins p^7 and p^8, secured to or formed on the hubs of printing levers r^4 and r^5. These printing levers are mounted loosely on a suitable shaft, and one of them is elevated to a horizontal position through the medium of the pin p^6 when the armature p^4 is attracted. The position of the L shaped piece p^5, by effecting the location of pin p^6, determines in an obvious manner which one of the two shall be elevated. The L shaped pieces p^5 extend down through a ring t^4, which has for its center the common center on which all the printing levers strike. By shifting the position of the ring, the position of the L shaped pieces will be changed. Now, the ring has attached to it, two pieces of soft iron, t^5 and t^6, which pass downward and serve as armatures for the magnets S and S′, respectively. It is evident that the ring can be moved to different positions by sending currents through S and S′. In practice, all the simple letters will be arranged on corresponding printing levers, and the letters marked with a "prime" will be formed on the other levers, say the former on the right-hand levers and the latter on the left hand levers. In that case, if the magnet S be energized before the printing of the word is begun, the simple letters will follow. If S′ is first energized, the "primes" will follow.

In operating my apparatus, one or the other of the magnets S, S′, is operated whenever a space occurs, and it is operated in exactly the same manner as the regular printing magnets.

It is, of course, understood that the printing is done on an ordinary printing roll or strip in the usual manner, or rather more after the manner of an ordinary mechanical type writer. It has not been thought necessary to show the means for feeding the roll, as such means are common and very well understood.

In Fig. 6, I have illustrated a modification of my printing magnet, the object being to operate the printing lever by positive pushing action. In this construction the pin p^6 rests under one of the printing levers, and when the armature p^4 is attracted pushes it into operative position, as shown in dotted lines. The function of the magnet O which is located in the same circuit with the magnet I, Fig. 3 is to assist in the action of bringing the printing lever into place. The said magnet has one of its poles formed into a casing O^4, which extends down into a position where it can attract the type arms as they are pushed up. The printing levers may be made of soft iron or they may be provided with soft iron armatures, as desired.

W, W, are ordinary ribbon rollers, and X, X, the usual paper rollers. The ribbon and paper pass through slots in the casing O^4 and are fed by any suitable means.

Fig. 11 shows means for operating the printing strip and inking ribbons, and also illustrates the circuit connections of the printing magnet O. As has been stated above, this magnet is in the same circuit with the magnet I. Also in the same circuit is located a magnet I^4 whose armature I^5 is provided with a pawl I^6, which engages with a ratchet I^7, rigidly connected with a drum I^8. The paper roll or strip passes over this drum, being pressed upon it by a spring roller I^{10}. The armature of the magnet I^4 has a retractile spring S^4 which operates the ratchet I^7 through the pawl I^6 at each release of the armature by the magnet. The movements of the ratchet and the drum connected therewith also move the printing roll. The ratchet and drum are connected by a suitable train either of pinions or friction rollers with the shaft which carries the ribbon roller W, so that at the same time that the paper is fed the inking ribbon is also fed. The connections are such that the paper will be fed single a space at each operation of the ratchet I^7, while the inking ribbon is fed more slowly.

The part which I have called the L shaped piece p^5 may be described as a link inasmuch as it has a swivel connection with the armature p^4 and need not be of any particular shape. In like manner the pin p^6 may be regarded as a pair of pins or catches, each of which is adapted to lift a different one of the printing levers r^4 and r^5. Moreover, the ring t^4 is made in that shape to adapt it especially to use in connection with my present apparatus.

Links p^5 may be operatively connected with the ring t^4 in any convenient manner. I have shown them passing through holes in the ring, but they may rest between teeth on the ring or in notches cut therein.

The type levers may be arranged singly instead of in pairs, in which case the connection between the armature levers and the type arms would be a positive one. This arrangement is shown in Fig. 11.

Having now described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination of a magnet and its armature lever, of a link attached to the inner end of the lever, the said link having a pair of catches or pins which are located beneath a pair of printing levers and the said link being operatively connected with an adjustable ring or arm, the relation of the parts being such that the pin or catches on the link can alternately but not both at once come into operative connection with the printing levers; substantially as described.

2. The combination with a series of pairs of printing levers and a series of catches under the same, the said catches being formed on or attached to a series of links secured to arma-

ture levers, of a ring with which the said links are operatively connected, and a pair of electro-magnets for shifting the position of the said ring; substantially as described.

3. The combination with a series of printing magnets provided with armature levers p^4, links p^5, and pins or catches p^6, of a series of pairs of printing levers r^4 and r^5, and a ring t^4 with which the said links are operatively connected, the said ring having attached to it the armatures t^5 and t^6 of the magnets S, S'; substantially as described.

4. The combination with a type lever and means for operating it, of a magnet whose core is located in the path of the said lever and serves as an anvil for the stroke of the same as well as to aid in its operation; substantially as described.

5. The combination with a type lever and means for operating it, of a magnet whose core is located in the path thereof and serves as an anvil for the stroke of the same, and whose poles are arranged in proximity thereto so as to aid in its operation; substantially as described.

6. The combination with a magnet whose core serves as an anvil for the stroke of a printing lever, of a casing having slots through which the usual printing and paper rolls pass; substantially as described.

7. The combination with a magnet whose core serves as an anvil for the stroke of a printing lever, of a casing having slots through which the usual printing and paper rolls pass, the casing forming one of the poles of the said magnet and being placed near the path of the said lever so as to aid in its operation; substantially as described.

8. The combination with a single main circuit with means for producing therein permutation of single and successive currents, of two or more relays located in said circuit and adapted to respond to said changes in the electrical conditions of said circuit, a series of local electro-magnets E', &c. F', &c., the circuits of which are controlled by relays in groups of two, means actuated by the energizing of any pair for keeping the circuit of one of them closed after a change in the condition of the main circuit, and a series of receiving magnets D^6, whose circuits are controlled by the local magnets; substantially as described.

9. The combination with a series of receiving magnets, each of whose circuits is open at three or more points and a series of groups of three magnets E', E^2, I and F', F^2, I &c. adapted when operated to close the circuit of the receiving magnets at all points, of two or more relays adapted to respond to different conditions of a single main circuit with means for producing successive changes in single currents along said main line, the said relays serving by the position of their armatures to control the said magnets in groups of two for keeping the circuit of one of them closed after a change in the condition of the main circuit whereby by single and successive changes in the main line the circuit of any receiving magnet as D^6 may be completed; substantially as described.

10. The combination with a type lever, of an electro-magnet having its core in the path of the type on said lever so as to serve as an anvil therefor, and a movable strip adapted to pass over the said core and receive the said impressions of the type; substantially as described.

11. The combination with the single main line, the series of local magnets E', E^2, &c., the corresponding series F', F^2, &c., a relay in the main line controlling two magnets at a time, one in each of the series, a retaining circuit for each magnet E, a printing circuit controlled jointly by said two magnets, and a magnet as I in the printing circuit controlling said retaining circuit; substantially as described.

12. The combination with a series of magnets E', E^2, &c., of the corresponding series F', F^2, &c., a relay controlling two magnets at a time, one magnet from each series, a retaining circuit for each magnet E, a printing magnet D^6, a local circuit therefor, and three circuit closers in said circuit controlled by the said two magnets jointly with a third magnet from series E; substantially as described.

13. The combination with the series of magnets E', E^2, &c., of the corresponding series F', F^2, &c., a relay adapted to act in a distinctive manner under each electrical condition of the main line, means for transmitting along said main line a series of successive single impulses, said relay controlling with each action the circuit of two magnets, one from each of the two series, a printing magnet, a local circuit therefor, and two or more circuit closers therein controlled by the combined action of the magnets in the two series; substantially as described.

In witness whereof I have hereunto affixed my seal and signed my name in the presence of two subscribing witnesses.

EDWIN POPE. [L. S.]

Witnesses:
W. A. H. CEFF,
ADOLPHE CASAULT.