A. C. CREHORE.

PRINTING TELEGRAPH.

APPLICATION FILED JAN. 16, 1905.

917,011.

Patented Apr. 6, 1909.

2 SHEETS—SHEET 1.

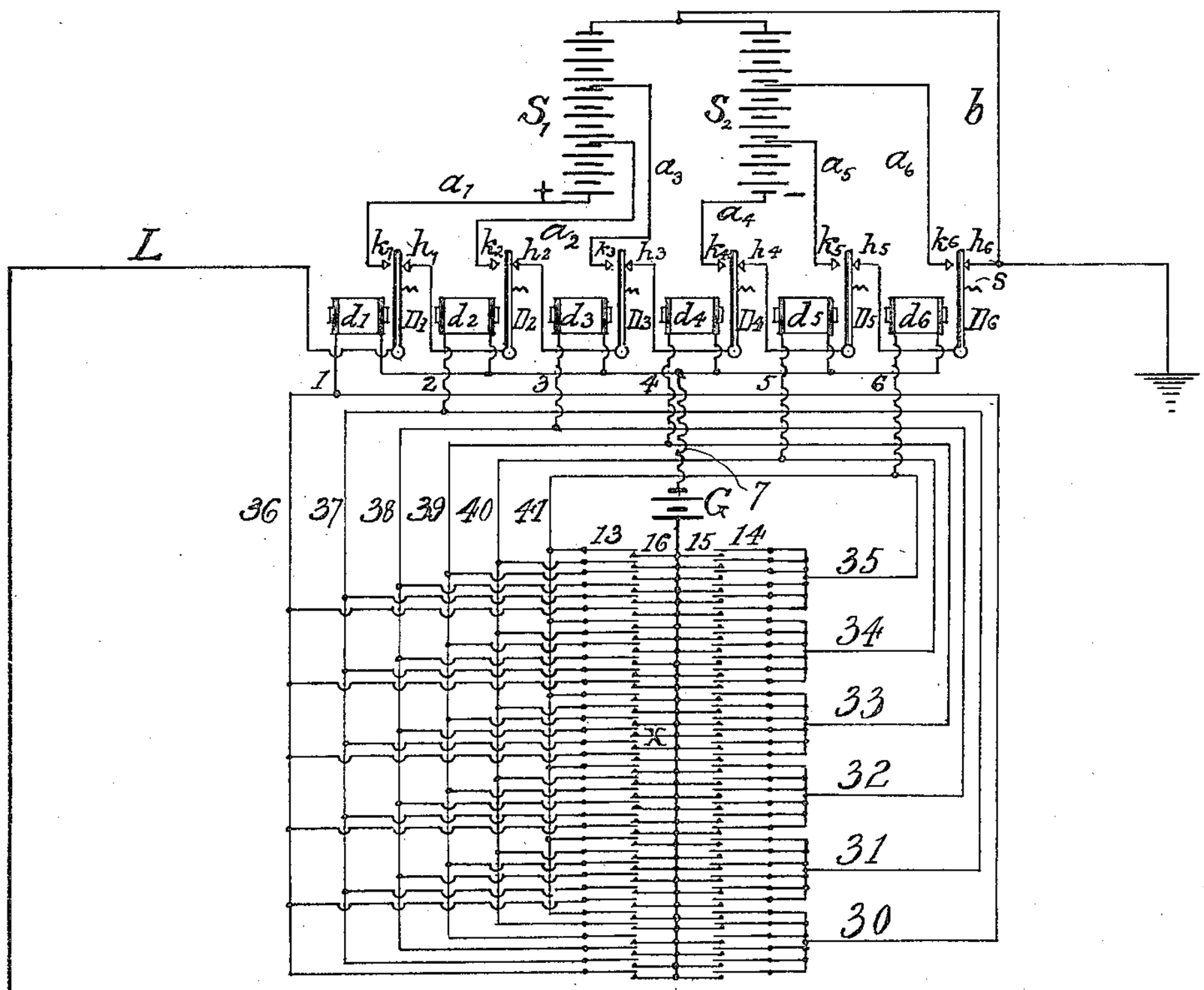
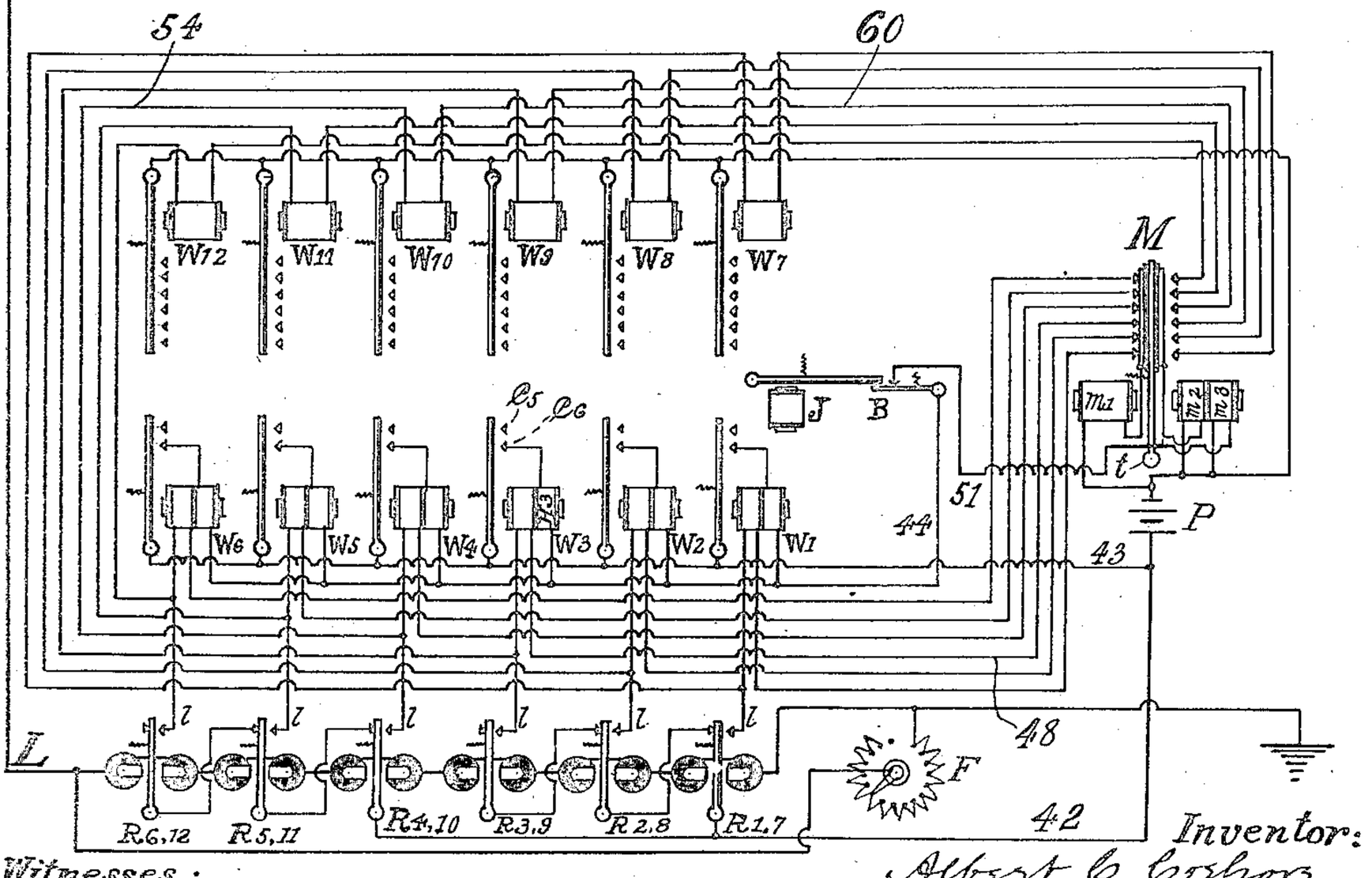


Fig. 1.



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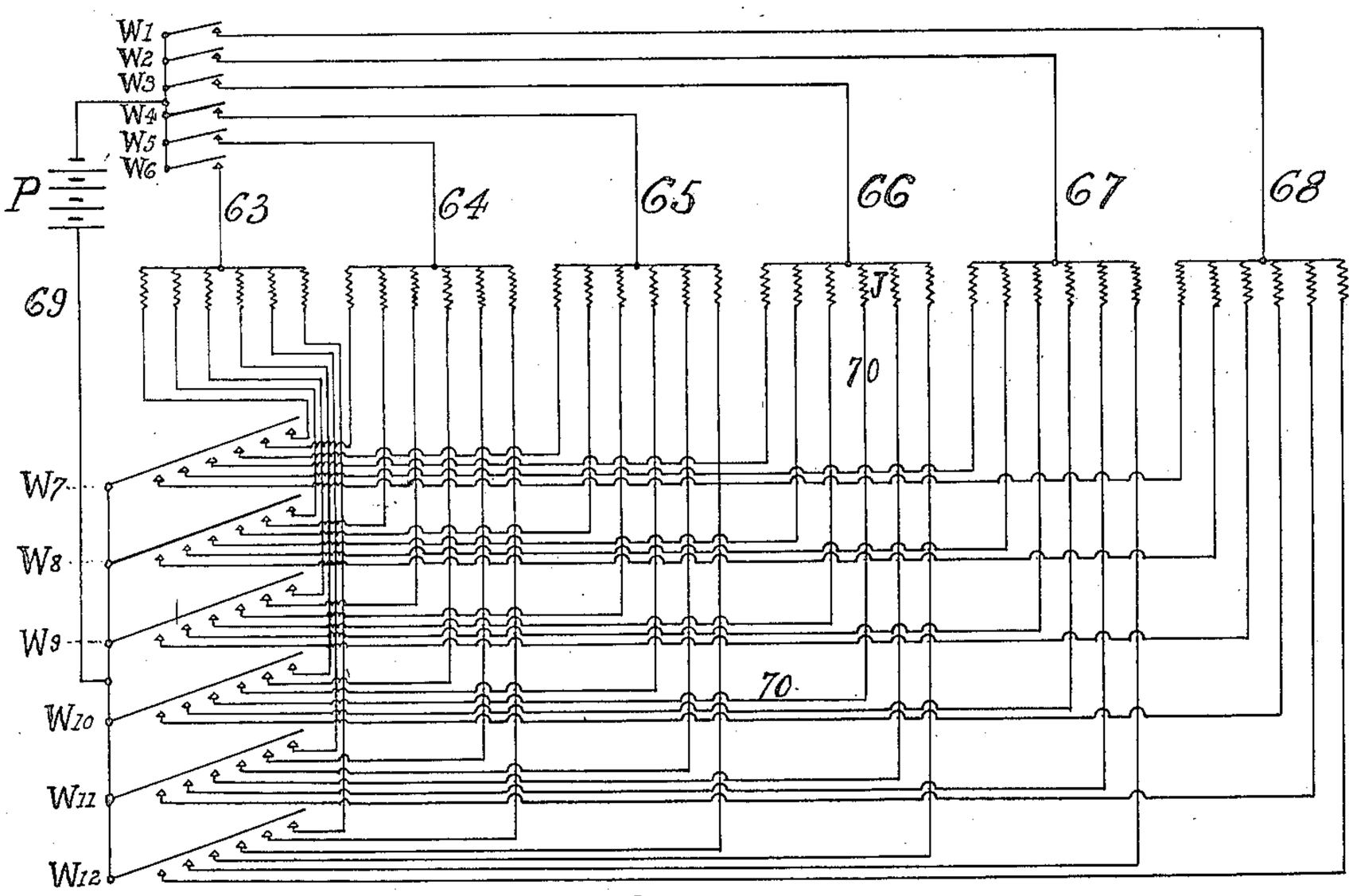

Fig. 2.

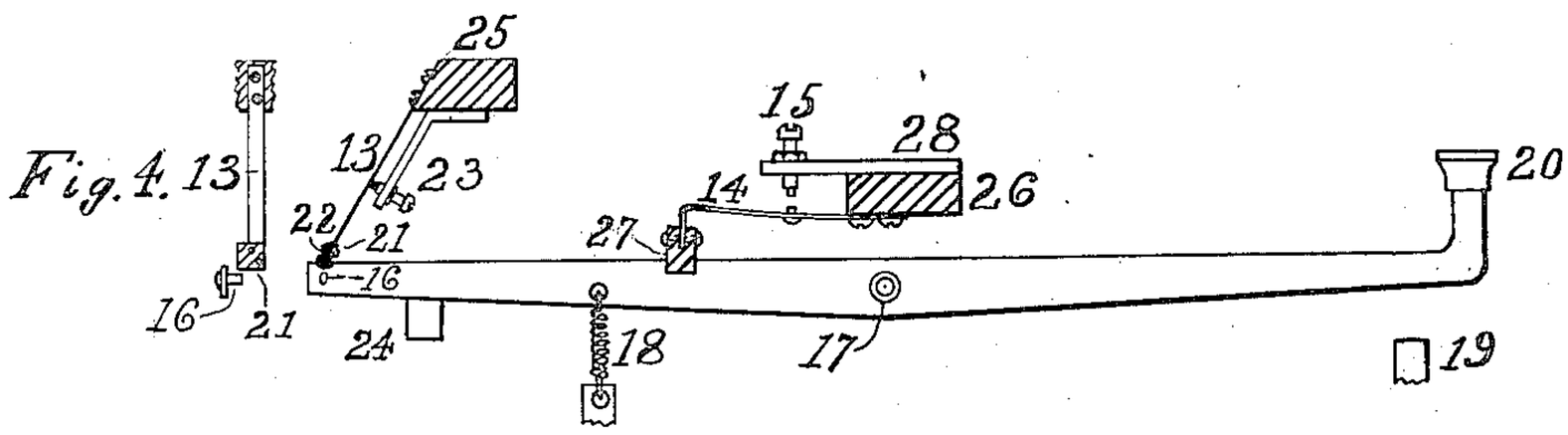

Fig. 4. 13

Fig. 3.

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UNITED STATES PATENT OFFICE.

ALBERT C. CREHORE, OF YONKERS, NEW YORK, ASSIGNOR TO TYPEWRITING TELEGRAPH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

PRINTING-TELEGRAPH.

No. 917,011. Specification of Letters Patent. Patented April 6, 1909.

Application filed January 16, 1905. Serial No. 241,259.

To all whom it may concern:

Be it known that I, ALBERT C. CREHORE, a citizen of the United States, residing at Yonkers, county of Westchester, State of New York, have invented certain new and useful Improvements in Printing-Telegraphs, of which the following specification and accompanying drawings illustrate one form of the invention which I now regard as the best out of the various forms in which the invention may be embodied.

Figure 1 is a diagrammatic illustration of my invention, including the apparatus at the sending station, also the line and secondary relays at the receiving station, Fig. 2 shows diagrammatically the printing magnets, Figs. 3 and 4 show the details of the transmitting key.

My present invention is an improvement upon a former system of mine involving a printing telegraph apparatus by which a series of magnets at the receiving station, adapted to operate the respective keys of a typewriter, are individually selected and operated by the respective keys of a typewriter key-board at the sending station. In that system I provided, at the receiving station, two groups of line relays, one group in each of the two line wires, and, by the simultaneous action of the two line wires, I selected and operated a pair of those relays, one from each group, which, in turn, served, by means of two secondary relays, to work two circuit closers placed in series in the local circuit of some one of the series of printing or receiving magnets. In my present invention I have a similar arrangement, except that I employ but one line wire and, by means thereof, select and operate the two desired line relays successively instead of simultaneously. I also employ but six main line relays instead of twelve, since I make the selection of the two relays by two impulses over the same line wire for each letter, and, whereas in the former case the two impulses (on the two separate line wires) acted respectively on the two groups of line relays, in the present case the first impulse may act upon the six relays as before, and the second impulse may act again on the same relays just as if they were a different group. In one sense therefore I still have two groups of relays, the same relays serving first in the character of one of my former groups, and next in the character of the other of my former groups. Practically, however, I gain the advantage of requiring but six relays instead of twelve. In order that these six relays may act first in one character in response to the first impulse, and then in another character in response to the second impulse, I provide a device which I designate as a transfer switch, that acts to give the line relays control of one or the other of two sets of secondary relays, each set containing six magnets, and two of them, one from each set, controlling the two circuit closers placed in series in the circuit of some one of the 36 printing magnets. I also provide means for automatically operating the transfer switch, so that for the first main line impulse it will act upon one set of secondary relays, and the second impulse upon the other set.

Certain other features of novelty will appear as this description is continued.

Turning to the drawings as an illustration of the system to be described, I will first consider the arrangements at the transmitting station, it being remembered that I must provide therein for the sending, for each character or letter to be selected and printed, of two successive impulses over a single main line. In other respects the transmitting apparatus is substantially like that of my former application, there being a series of magnetically operated contact levers, which serve to send currents of six different kinds differentiated by polarity and also by strength. I provide, as before, three different values of current, each of which may be of one polarity or the other, making 6 different kinds of current in all.

Referring to Fig. 1, the transmitting apparatus is shown in upper part, and the receiving apparatus in the lower part of the figure, the two being connected by the line wire L. The line wire, entering the transmitting station, passes first to the contact lever D^1; thence, by its back stops h^1 to the second contact lever D^2; thence by the back stop h^2 to the third contact lever D^3; and so on until from the final back stop h^6 it passes to ground or to another station. The several contact levers are normally held against their back stops by a spring s. Two sources of current, conventionally represented as batteries, are provided, indicated respec-

tively as S^1 and S^2, one serving to send positive and the other negative currents to the line L. Both batteries have one of their two terminals connected to ground permanently, this being an advantageous arrangement for several reasons. The opposite terminals of the two batteries are connected respectively to the front stops k^1 and k^4 of the several contact levers aforesaid; while the front stops of the remaining levers are connected to intermediate points in the respective batteries, so as to receive therefrom an electromotive force smaller than that produced by the entire battery. Thus contact k^3 is connected to the first battery section, and k^2 to the secondary battery section, so as to receive respectively one-third and two-thirds of the total electromotive force. The front stops k^5 and k^6 are similarly connected to the sections of battery S^2. From this arrangement it is manifest that when any one of the six contact levers is brought against its front stop, it will simultaneously break the connection of the line L to ground through the contact levers and back stops to the right of the one which is operated, and send a battery current to the line through the back stops and contact levers to the left of the one operated. By this means I am enabled to transmit to the line L any one of the six different kinds of current heretofore mentioned, while between the current impulses the line L will be grounded and discharged. This grounding of the line between the successive current impulses is a feature of practical importance in the operation of my system, which also employs current of a low frequency, by reason of which it may be used to advantage on telephone circuits without interfering with the simultaneous transmission of the telephone current.

For operating the respective contact levers D^1—D^6 I provide the corresponding magnets d^1—d^6, which all have one of their terminals connected to the local battery G by the wire 7, while their opposite terminals are connected individually to the opposite terminal of G by the contacts 13 16, or 14 15 of the several transmitting keys. It is manifest that in operating the six magnets in groups of two each, there are 36 possible combinations, including as one group the operation of each magnet twice, to send two current impulses of the same kind over the line wire L in succession. These 36 combinations are shown in the diagram, the first impulse being produced by closure of the contacts 13 16 and the second by the closure of the contacts 14 15, these closures being separated by an interval during which the line is grounded as aforesaid. For example, the terminal 1 of magnet d^1 is connected to the wires 36 and 30, the latter being connected to the lower six contacts 14 and the former being connected to six of the contacts 13 distributed as shown in the diagram. The contacts 15 and 16 are connected by the wire X to the battery G. In a similar way the terminal 2 of magnet d^2 is connected to the wires 37 and 31; the terminal 3 of magnet d^3 to the wires 38 and 32; the terminal 4 of magnet d^4 to the wires 39 and 33; the terminal 5 of magnet d^5 to the wires 40 and 34, and the terminal 6 of magnet d^6 to the wires 41 and 35. Then if we take the upper one of the vertical series of contacts, it is manifest that the closure of 13 16 will energize magnet d^6, while the succeeding closure of contacts 14 15 will operate the magnet d^6 a second time. On the other hand, taking the contacts opposite the letter X the closure of 13 16 will, through the line 38, energize magnet d^3, while the closure of 14 15 through the line 33 will energize magnet d^4. In this manner the successive closure of the several sets of contacts will operate respectively the 36 pairs of magnets and thereby send for each letter or character transmitted a pair of succeeding current impulses differentiated in character from all of the remaining 35 pairs.

Turning to Figs. 3 and 4, I have shown therein a key for operating two sets of contacts in succession. The key lever is pivoted at the point 17 and provided at one end with the button 20 by which it may be depressed against a stop 19. The opposite end of the lever is normally held down by a spring 18 against a stop 24. Near the extremity of this end of the lever is a pin 16 oval in cross section projecting from one side of the lever, as shown in Fig. 3. This pin is the contact 16 which I have already referred to. Its comrade contact 13 consists of a spring 13 fastened to a block 25 and normally resting against a stop 23. On the tip of the spring is a small plate 21 of metal with a backing 22 of insulating material. As shown in Fig. 4 this plate is offset from the spring 13, so that, when the pin 16 rises, it will first come in contact with the plate, lifting slightly the spring 13, and after passing over the inner metallic surface of the plate, it will move entirely off from it, allowing the spring 13 to drop back and carry the plate with it, so that the return or downward stroke of the pin 16 will pass over the insulated side of the plate 21 and produce no electrical connection between 16 and 13. The second set of contacts 14 and 15 are mounted on opposite sides of the block 26, the former taking the form of a spring attached at one end to the under side of the block 26, and at the other end to a block 27 on the upper edge of the key lever; while the latter takes the form of a screw in the end of a plate 28. The depression of the key lever by the button 20 will first close the contacts 13 16, as already described, then break the circuit, then close the contacts 14, 15, and then, on its return stroke, will break

the connection between 14 and 15 and the circuit will remain broken until the return stroke of the lever is complete. There will be a series of such key levers, 36 in number, or as many of the 36 as one may desire to use; and the whole will make up a transmitting key board similar to the key board of an ordinary typewriter. If desired, the keyboard of an actual typewriter may be employed, so that the message may be simultaneously transmitted to a distant station and printed on the home typewriter. I prefer, however, to make the keyboard separate, and to operate the home typewriter electrically by the same operations which work the distant typewriter, just as a Morse operator merely works his key and operates both the home and distant relay by the same current.

Turning back to Fig. 1, I will next describe the receiving apparatus up to the point where the transmission of the two impulses, in the manner just described, serves, at the receiving station, to select and operate some one pair of the secondary relays W^1—W^{12}. The manner in which these two secondary relays then select and operate some individual printing magnet is shown in Fig. 2, being identical with the arrangement for this purpose provided in my former arrangement. At the receiving station the main line L passes through six polarized relays in series (shown at the bottom of the figure) and goes thence to ground or to another station on the same line. The first of these six relays is designated R 6, 12, these two numerals indicating that during one of the two line impulses the relay will control the secondary relay W^6 and during the second impulse the secondary relay W^{12}. The remaining relays are similarly designated by the numerals of the secondary relays which they respectively control at each one of the two impulses. I prefer to give these relays a permanent adjustment and then maintain the line currents which pass through them substantially unchanged by a shunting resistance F. By this means the different current strengths to which the several relays respond will be maintained unchanged. One half of the six relays respond to positive currents only and the other half to negative currents only. Assuming that the left-hand three respond to positive currents, the relay R 6, 12 will alone respond to the weakest positive current. It and the next relay R 5, 11 will respond to the medium current, while all three will respond to the strongest current. The armatures of these relays are normally held against their back stops, and the local circuit from battery P comes by the wire 42 to the lever of relay R 4, 10 and goes thence by its backstop to the lever of R 5, 11 and thence by its back stop to the lever of R 6, 12 at which the circuit is normally broken. Therefore, when a weak current flows, the relay R 6, 12 will alone respond and throw its lever against the front stop *l*. To a medium current the relay R 5, 11 will also respond, but will instantly break at its back stop, the local circuit-connection, leading to the lever of R 6, 12, so that while the latter relay may operate, it will have no effect upon the local circuit. Similarly, relay R 4, 10 will respond to the strongest, current and immediately break, at its back stop, the local circuit connections leading to the levers of the other two relays which will operate but have no effect upon the local circuit. In this way, by sending the proper strength of positive current, any desired one of the three relays just mentioned may be operated and, similarly, by sending any one of the three available strengths of negative current, any desired one of the remaining three relays can be selected and operated. The one of the six relays thus selected will, on the first of the two impulses required for the transmission of each letter, operate one of the lower sets of six secondary relays W^1—W^6 and, on the second impulse will operate some one of the upper set of six secondary relays W^7—W^{12}. This differentiation between the relay action on the first and second impulses, is produced by means of a transfer switch M, which transfers the control exercised by the relays first to the lower set, and then to the upper set of secondary relays.

The switch M is normally spring biased to the left, so as to connect in multiple with the six contacts leading to the lower set of secondary relays. The circuit of battery P passes through the switch-retaining magnet m^1 of the transfer switch M, from the left-hand contact plate of that switch, which bears upon the six contacts aforesaid and thereby connects one terminal of each of the lower set of secondary relays to the battery P in multiple. The other terminals of these relays are connected individually and respectively to the front contacts *l* of the six line relays; while, as aforesaid, the levers of these relays communicate with the opposite terminal of battery P. Thus, in the biased position of the switch M, the several relay contact levers will close the local circuits of the several secondary relays W^1—W^6, while the relay thus operated will retain its armature by the closure of a locking coil H^3 at the contact c^6, this contact being additional to contact c^5, by which, as will be hereinafter explained, the relay acts on the printing magnets. For example, we may assume that relay R 3, 9 closes the circuit of secondary relay W^3. Then the contact lever of W^3 will close the local locking circuit as follows: battery P, wire 43, contact lever of W^3, locking coil H^3, wire 44, releasing switch B, wire 51, shifting magnet m^3 to the opposite terminal of battery P. This locking circuit will remain closed until the releasing switch B is

opened by the action of one of the printing magnets J, it being understood that all the printing magnets will, at the limit of their stroke, act upon the switch B to break the locking circuit. At the same time the energizing of shifting magnet m^3 will have a tendency, which, however, is ineffective, to move the transfer lever M. So long as the first one of the two current impulses is going over the line wire L (operating, as we have assumed, the relay R 3, 9 which operates in turn the secondary relay W^3) the retaining magnet m^1 aforesaid will remain energized and prevent the shifting of the switch M. So soon, however, as the first impulse comes to an end, the relay R 3, 9 will be deënergized and will open the operating circuit of W^3 which includes also the retaining magnet m^1. This will allow the transfer switch M to move to the right, and connect battery P to the upper set of secondary relays W^7—W^{12}, the circuit from the battery P passing through retaining coil m^2 of the transfer-switch on its way to the contact plate of switch M to the right of the switch, just as it passed through the retaining coil m^1 on its way to the contact plate at the left of the switch. It will be remembered that, during this time, the locking circuit, which retains the armature of secondary relays W^3, is still in action. After the switch M has been shifted as aforesaid, one of the six line relays will again be operated by the second line impulse, and will act to select and operate one of the six secondary relays of the upper set W^7—W^{12} just as they selected and operated one of the six secondary relays W^1—W^6, the latter set being now open-circuited at switch M and the former set having their circuits closed at the same point. Thus the current from battery P and line 42 will go to the armature lever of that one of the six relays which has been selected and will pass thence to one of the upper set, instead of to one of the lower set, of secondary relays, since the circuit leading from each armature-lever is branched to two secondary relays, one in the lower and the other in the upper set (for example the circuit from the armature-lever of R 6, 12 branches to the lower secondary relay W^6 and the upper secondary relay W^{12}) and the current will pass to that one of the two relays whose circuit is closed at the switch M. The one of the upper set of secondary relays which has thus been operated will be retained in action so long as the key is held down, while the switch M will be likewise retained during the same period by the coil m^2 in series with the secondary relay which has been selected and operated, and, even if the printing magnet acts and opens the locking circuit which contains the coil m^3, the switch M will not go back so long as the transmitting key is held down and the second impulse through the retaining coil m^2 thereby prolonged. It is only when the key is permitted to rise at the sending station that the transfer switch M will be permitted to come back to its normal biased position.

I have thus described how, for the transmission of any desired letter or character, a key at the sending station will be depressed, thereby sending two current impulses in succession which have, in the manner described, selected and operated that pair of secondary relays which corresponds to the key that has been operated. In like manner each one of the transmitting keys will select and operate some one pair of the 12 secondary relays W^1—W^{12}, there being 36 keys and 36 pairs of relays available from the 12 relays.

In Fig. 2 I represent a series of printing magnets which are divided into six groups, those in each group having their terminals on one side all connected in multiple to the same wire. Thus there are six such wires 63, 64, 65, 66, 67, 68 leading respectively to circuit closers operated by the several secondary relays W^1—W^6 which, when closed, connect them to one terminal of the battery P. The opposite terminals of the magnets in each group are connected respectively to circuit-closers operated by the several secondary relays W^7—W^{12}; and, since there are six groups each of the said relays controls six circuit closers one from a magnet in each of the six groups. The circuit closers all lead, by the wire 69, to the opposite terminal of battery P. It is therefore evident that if two secondary relays are energized, one from each of the two groups of secondary relays, they will close a circuit from battery P through some one of the printing magnets. For example, suppose that relay W^3 from one group and W^{10} from the other group are energized, in the manner already explained. Then it will appear that W^3 will connect wire 66 to battery P, and the wire will put all the terminals of the group of printing magnets to which it pertains in connection with the battery. But of the opposite terminals of the magnets in this group, only one of them, to wit, that of the magnet J, leads by wire 70 (Fig. 2) to the circuit closers of W^{10}. Hence that one magnet will be energized, its circuit leading from battery P, by wire 66 and circuit closer of W^3 on the one side, and on the other side from the opposite battery terminal, by the circuit-closer of W^{10}, and wire 70. In like manner, any one of the 36 printing magnets may be selected and operated by the action of two secondary relays, one from each group or-set, and the two secondary relays will, in turn, be selected and operated by the energizing of two primary or line relays, while the two primary relays will be selected and operated in the manner I have described by the sending of two current impulses in succession over the line wire L, by the depression of some one of the 36 transmitting keys at the sending station. In effect, the individual

magnets of the series of recording or printing magnets are selected and operated by the two succeeding current impulses, through the intervening agencies I have described.

It will be observed that my present arrangement is characterized by the use of but two succeeding impulses to print a character or perform such an operation as the shifting of the carriage or the depression of the shift-key for capitals. Moreover, each and all of the several operations requires no more than two succeeding impulses. Each pair of impulses also operates one particular pair of line relays at the receiving station, out of the group of six relays there provided. This distinguishes my arrangement from others which require three or more succeeding impulses to print a character or perform a corresponding operation and also from other arrangements which require a variable number of impulses for the different characters. Wherever in the following claims I refer to a receiving magnet, or to a pair of line relays, or to a pair of succeeding current impulses, corresponding to a letter or character of the transmitted message, it will be understood that the expression also includes such magnets and pairs of relays or impulses as may correspond to an operation like the shifting of the typewriter carriage or depression of a shift-key for capitals.

It is to be understood that the principles of my invention may be extended to sets of relays greater than six or may be otherwise embodied differently from the arrangement shown without departing therefrom.

What I claim as new and desire to secure by Letters Patent is:

1. A telegraph apparatus comprising in combination, two line relays, a series of receiving magnets each corresponding to a letter or character of the transmitted message and each selected and operated by the said relays, means for energizing the two relays in succession from a sending station by succeeding impulses over a single line wire, and means consisting of a separate relay coil and contact for maintaining the effect of the first impulse until the second impulse has occurred.

2. A telegraph apparatus comprising in combination, two line relays, a series of receiving magnets each corresponding to a letter or character of the transmitted message and each selected and operated by said relays, means for successively energizing the two line relays by succeeding impulses over a single line wire, and a series of transmitting keys corresponding each to one of the several receiving magnets and each single key controlling the transmission of two succeeding current impulses.

3. A telegraph apparatus comprising in combination, a series of receiving magnets each corresponding to a letter or character of the transmitted message and each selected and operated by two succeeding current impulses over a single line, each pair of impulses differing from other pairs as regards strength or polarity, and means for transmitting such impulses in succession from a sending station.

4. A telegraph apparatus comprising in combination, a series of receiving magnets each corresponding to a letter or a character of the transmitted message and each selected and operated by two succeeding current impulses over a single line, a series of transmitting contacts at the sending station controlling the strength and polarity of the currents to be transmitted, operating magnets for said contacts, and means for operating two of said contacts in succession for each letter or character in the transmitted message.

5. A telegraph apparatus comprising in combination, a series of receiving magnets selected and operated respectively by two succeeding current impulses, each of such pairs of impulses corresponding to a letter or character of the transmitted message and differentiated from other pairs in strength or polarity, means for transmitting said current impulses comprising three sources of electromotive force differentiated in value, and contact devices for connecting either a positive or negative terminal of any one of said three sources to the line wire leading to the receiving station.

6. In a telegraph system, the combination with a series of receiving magnets selected and operated respectively by two succeeding and differentiated current impulses, of means for transmitting the desired pairs of impulses comprising six normally closed circuit breakers in series in the main line leading from the sending to the receiving station, and a normally open contact for each of said circuit breakers connecting with a differentiated source of electromotive force, with which contact the circuit-breaker connects at each operation to transmit a differentiated impulse over the line.

7. In a telegraph system, the combination with a series of receiving magnets selected and operated respectively by two succeeding and differentiated current impulses from the sending station, of means for transmitting said impulses in pairs differentiated by polarity or strength from one another, comprising a series of normally-closed circuit breakers in the main line, a corresponding number of sources of electromotive force differentiated by strength and polarity having their connection with the main line controlled by said circuit-breakers, magnets for operating said circuit-breakers respectively, and keys corresponding to the receiving magnets and controlling the circuit-breakers in pairs.

8. In a telegraph system, the combination with a system of receiving magnets selected and operated respectively by two current impulses in succession on a single line, a series of contacts at the sending station controlling the connection of the line to any one of six differentiated sources of electromotive force, magnets for operating said contacts and keys controlling said magnets in pairs and provided with succeeding contacts in separate circuits.

9. In a telegraph system, the combination with a series of receiving magnets selected and operated respectively by a set of two succeeding current impulses differentiated from other sets in strength or polarity, of means for transmitting the differentiated sets comprising sources of electromotive force having different values and polarities with one terminal permanently connected to ground or to the opposite side of the line, circuit-breakers in series normally closing the line through the transmitting station and means for simultaneously opening a circuit breaker and connecting the free terminal of one of said sources of electromotive force to the line leading from the transmitting to the receiving station.

10. In a telegraph system, the combination with a series of receiving magnets selected and operated respectively by a set of two succeeding current-impulses differentiated from other sets as to strength or polarity, of means for transmitting the differentiated sets comprising six different sources of electromotive force, six normally-closed circuit-breakers in series in the line, and a contact for each circuit-closer connected to one of said six sources of electromotive force for connecting one of said sources to line simultaneously with the opening of a circuit closer.

11. In a telegraph system, the combination with a series of receiving magnets each corresponding to a letter or character of the transmitted message and each selected and operated respectively by a set of two succeeding current impulses differentiated from other sets by strength or polarity, of a line wire, a series of transmitting contacts, sources of electromotive force differing in strength and polarity and controlled by said contacts, magnets operating said contacts, and normally-open keys each controlling in succession a set of said magnets and provided with one-way contacts engaging during one of the two directions of movement of the key.

12. In a telegraph system, the combination with a series of receiving magnets each corresponding to a letter or character of the transmitted message and each controlled respectively by a set of two differentiated current impulses transmitted in succession over a single line, a series of line relays responding respectively to the several impulses, two sets of secondary relays acting on the circuits of the receiving magnets, and a transfer switch for placing the two sets of secondary relays alternately in the control of the primary relays.

13. In a telegraph system, the combination with a series of receiving magnets each corresponding to a letter or character of the transmitted message, a series of line relays responding respectively to differentiated current-impulses corresponding in pairs to the respective letters or characters of the transmitted message, two sets of secondary relays acting on the circuits of the receiving magnets, a transfer switch for placing the respective sets of secondary relays under control of the line relays, and means for automatically operating the said switch.

14. In a telegraph system, the combination with a series of receiving magnets controlled respectively by differentiated sets of succeeding current impulses, of line relays, secondary relays divided into groups, a transfer switch additional to said relays for placing the groups alternately in the control of the line relays, and means for automatically operating said switch after each of the current impulses composing one of the sets of impulses aforesaid.

15. In a telegraph system, the combination with a series of magnets each controlled respectively by a single differentiated pair of succeeding current impulses, of line relays responding individually to currents differentiated in strength and polarity, circuit-closers in series in the circuit of each of said series of magnets, and means for operating said circuit closers respectively by the several succeeding current impulses composing one of the sets of impulses aforesaid.

16. In a telegraph system, the combination with a series of receiving magnets controlled respectively by a differentiated pair of succeeding current impulses on a single line, of a set of relays operated alternately by succeeding impulses, a transfer switch and circuit closers individual to the several receiving relays controlled respectively by relays from the said two sets.

17. In a telegraph system, the combination with a series of magnets controlled respectively by differentiated sets of succeeding current impulses on a single line, of a single set of line relays in series, two sets of secondary relays, a transfer switch, additional to said relays, locking devices for the relays operated by one of the current impulses composing one of the sets of impulses aforesaid, and circuit closers operated respectively by secondary relays from the two sets and controlling the said receiving magnets.

18. In a telegraph system, the combination with a series of magnets controlled respectively by differentiated sets of succeed-

ing current impulses, of circuit closers of said magnets, relays responding to said impulses and operating the circuit closers of said magnets, a transfer switch additional to said relays, for utilizing said relays in succeeding groups, locking devices and releasing means for said devices controlled by the operation of any one of said series of magnets.

19. In a telegraph system, the combination with a series of magnets controlled respectively by differentiated sets of succeeding current impulses, of line relays in series, two groups of secondary relays, a transfer switch, a retaining magnet for said switch energized by a preceding, and a shifting magnet therefor energized by a succeeding current impulse.

20. In a telegraph system, the combination with a series of magnets controlled respectively by differentiated pairs of succeeding current impulses on a line, of line relays, two sets of secondary relays, a transfer switch, means for shifting said switch on the completion of one current impulse on the line and for returning it on the completion of the succeeding current impulse.

21. In a telegraph system, the combination of two sets of magnets each set containing six or more magnets, means for selecting and operating one only of the first set of magnets by the electrical impulse first received and one only of the second set of magnets by the second electrical impulse received, a series of receiving magnets controlled each by a single pair of magnets selected and operated as aforesaid, and means for automatically restoring the apparatus to its original condition after the second impulse.

22. In a telegraph system, the combination of a set of main line relays responding to distinctive currents, a line wire over which two successive impulses only are required to transmit a character, of two sets of secondary relays each equal in number to the said main line relays, means for automatically disconnecting the first said set of secondary relays from the main line relays and connecting the second said set of secondary relays to the said main line relays after the first electrical impulse has terminated, and means for automatically disconnecting the second said set of secondary relays from the main line relays and connecting the first said set of secondary relays to the said main line relays after the second said main line impulse has terminated, as and for the purpose described.

23. In a telegraph system the combination of main line relays, two sets of secondary relays, each six or more in number, an electromagnetic switch having three independent coils, and controlling the operation of said sets of relays, one of said coils receiving current during the time the contacts of any of said main line relays remain closed for the first main line impulse, the second of said coils receiving current only during the time that the contacts of any of said main line relays remain closed for the second main line impulse as and for the purpose described.

24. In a telegraph system the combination of main line relays, two sets of secondary relays, each six or more in number, a magnetic switch controlling the operation of said sets of secondary relays having independent coils, the current in one of said coils being controlled at some of the contacts of said main line relays during the first impulse only, and the current in the second one of said coils being controlled by some of the contacts of said main line relays during the second successive main line current impulse only, as and for the purpose described.

In witness whereof I have hereunto set my hand before two subscribing witnesses the third day of January, 1905.

ALBERT C. CREHORE.

Witnesses:
L. T. SHAW,
M. A. MODER.