No. 869,420. PATENTED OCT. 29, 1907.

B. W. COCHRAN.

PRINTING TELEGRAPH.

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Fig. 1.

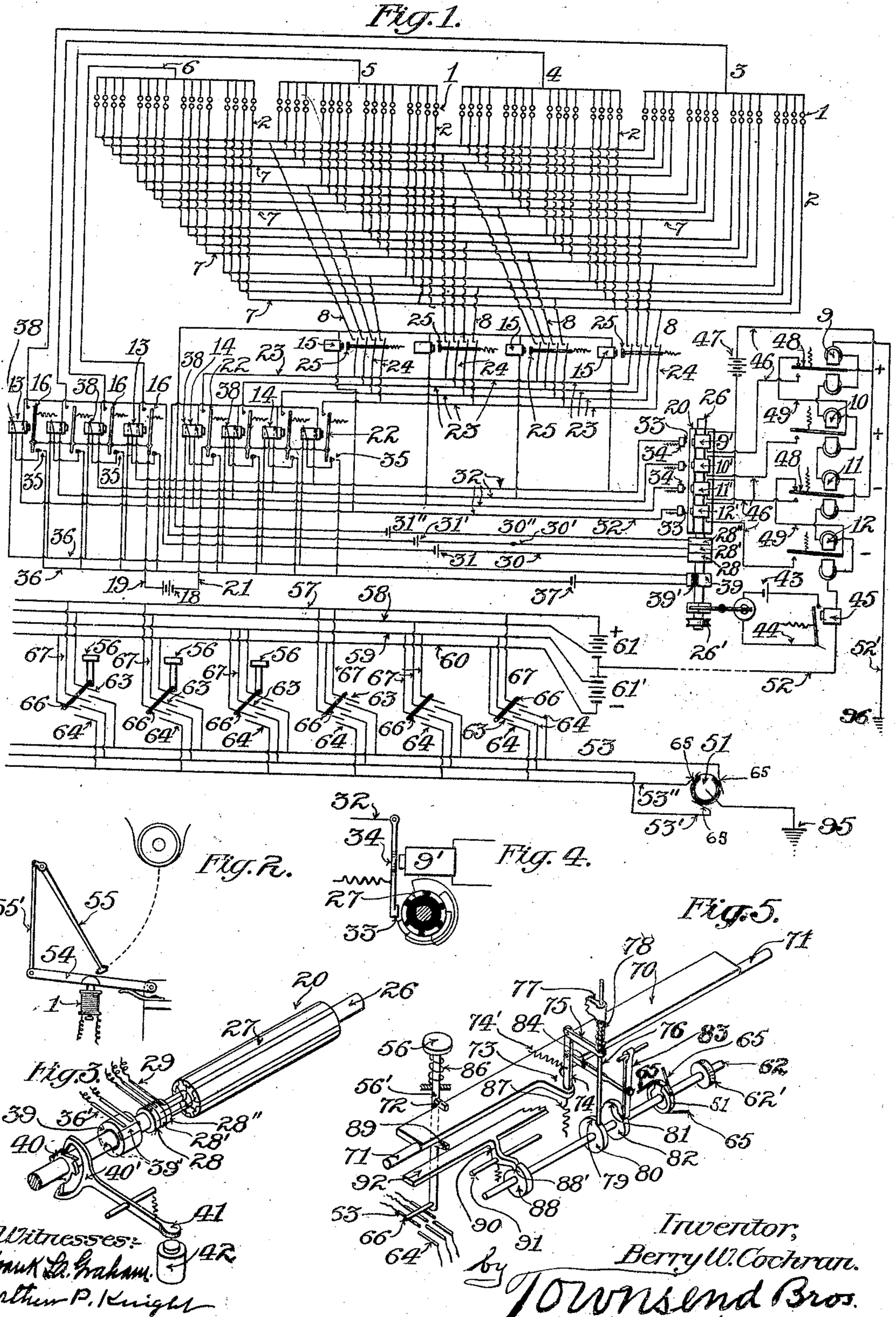

Fig. 2.

Fig. 4.

Fig. 3.

Fig. 5.

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PRINTING-TELEGRAPH.

No. 869,420. Specification of Letters Patent. Patented Oct. 29, 1907.

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To all whom it may concern:

Be it known that I, BERRY W. COCHRAN, a citizen of the United States, residing in Los Angeles, in the county of Los Angeles, State of California, have invented new and useful Improvements in Printing-Telegraphs, of which the following is a specification.

The main object of this invention is to provide a printing telegraph of extreme rapidity in operation and simplicity of construction.

The invention relates to printing telegraphs of the class wherein a plurality of printing magnets are selectively operated by a series of impulses, each of said magnets being brought into operation by a series of impulses having distinguishing characteristics.

An object of this invention is to reduce the number of impulses required, and to this end I provide for selection by means of impulses which have a plurality of different kinds of distinguishing characteristics, combined or permutated to give the requisite number of selections.

The system comprises, in connection with a telegraph line, a transmitter and a receiver respectively adapted to send and to receive impulses representing the characters to be printed. In the present case these impulses have two distinguishing kinds of characteristics, namely, different polarity and different strength. By combining these different characteristics four distinguishably different kinds of impulses may be sent. By sending a plurality or series of such impulses in succession to represent a given character, and varying the order of the impulses in the different series, the selective capacity of the system may be increased to any desired extent. Thus, according to the laws of permutation and combination, two impulses in which the four different characteristics are combined or permutated may be made to select sixteen characters, and three successive impulses for each character may be made to select sixty four characters. Three impulses are therefore sufficient for most purposes, and the system as herein shown, is adapted for operation with three impulses for each character.

The accompanying drawing illustrates the invention:—

Figure 1 is a diagram of the complete system. Fig. 2 is an elevation of one of the printing magnet devices in the receiver. Fig. 3 is a detail perspective of a rotating circuit changer in the receiver. Fig. 4 is a vertical section thereof. Fig. 5 is a perspective of the transmitter.

The invention is intended for operation in connection with a receiver of the class wherein a plurality of type bars are provided similar in operation to the ordinary typewriter, and a series or plurality of printing magnets are provided operating on said type bars to effect the printing, similar magnets being provided for effecting the feeding and line spacing operations; all of these magnets being included under the general term "printing magnets".

Referring to Fig. 1, a series or plurality of printing magnets 1 are provided, each included in a local circuit 2; these local circuits being arranged in groups, the members of each group having a common connection at one side of the printing magnets to a return wire, the respective return wires of the groups being indicated at 3, 4, 5, and 6. On the other side of the magnets 1, the connections 2 lead to permutative connection wires 7, the consecutive magnets 1 of each group being connected *seriatim* with the wires 7, there being as many wires 7 as there are magnets 1 in each group. The wires 7 are subdivided into groups, each comprising four wires, and the printing magnets 1 are similarly subdivided into four sub-groups connected respectively with the four groups of wires 7. A plurality of wires 8 lead from the corresponding wires 7 of each group, these wires 8 being divided into four groups, the wires 8 of the first group being connected to the first wire of each of the groups of wires 7, the wires 8 of the next group being connected to the second wires of each group of wires 7, and so on. These connections enable selection of any one of the magnets 1, the selection of a particular magnet being effected by establishing connection to the wire 3, 4, etc., which leads to that group, and by establishing connection through a wire 8 to the particular magnet desired in that group. In this latter connection, the selection of the group of wires 8 determines which one of the four wires of the sub-groups of wires 7 etc., will be selected; while the selection of the particular wire 8 in the selected group etc., will determine which one of the groups of wires 7 will be selected. These three selections necessary to pick out any one of the magnets are performed by three sets or groups of relays, 13, 14, 15, which are brought into operative connection successively by means of a circuit changer 20, and the selection within the groups is effected under control of four main line relays, 9, 10, 11, 12. Each of the sets of relays comprises four relay magnets, the armatures 16 of the magnets 13 controlling connection to wires 3, 4, 5, 6, from the local battery 18, one side of which is connected by a wire 19 to the armatures 16, and the other side of said battery being connected by wire 21 to the armatures 22 of magnets 14 which control connection to four wires 23 leading to contact springs 24 adapted for connection with the wires 8 aforesaid, said contact springs 24 being controlled by the armatures 25 of the relay magnets 15. These groups of relays 13, 14, 15, are brought into action successively or sequentially by means of a circuit changer or controlling device; the same comprising, for example, a cylinder or drum 20 mounted on a shaft 26 driven by any suitable means, indicated at 26′, and provided with three or a multiple of three, (in this case, six) circumferentially equidistant contacts or

segments 27 connected respectively to rings 28, 28′, 28″, from whose brushes 29 wires 30 30′, 30″ lead through local batteries 31 31′, 31″, respectively to one side of the several groups of relays 13, 14, 15. The other side of the relays of each group are connected to wires 32 leading to the movable contacts 33 which are formed on or carried by the armature levers 34 of relay magnets 9′, 10′, 11′, 12′. Thus as any one of the said relay magnets operates it will draw the corresponding contact 33 against the cylinder 20 and establish connection to a particular one of the relay magnets 13, 14, 15. This connection is established first, for one of the relay magnets 13; then, as the cylinder 20 rotates, magnets 14 and 15 are brought successively into circuit. The last connection, by the third impulse, completes the sequence for one character or operation, and it is necessary to hold the precedently or first and second operated relays 13, 14, in operated position until this sequence is completed; or, in other words, until the third relay 15 has operated to close the final connection to the individual printing magnet, and the latter has been operated. For this purpose the armature of each relay magnet 13 and 14 controls a pair of insulated contacts 35, the several pairs of contacts 35 being arranged in parallel branches across a local circuit 36, including a battery 37, the branch circuit through each pair of contacts 35 including a coil 38 of the corresponding relay magnet 13 or 14, so as to maintain the energization of the relay magnet irrespective of the subsequent interruption of the main line.

To restore the relay devices to normal or unoperated position at the end of each operation, a circuit breaker is provided for local circuit 36 comprising a disk 39 on shaft 26 of cylinder 20 and spring contacts 36′ connected to circuit 36 and engaging said disk to normally close said circuit, the disk 39 having an insulating part 39′ that comes under these contacts as the disk is about to complete its semi-rotation, so as to momentarily break the circuit and allow the operated relays 13, 14, to release their armatures.

Cylinder 20 is operated step by step, moving one step for each impulse; being, for example, controlled by an escapement wheel 40 whose anchor 40′ is operated by the armature 41 of a magnet 42 energized by a battery 43 in a local circuit 44 controlled by a relay 45 in the main line, said relay being responsive to all impulses that come over the line, so as to allow the cylinder 20 to move one step (in this case one-sixth of a revolution) for each impulse received.

Each magnet 9′, 10′, 11′, 12′, controls the connection to a corresponding one of the relays in each of the groups 13, 14, 15, and said magnets 9′, etc., are controlled through local circuits 46, including a battery 47, by main line relays 9, 10, 11, 12, whose armatures 48 are adapted to selectively respond to four different kinds of impulses obtained, for example, by the combination of two different polarities and two different strengths. For this purpose devices 9, 10, 11 and 12 are formed as polarized relays, 9 and 10, responding, for example, to positive impulses and relays 11, 12, to negative impulses, and relays 9 and 11 respectively requiring for their operation stronger current than relays 10 and 12. As a strong impulse will operate both the relays of corresponding polarity, means are provided whereby the operation of the strong relay will render the weak relay inoperative. For this purpose the local circuit 46 of each weak relay 10, 12, includes a connection 49 to the back contact of the armature 48 of the strong relay of corresponding polarity, so that as said strong relay operates it will break the local circuit 46 for the weak relay before the latter has time to render said circuit operative.

The printing magnets 1 may operate the type bars and other devices referred to in any suitable manner. Thus, as shown in Fig. 2, the armature lever 54 of a printing magnet may be connected to operate the type bar 55 by a connecting link 55′.

The transmitter comprises a circuit changer 51 for successively shifting the operating connections of the main line 52, to three local circuits 53, 53′, 53″, and a plurality of keys 56 are provided to bring into connection with the line and with these local circuits electromotive force generating means of different polarity and different strength, the said electromotive force generating means being applied through four leads 57, 58, 59, 60, connected to two batteries 61, 61′, which at their inner ends are connected together and to the line. Wires 57 and 58 lead from points of successively higher potential of battery 61, and wires 59 and 60 lead from points of successively higher potential of battery 61′, the polarity of wires 57, 58, being for example, positive, and the wires 59, 60, negative.

Each key 56 operates by means of an insulating arm 66 three contact springs 63 which, on depression of the key, contact with three fixed terminals 64 connected respectively to the three circuit changer wires 53 53′, 53″. The circuit changer may consist of a disk 51 on a shaft 62 mounted to rotate, and having suitable driving means, 62′ and having a single contact which in rotation of the disk passes successively under three brushes 65 connected to the respective wires 53, 53′, 53″. Wires 67 lead from the key-operated contact springs 63 to the battery or potential wires 57, 58, 59, 60, the connections between said wires being varied or different for the respective keys. Thus, for the key shown at the left of Fig. 1, lowermost spring 63 is connected to the wire 60, the next spring to the wire 57, and the top spring to the wire 58; and in the next key the lowermost spring is connected to the wire 57, the next spring to the wire 58, and the top spring to the wire 60; thus changing the order of connection; the next key has all three springs connected to wire 59; the key at the right has the three contacts connected respectively to wires 60, 59 and 57, etc. There will be as many of these keys as there are "printing magnets," and the connections of the contact springs for said keys to the several battery wires 57, 58, 59, 60, will be differently combined or permutated, these connections determining not only the character of the impulses which will be sent to the line by any one key, but the sequence of said impulses.

The transmitter further preferably comprises certain controlling and interlocking devices comprising a release bar 70 pivoted at 71 and engaged by lugs 72 on the key stems 56′, said bar having a projecting arm 73 on which normally rests an arm 74 pivoted to a bracket or lug 75 on a rod 76, sliding in guide 77 and normally pressed by a spring 78, to bring its lower end in front of a shoulder 79 on a disk 80 on the shaft 62 of the circuit changer.

When any key is depressed it operates through bar

70, arms 73, 74, and lug 75, to raise rod 76 out of the path of shoulder 79, whereupon the shaft will start to turn under the influence of its operating means, above referred to, causing rotation of circuit changer 51. As the shaft 62 turns, a projection 81 of a disk 82 on said shaft strikes a lever 83 to which is loosely connected a link 84 pivoted to arm 74; this movement pulling the arm 74 off of arm 73 and allowing the rod 76 to move into position against the stop disk 80 ready to fall in front of the shoulder 79 when the disk completes its rotation. When the key 56 is returned to normal position by its spring 86, bar 70 is turned by spring 87 to depress arm 73, whereupon arm 74 is pulled over said arm 73 by a spring 74′. Rod 84 slides through lever 83 a sufficient distance to enable return of the lever independently of the rod.

A disk 88 on shaft 62 has a notch 88′ in which normally engages the end of a lever 90, pivoted at 91 and carrying a locking bar 92, which on rotation of disk 88 is forced toward key stem 56, thereby engaging over a lug 89 on the depressed key stem, to hold the key down, and under the lugs 89 of the other key stems to lock them against operation until the revolution is completed.

The operation is as follows:—The transmitting operator will depress that one of the keys 56 which corresponds to the character to be transmitted. This operates through the releasing mechanism above described to start the rotation of shaft 62 and disk 51, thus establishing connection from ground, indicated at 95 in Fig. 1, through the disk 51 and the brushes 65, through the transmitter and the main line battery to the line. Thus, assuming that the key corresponding to the group at the extreme left of Fig. 1 has been operated, the circuit will first be established from said ground through the disk 51 to brush 65 leading to wire 53; thence by contacts 64, 63, and one of the wires 67 to the wire 58 and plus battery 61 at an intermediate or low strength point. From the other side of said battery the line 52 leads through escapement relay 45 and thence through the magnets 12, 11, 10, 9, in series, and by a connection 52′ to ground at 96. The negative side of the battery being brought to line in this case the impulse will be negative, and only relay 12 will be energized, relay 11 not responding to the weak current sent by the section of battery included. The armature 48 of said relay will close the local circuit 46 leading to magnet 12′ which will operate its armature 34 to draw the corresponding contact 33 against the cylinder 20. Meanwhile, the operation of relay magnet 45 has controlled the escapement mechanism, but the initial movement thereof in such operation is slight and not sufficient to change the contact relations, so that the contact 33 will engage with the initial contact strip of cylinder 20 connected, say, to wire 30. Current will therefore pass in local circuit 30 from the battery 31 through contact of cylinder 20, contact 33 and wire 32 to one of the magnets 13,—in this case the one at the left of the group,—and by wire 30 back to the battery 31. The magnet 13 so energized will operate its armature to close the local circuit 3 leading to the first group of printing magnets, and this armature will be retained in its operated position by the means above described. Further rotation of the transmitter disk 51 will establish the contact through brush 65 to wire 53′, and operated transmitter key will continue connection from said wire 53′ through contacts 64, 63, and wire 67 to the combination wire 57 leading to the positive side of battery 61; thus sending a negative impulse of full strength to the line and energizing relay magnets 11 and 12, but magnet 12′ is not operated for its circuit is broken by armature 48 of the strong relay 11, and only the corresponding magnet 11′ is operated. The cessation of the precedent or first impulse has resulted in release of the escapement, allowing the cylinder 20 to turn to bring the next segment into position opposite the contacts 33 so that energization of relay 11′ will establish connection from battery 31′, through wire 30′, a segment of cylinder 20, contact 33 and corresponding wire 32, to one of the magnets 14 in the second group; *i. e.*, the second from the extreme left therein, the circuit being continued from said magnet by wire 30′ back to the battery 31′. The magnet so energized will attract its armature to close connection through wires 23 to a certain contact spring 24 of each of the groups controlled by the relays 15. The final impulse for the character is then transmitted through wire 53″, contacts 64, 63, of the operated key, combination wire 60, to the negative side of battery 61′, thus sending a positive impulse to the line operating the strong plus relay 9. The commutator or controlling device 20 has meanwhile been shifted to bring the third local battery 31″ in operative connection, the circuit leading therefrom through the wire 30″, a segment of cylinder 20, contact 33, one of the wires 32, to one of the magnets 15,—in this case the one at the extreme right,—and thence by wire 30″ back to the battery 31″. The magnet 15 so energized operates its armature to close all of the contacts 24 of the corresponding group, thereby completing final connection for the operation of the printing circuit, the same being traced as follows:—From battery 18, through wire 19, operated armature 16 of the first group of relays 13; then by wire 3 to the common connection for the first group of printing magnets, those on the right; then through the first magnet in the third sub group of the first main group counting from the right, through a connection 2 to one of the wires 7; thence by a wire 8 to the first spring in the fourth group of contacts 24 operated by relays 15; thence by wire 23 to the contact and armature of the operated relay 14 of the second group, and so to the other side of battery 18. The "printing magnet" having thus been operated to perform the printing or other described operation, the sequence of operation is concluded by circuit breaker 39 operating as above described to break the retaining circuits for the first and second sets of relays 13, 14, thereby allowing armatures thereof to return to normal position and restoring the system to its original condition ready for the transmission of another sequence of impulses, the transmitter having been meanwhile restored to normal position as above described.

Various modifications may be made in the system above described and in the various devices used therein, without departing from my invention.

What I claim is:—

1. A plurality of printing magnets, circuits therefor connecting said magnets in groups, sets of relay devices op-

eratively connected to select the different groups and the different magnets of each group, a movable contact means operating to shift the operating line connection successively to the respective sets of relay devices, a line and relays therein, responding to electric impulses having different combinations of characteristics, and controlling the different relays in the respective sets, and means for imparting to the line electric impulses having such different combinations of characteristics.

2. The combination of a plurality of printing magnets, a line, relays controlled sequentially by the line to establish operating connection to individual printing magnets, a retaining circuit for each precedently operating relay, including a supplementary energizing coil for said relay, said retaining circuits including contacts controlled by the respective precedently operating relays, a movable controlling device operating to bring the relays sequentially into operating connection and comprising a circuit breaker for said retaining circuit.

3. A plurality of printing magnets, circuits therefor connecting said magnets in groups, sets of relay devices operatively connected to select the different groups and the different magnets of each group, a movable contact means operating to shift the operating line connection successively to the respective sets of relay devices, a line and relays therein responding to electric impulses having different characteristics and controlling the different relays in the respective sets, means for imparting to the line a sequence of impulses for operating the line relays, and means for retaining the precedently-operated selecting relays in operated position until the sequence is completed.

4. A plurality of printing magnets, selecting relays therefor, a rotary circuit changer having a plurality of circumferentially disposed contacts arranged in operative relation with the armatures of said relay devices.

5. A plurality of printing magnets and circuits therefor connecting said magnets in groups, sets of relay devices operatively connected to select the different groups and the magnets in the respective groups, an operating line, a rotary contact means operating to shift the operating line connections from one set of relays to another, relay devices responsive to line impulses of different character and controlling the relay devices in the aforesaid sets, and means responsive to all line impulses controlling the operation of the rotary circuit changer.

6. A printing telegraph transmitter comprising electromotive force generating means, and leads connected thereto at points of different polarity and different electromotive force, a circuit changer and a plurality of leads connected thereto and sequentially brought into the line connections thereby, a plurality of keys and contacts controlled thereby and connected to the circuit changer wires and to the electromotive force generator leads in different combinations.

7. A printing telegraph transmitter comprising a rotary circuit changer, a plurality of keys, a line, means controlled by the keys and the circuit changer to send a sequence of impulses of different character to the line, stop means for the circuit changer controlled by the keys to release the circuit changer for operation on operation of any key, and means controlled by the circuit changer to disconnect the connection between the keys and the stop means.

8. A printing telegraph transmitter comprising a rotary circuit changer, a plurality of keys, a line, means controlled by the keys and the circuit changer to send a sequence of impulses of different character to the line, stop means for the circuit changer controlled by the keys to release the circuit changer for operation on operation of any key, means controlled by the circuit changer to disconnect the connection between the keys and the stop means, and restoring means reëstablishing such connection on partial rotation of the circuit changer.

9. In a printing telegraph transmitter, a plurality of keys, a release bar engaged thereby, a rotary circuit changer, a stop therefor, an arm connected to said stop and movable into and out of engagement with the aforesaid release bar, a spring tending to draw the arm into such engagement, a cam connected to the circuit changer, and means operated by said cam and connected to aforesaid arm to release its engagement.

In testimony whereof, I have hereunto set my hand at Los Angeles California this 12th day of April 1905.

BERRY W. COCHRAN.

In presence of—
ARTHUR P. KNIGHT,
JULIA TOWNSEND.