C. K. JONES.

PRINTING TELEGRAPH.

APPLICATION FILED SEPT. 2, 1909.

982,274. Patented Jan. 24, 1911.

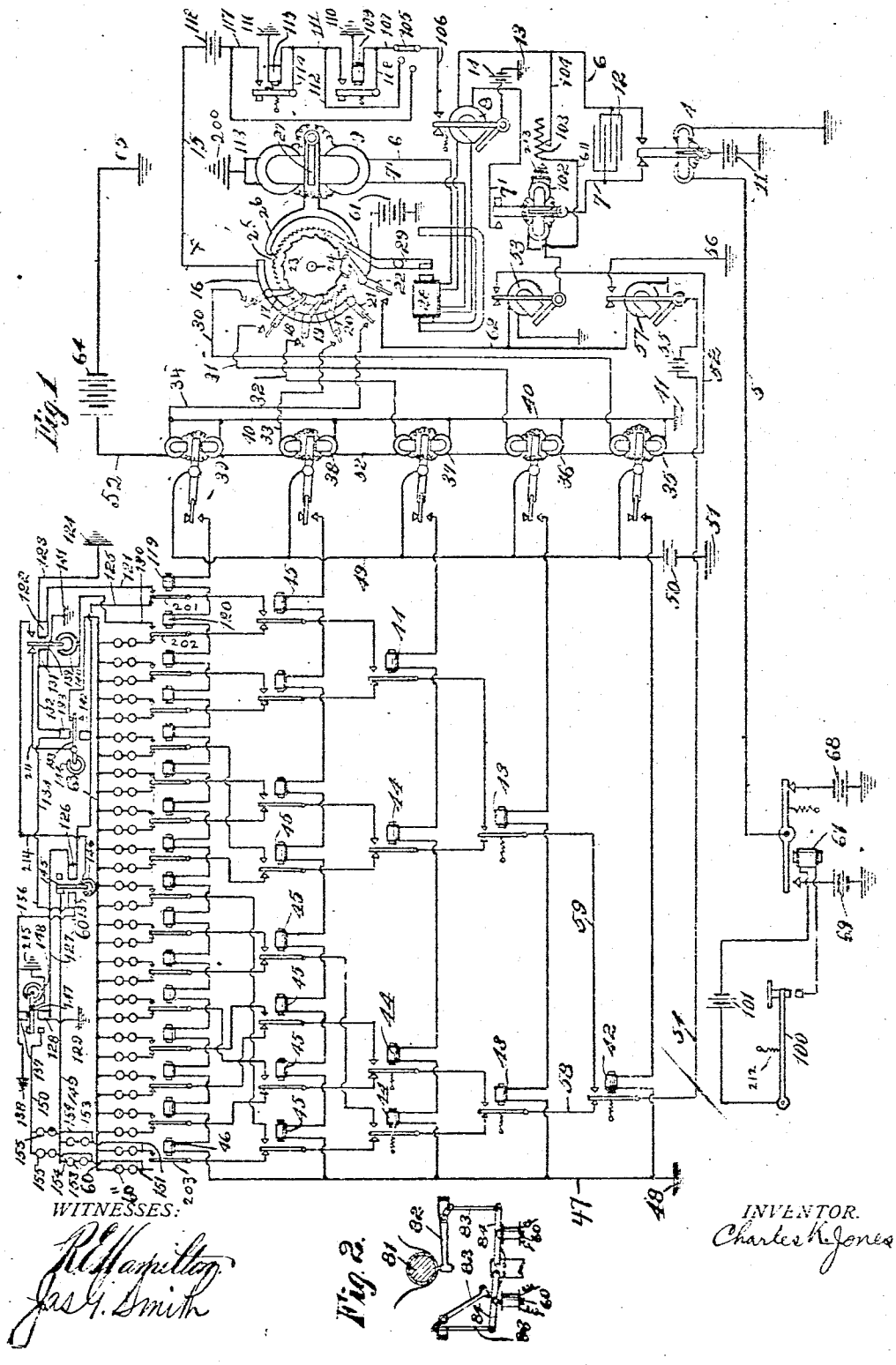

Fig. 1

Fig. 2.

WITNESSES:

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PRINTING-TELEGRAPH.

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To all whom it may concern:

Be it known that I, CHARLES K. JONES, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Printing-Telegraphs; and I do declare the following to be 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, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to printing-telegraphs; and it consists in a novel arrangement of selecting-relays and associate devices whereby by the operation of a single relay in a single main-line circuit controlling the selective action of the said selective-relays any one of a plurality of type-bars or printing devices may be actuated at will.

My invention consists of apparatus whereby automatic protection is provided to the receiving instrument against destruction by a powerful electric energy such as is necessarily used in an instrument of this character; means whereby the instrument may be adjusted to correspond with the speed of the transmitting apparatus; means whereby the operating magnets may be doubled or trebled or any number desired without sacrifice of speed and without increasing the number of the parts of the instrument correspondingly; and generally my invention consists in the novel features hereinafter set forth, and particularly pointed out in the claims.

The objects of my invention are to improve and simplify printing-telegraph systems and apparatus, to simplify and improve the operation of printers employing type-bars or similar printing devices for the several characters, to transmit messages directly to the main-line from a suitable key-board transmitter, from an ordinary hand-manipulated key, such as is shown in the accompanying drawings to operate the printing instrument, or from any type of transmitting instrument, including the slowest to the highest speed instruments. Hitherto similar inventions are unprovided with devices whereby the receiving instrument may be adjusted to a variation in speed with respect to the transmitter, such an adjustment having to be made with the transmitter to control its own speed to accommodate itself to the receiving instrument, which defect makes it necessary that communication with the distant transmitting station must be effected through some exterior means, such as the telephone or the telegraph to effect such adjustment, rather than through the medium of the said printing instrument and its transmitter; likewise no devices are provided whereby the powerful electric energy necessarily used in an apparatus of this kind is automatically cut off from the receiving apparatus after a print is effected and while the parts are standing in the normal position unused for a time, thus often destroying some of the parts of the apparatus by reason of neglect of the attendants. The foregoing defects obviously render it imperative that the instrument must be under the constant care of a skilled attendant. The obviation of the last-named defect makes it possible to operate my invention in small private offices and places of ordinary business, rather than exclusively in large commercial telegraph offices where they can be under the care of a skilled attendant. Similar inventions are confined to the exclusive use of capital letters for printing because of the complication involved in the apparatus operating a duplicate set of printing magnets for the small letters and should both capitals and small letters be used it is done with a sacrifice in the speed of the transmission.

All of the foregoing defects are obviated in my invention; the receiving instrument may be adjusted to the speed of the transmitter used, ranging from the slowest hand-manipulated key to the highest speed instrument; when the instrument stands in the normal position unused no electricity manifests itself, the system being known as an open-circuit instrument: three groups of operating magnets are provided whereby the small letters, numerals and punctuations may be used in the first group, capital letters, numerals and punctuation marks in the second group and the third group may be used for any mechanical purposes desired, or for operating the key-board of a type-setting machine, or for any similar device; to use the second group a special magnet is provided for energization which action will result in cutting out of circuit the first group and simultaneously therewith cutting into circuit the second group; to use the third group another special magnet is used for

energization which action will result in cutting out of circuit the first and second groups and simultaneously therewith cutting into circuit the third group; another special magnet is provided for energization which action will result in the second and third groups being cut out of circuit and simultaneously therewith the first group will be cut into circuit; thus any one of the three groups of operating magnets may be used at will. I have spoken of only three groups of operating magnets but it is obvious that this number may be increased by similar methods employed; and generally to avoid the complication of former printing-telegraph systems and to permit the direct transmission of messages with the same facility with which a type-writer may be operated.

I will now proceed to describe my invention with reference to the accompanying drawings, in which one embodiment of the invention is illustrated and will then point out the novel features in claims.

In the said drawings, Figure 1 is a diagram showing an ordinary hand-manipulated key for a transmitting instrument and the various relays, associated devices, type-bar magnets, and circuits of the corresponding receiving instrument or printer. Fig. 2 illustrates one form of type-bar mechanism adapted to be actuated by type-bar magnets.

In this system I employ for the transmission of the messages successions of current pulses, which are the same in number for all the characters, but vary in length, all as described in various patents to C. L. Buckingham, and these pulses are usually, but not necessarily, alternately of opposite directions. For transmitting the characters of the English alphabet I employ six pulses for each message, which enables me to operate at will any one of thirty-two magnets, thus permitting the transmission of all the characters of the alphabet and leaving a margin for transmission of punctuation-marks and for the operation of spacing, carriage-return, and shift mechanism, such as are used on various well-known electrical type-writers. For transmitting a less number of characters than are contained in the alphabet I may employ a fewer number of pulses for each signal, and for transmitting a greater number of characters than are provided for herein I may employ more than six pulses for each signal, but the latter is not necessary on account of there being two additional groups of type-bar magnets available for any purpose desired, said groups having been explained previously.

Referring now to the drawings and at first to Fig. 1, the said figure shows an ordinary telegraph hand-manipulated key for a transmitting instrument, which instrument will be described more fully hereinafter, and a receiving instrument comprising a main-line relay 4, and a plurality of relays and a sunflower hereinafter described. The receiving instrument and transmitter are connected by a line-wire 5. At the transmitting end this line-wire passes through contacts of an ordinary pole-changer 67, forming a part of the transmitter and operated by a local circuit controlled by contacts of the key. At the receiving end the line-wire 5, passes through main-line relay 4, which in the instance shown is a polar relay, to ground.

Main-line relay 4 controls two local circuits 6 and 7, connected to opposing contact-points of the main-line relay, both of which circuits pass through coils of a neutral relay 8, and through a synchronizer-magnet 28 and opposing coils of a magnet 9, operating escapement mechanism of the sunflower hereinafter described, to ground at 200. Circuit 6, however, is connected to a branch line 101, thence to an adjustable resistance 103, wire 6″, passing through opposing coils of polar relay 102, thence to ground 213. Circuit 7 before reaching magnet 8, passes to armature of polar relay 102, and from the left hand contact of said armature passes to magnet 8, as circuit 7′, thus circuit 7 is normally broken by the armature of relay 102. A battery 11 or other suitable source of electricity is connected to ground and to the armature of main-line relay 4. One or the other of circuits 6 and 7 is completed through battery 11, according as the said armature of relay 4 is in contact with the right-hand or left-hand contact of said relay however, this is not true until the first pulse actuates the armature of main-line relay 4 into the abnormal position, said actuation resulting in the actuation of the armature of relay 102 into the abnormal position, thus completing circuit 7 to magnet 8 and said circuit will so remain until all of the parts of the instrument are restored to normal positions which takes place immediately following the print. The armature of entrance relay 102 is the means whereby the electric energy is kept from the instrument while the armature of relay 4 remains in the normal position after a print is effected.

The circuit controlled by relay 8 passes from ground at 13, through battery 14, the armature of relay 8 and conductor 106, switch 105, wire 107, magnet 109 and to ground. From wire 107 another circuit is effected through the armature of relay 109 branch 111 magnet 115 to ground. The energization of magnet 109 causes the actuation of the armature of relay 109 and the actuation of relay 109 causes the energization of magnet 115, which actuates the armature of relay 115. The actuation of the armature of relay 115 effects a circuit from wire 111 through armature of relay 115 to

wire 117 through battery 118 and wire 15. Relays 8, 109 and 115 are called the retarding set or dash relay, its object being to transmit only the long pulses or dashes to the parts hereinafter described.

While I have shown a battery 118 used in the retarding-set circuit as auxiliary to the battery 14, it is obvious that this auxiliary battery may be omitted without changing the operation, battery 14 being of the proper strength.

Switch 105 is for the purpose of cutting out of circuit relays 109 and 115 when so desired to correspond with a higher rate of speed of the transmitter; if switch 105 is made to contact with wire 112, then relay 109 will be cut out of circuit and if switch 105 be made to contact with wire 113 then both relays 109 and 115 will be cut out of circuit and in the latter case the circuit would pass from wire 106 through switch 105 wire 113 to wire 117, battery 118 to wire 15.

A condenser 12 is connected across the contact-points of the relay 4 to reduce sparking.

From wire 15, the circuit passes to a plate 16 of the sunflower, to which the first five contact-points 17, 18, 19, 20, and 21 of that sunflower are electrically connected. This sunflower is of the type described in the patent to Buckingham, No. 544,347, dated August 13, 1895, and consists of contact-points 17, 18, 19, 20, 21 and 22, adapted to be actuated successively by teeth of a ratchet-wheel 23 during movement of said wheel through the space of one tooth. Said ratchet-wheel is mounted upon a shaft 24 upon which is also mounted an escapement wheel 25, having three times the number of teeth of ratchet-wheel 23 and controlled in its movement by the escapement-anchor 26, which is actuated by the armature 27, which is polarized.

The coils of magnet 9 through which circuits 6 and 7′ pass being oppositely wound alternate pulses in these circuits will cause the vibration of the escapement anchor 26, and six such pulses, permitting rotation of escapement-wheel 25 through the space of three teeth, will advance ratchet-wheel 23 through the space of one tooth, causing contact-points 17 to 22 to complete their respective contacts successively and completing one cycle operation of the sunflower. The shaft 24 of the sunflower is driven by any suitable device, such as a spring-motor or friction drive, which will permit intermittent motion of said shaft. Magnet 28 beneath the sunflower is a synchronizer-magnet operating an armature-lever 29, having a hook adapted to engage the teeth of ratchet-wheel 23. The function of this synchronizer is fully described in the patent to Buckingham, No. 544,347, and need not be further described here since its description is not necessary for the understanding of the operation of the apparatus. Indeed, if automatic correction of the operation of the apparatus for loss of synchronism between the receiver and transmitter is not desired this synchronizer may be omitted, circuits 6 and 7′ passing directly from the magnet 8 to the coils of magnet 9.

It was stated above the metal frame 16, carrying contact-points 17 to 21, is connected to conductor 15 passing through contacts of the retarding set with battery 14 and thence to ground 13. These contact-points 17 to 21, inclusive, which may be termed "selector-contacts," when operated by the movement of ratchet-wheel 23 complete circuits successively from the contact-points of the retarding set through conductors 30 to 34, respectively, leading to the magnets of polar selecting relays 35, 36 37, 38 and 39, respectively, and thence through a common return-conductor 40 to ground at 41, but it will be seen that none of these circuits through the magnets of the polar selecting-relays will be closed unless at the instant when any one of those circuits is closed through the sunflower the transmission of a long pulse through the line has caused the retarding set to complete the circuit through battery 14 to ground at 13.

Polar selecting-relays 35 to 39, inclusive, control circuits of secondary selecting-relays 42, 43, 44, 45 and 46 respectively. There is one relay 42, two relays 43, four relays 44, eight relays 45, and sixteen relays 46, the relays being arranged, therefore, in five clusters, forming a geometrical progression. The relays of each cluster are connected in series in circuits controlled by the corresponding polar selecting-relay, which circuits are connected in multiple to a return-conductor 47 and thence to ground at 48. The circuits of these secondary selecting-relays 42 to 46, inclusive, are normally broken: but the armatures of the several polar selecting-relays are connected by a multiple current-lead 49 to a battery 50 and to ground at 51, and when the magnet of any one polar selecting-relay is energized by a current passing through the sunflower and its armature deflected said polar selecting-relay completes the circuit through the secondary selecting-relays which it controls, thereby energizing all of said relays of its cluster.

The armatures of the primary or polar selecting-relays 35 to 39, inclusive, tend to remain in contact with whatever contact-point they are in contact at the time. These relays are provided with a second or restoring circuit 52, passing in series through all of these relays, which circuit when completed by a restoring-relay hereinafter mentioned returns the armatures of all these relays to their normal positions, break-

ing the circuits of the secondary selecting-relays 42 to 46, inclusive. This restoring-circuit 52 is arranged to be completed by a restoring-relay 53 after circuit is completed through the sixth contact piece 22 of the sunflower, as hereinafter described.

Referring now to the secondary selecting-relays 42 to 46, the armature of relay 42 is connected to a circuit 54, including a battery 55, which circuit is arranged to be connected to ground at 56 by a relay 57, termed the "sixth-pulse" or "final-pulse" relay, when said relay 57 is energized. The contacts of the secondary selecting-relays are connected in tandem, as follows: Relay 42 has two contact-points connected by conductors 58 and 59, respectively, to the armatures of the two relays 43 forming the second cluster of secondary selecting-relays. Each of relays 43 in turn has two contact-points, each connected, respectively, to the armature of one of the four relays 44 forming the third cluster of secondary selecting-relays. In similar manner each relay 44 controls a circuit passing through the armatures of two of relays 45 forming the fourth cluster of secondary selecting-relays, and in like manner each of relays 45 controls the circuit passing through the armature of two of relays 46 forming the fifth cluster of secondary selecting-relays. Each of relays 46 has two contact-points by which it may complete a circuit through one or the other of two magnets of a series of magnets 60, which may be termed "type-bar" magnets or "printing" magnets, though, as hereinafter shown, certain of these magnets may operate shift mechanism, carriage-returning mechanism, or the like. It will be seen that by means of the various secondary selecting-relays 42 to 46, inclusive, a circuit may be completed through any one of the various type-bar magnets 60 at will.

The sixth contact-point 22 of the sunflower is electrically connected to a source of energy 61, and when said contact is actuated by ratchet-wheel 23 a circuit is completed from the source of energy 61 through conductor 62 and the magnets of restoring-relay 53 and sixth pulse relay 57 in multiple to ground. Sixth-pulse relay 57 is a rapidly-operating relay, and when it operates it completes the circuit of battery 55 through the contact-points of the various selecting-relays 42 to 46, according to the positions of the armatures of these relays, and through the particular type-bar magnet 60 which may have been selected by the operation of these secondary selecting-relays to a common return-conductor 63 and thence to armature 143, wire 211, armature 139 to ground 141. The restoring relay 53 operates relatively slowly as compared with sixth-pulse relay 57; but when its armature makes contact with its contact-point it completes the restoring-circuit from ground at 65 through battery 64, wire 52 thence passing through the restoring coils of primary relays 35 to 39, inclusive, thence to wire 52, thence through armature of relay 53 and passing through the restoring coils of relay 102 to ground at 213.

Referring now to the transmitter, the same as shown in the drawings, consists of an ordinary hand-manipulated telegraph key, adapted for engagement with a wire leading to magnet 67, thence to wire leading to a source of energy 101, thence to a wire returning to key 100; magnet 67 controls the spring-held armature of an ordinary pole-changer, which pole-changer in its operation places alternately on the line-circuit sources of electric energy 68 and 69 of opposite polarity, thereby producing in the line conductor 5 current impulses of opposite polarity; the key 100 is held normally in one position by spring 212. The receiving instrument is operated by short and long closures or by combinations of short and long closures made by the key 100 engaging its opposing contact, said contact being connected by a wire leading to the magnet 67. I do not limit myself, however, to any particular construction of transmitting instrument, as the receiving instrument is adapted to be operated by any type of transmitting instrument.

The operation of this apparatus is as follows: Supposing, for example, that the message to be transmitted consists of a dash or long pulse followed by three dots or short pulses and then by two dashes or long pulses: the key 100 is depressed so that it makes contact with its opposing contact, and said key is then released and allowed to return to normal position by the action of spring 212, and the magnet of the pole-changer 67 being energized battery 69 is placed to the line, and circuit 6 is completed through magnet 8, synchronizer-magnet 28, and sunflower magnet 9 to ground at 200. This results in the rotation of escapement wheel 25 through half the space of a tooth, thereby closing selector contact 17 of the sunflower. This first pulse being a long pulse or dash, the circuit of battery 14 through the contact of relay 8 is completed, resulting in the actuation of relay 109, and the actuation of relay 109 resulting in the actuation of relay 115, thereby completing the circuit through battery 118, wire 15, selector contacts 17, wire 30, coils of relay 35, to ground at 41. Between relay 115 and conductor 15 the circuit is given additional energy by an intermediate battery 118. The action of the first pulse just described also actuates the armature of relay 102 into the abnormal position as follows: from wire 6 to wire 104, to resistance 103, wire 6'' through magnet 102 to ground 213. On the sending of the next pulse transmitter-battery 69 is disconnected from the line and battery 68 con-

nected to the line, the line-relay 4 completes circuits 7 and 7', and the sunflower escapement-wheel 26 rotates through the space of another half tooth; but since this pulse is a dot the retarding set (relays 8, 109 and 115) does not complete the circuit through the sunflower-contacts and secondary selecting-relays 43 are not energized. The next two pulses which are transmitted being also dots, the selecting-relays are not operated: but the fifth pulse transmitted being a dash a circuit is completed by the retarding set through selecting contact-point 21 of the sunflower and the primary selecting-relay 39, which relay being thus energized energizes the secondary selecting-relays 46. It will be seen that by the operation of the selecting-relays a circuit has been formed which passes through one of the printing-magnets 60—namely, that designated as 60' in Fig. 1: but the circuit through this magnet is not completed until upon the sending of the sixth pulse sunflower-contact 22 completes the circuit through sixth pulse-relay 57 and restoring-relay 53. Upon the operation of relay 57 the circuit through magnet 60' is completed and the corresponding type-bar operated. The next instant restoring-relay 53 completes the restoring-circuit and all the selecting-relays and the relay 102 are returned to their normal condition and there is no further current into the instrument except to the main-line relay, the circuit being broken by the armature of relay 102 being actuated into the normal position, until line-relay 4 is again actuated into the abnormal position.

In Fig. 2 I have shown mechanism for operating type-bars by electromagnets, the parts there shown being an ordinary typewriter roll or platen 81, type-bars 82, connected by links 83 to armature-levers 84, adapted to be operated by the printing-magnets 60: but it will be understood that I do not limit myself to any particular printing mechanism and that the mechanism of any of the well-known electrical type-writers may be used. Further, it will be understood that certain of the magnets 60 may operate shift, spacing, and carriage-return mechanism such as are commonly used in electrical type-writers, such magnets acting directly or as relays to complete the circuit of other magnets. Fig. 1, also illustrates two additional groups of printing and operating-magnets and a plurality of circuit-making relays controlling said groups an explanation of which is as follows: The first group may be used for small letters, punctuation-marks, numerals and for operating purposes, such as shifting the carriage, etc., the second group for capital letters, punctuation-marks, numerals and for operating purposes, the third group for italic letters, or for any other purpose desired. The first group including the circuit-making relays stand normally cut into circuit with the secondary relays; to cut out the first group and substitute therefor the second group, the operation of five dashes will be necessary to effect an actuation of armature 201, which when actuated will embrace one of the magnets of circuit-making relay 122 in a circuit controlled by the secondary relays; when the final pulse is operated circuit-making relay 122 is operated thereby consummating the purpose. To cut into circuit the third group and simultaneously therewith to cut out of circuit the second group, the operation of four dashes and one dot are necessary to effect an actuation of the armatures of circuit-making relays 142, 126 and 128 which when actuated by the final pulse will consummate the purpose. To restore the groups to normal position three dashes, one dot, and one dash are necessary to effect a formation of the proper selecting-circuit embracing the magnets of circuit-making relays 131, 133, 135 and 137, which when energized by the final pulse will restore the groups to normal position.

The armature of each circuit-making relay is moved to either of its positions by separate magnets and the said armatures are also held in either of their positions by permanent magnets: one of the said armatures is provided with contacts on both sides whereby a connection is formed in either of its positions: but it will be understood that I do not limit myself to any particular type of relay to accomplish the foregoing results and that any of the well known relays may be used.

The circuits are as follows: If armature 201 is actuated into contact with wire 121 as a result of the operation of five dashes, the final pulse will cause the operation of circuit-making relay 122, via wire 121, magnet 122, wire 123 and to ground, thus cutting out of circuit the first group and cutting into circuit the second group. If five dots now be operated, the final pulse will effect an energization of a type-bar magnet in the second group corresponding with type-bar magnet 60'' of the first group, the circuit being as follows: The circuit leaving armature 203 goes to wire 151 and thence to type-bar magnet corresponding with type-bar magnet 60'', wire 149, armature 145, wire 214, armature 139 and to ground 141; if a coresponding type-bar magnet in the third series, 155 be desired to be operated then armature 201 is the means through which the same is effected as follows: The circuit leaves armature 201 going to wire 125 magnet 142, thence to magnet 126, thence to magnet 128 and to ground at 129, thus actuating armatures 143, 145 and 147; now if the parts be operated which would

result in the energization of type-bar magnet 60″, the circuit will be as follows: from armature 203 wire 151, wire 154 to the desired type-bar magnet and thence to wire 150, armature 147 and to ground at 215. The restoration circuit is as follows: armature 202, wire 130, magnet 131, wire 132, magnet 133, wire 134, magnet 135, wire 136, magnet 137 and to ground 138.

It will be obvious that my invention is susceptible of many variations and modifications without departing from the principles herein set forth, and I do not limit myself to the details of construction and arrangements of the parts herein illustrated and described.

It will be understood from the foregoing description and illustrations that the receiving instrument is operated by the armature of the main-line relay coming into contact with both of its opposing-contacts and it therefore follows that if connection be made similarly with a main-line relay which is operated by a current in one direction only, or with a receiving relay of a duplex or quadruplex instrument the same results will be obtained.

What I claim is—

1. In a printing-telegraph, the combination of an electrically-controlled sunflower, a plurality of selecting-circuits controlled thereby, and a plurality of corresponding primary selecting-relays, one for each such circuit, a plurality of secondary selecting circuits, controlled by said primary selecting-relays, secondary selecting-relays in said secondary selecting-circuits arranged in geometrical progression, each such selecting-relay of each cluster but the last controlling the circuits through the contacts of a plurality of relays of the next cluster, a group of printing and operating-magnets, connected to the individual contacts of the last cluster of secondary selecting-relays, a plurality of circuit-making relays comprised in said group of printing and operating-magnets, a second group of printing and operating-magnets and circuits therefor, said second group corresponding to the remaining printing and operating-magnets in the first group controlled by said circuit making relays whereby said remaining printing and operating-magnets in the first group may be cut out of circuit with said secondary selecting-relays of the last cluster and a second group substituted therefor, a main-line relay, an entrance-relay, having its armature connected to control the circuit closed by the main-line relay in its normal position and maintain the same normally open, a restoring-relay, a restoring-circuit operated thereby passing through said primary-selecting-relays, and through said entrance-relay, and means controlled by the sunflower after the operation of said primary and secondary-relays, for completing a circuit through contacts of the secondary selecting-relays to the selected printing or operating magnet, and means for operating the restoring-relay.

2. In a printing-telegraph, the combination of an electrically-controlled sunflower, a plurality of selecting-circuits controlled thereby, and a plurality of corresponding primary polar selecting-relays, one in each such circuit, said relays having restoring-coils, of a plurality of secondary selecting-circuits, controlled by said primary selecting-relays, secondary selecting-relays in such secondary selecting-circuits, arranged in geometrical progression, and having their contacts connected to contacts of the succeeding cluster, a plurality of groups of printing and operating-magnets, a plurality of circuit-making relays comprised in said groups of printing and operating magnets, said groups controlled by said circuit-making relays, the magnets in said first group of printing and operating-magnets controlled by said secondary selecting-relays, a main-line relay, a polar entrance-relay, said entrance-relay having also restoring-coils, said entrance-relay maintaining in conjunction with said main-line relay a normally open-circuit system for the remaining relays, a restoring-relay and a circuit therefor including the restoring-coils of the primary selecting-relays, and the entrance-relay, and means controlled by the sunflower, after the operation of the primary and secondary relays, for completing a circuit through the contacts of the secondary selecting-relays to the selected printing or operating-magnet, and means for operating the restoring-relay.

3. In a printing-telegraph, the combination with an electrically-controlled sunflower, said sunflower having a plurality of selecting-contacts adapted to be operated successively, and a corresponding plurality of primary selecting-relays in circuit each with one of said selecting-contacts, of a plurality of secondary selecting-relays, arranged in clusters corresponding to and controlled by the primary selecting-relays, said secondary selecting-relays of each cluster succeeding the first having contacts connected to contacts of their respective relays of the preceding cluster, a plurality of groups of printing and operating-magnets, a plurality of circuit-making relays comprised in said groups of printing and operating magnets, and having magnets controlled by said secondary selecting-relays, said groups controlled by said circuit-making relays, the magnets in said first group of printing and operating-magnets controlled by the secondary selecting-relays of the last cluster, a main-line relay, an entrance-relay coöperating with said main-line relay for maintain-

ing a normally open-circuit system, means controlled by said sunflower for completing a circuit through the contacts of the secondary selecting-relays and the selected printing or operating-magnet, and means for restoring the primary selecting-relays, and the said entrance-relay, controlled by a sunflower contact which is operated after the selecting-contacts of said sunflower are operated.

4. In a printing-telegraph, the combination with an electrically-controlled sunflower, said sunflower having a plurality of selecting-contacts adapted to be completed successively, and a corresponding plurality of primary selecting-relays in circuit each with one of said selecting-contacts, of a plurality of secondary selecting-relays, arranged in clusters corresponding to and controlled by the primary selecting-relays, said secondary selecting-relays of each cluster succeeding the first having contacts connected to contacts of their respective relays of the preceding cluster, a plurality of groups of printing and operating-magnets, a plurality of circuit-making relays, having magnets controlled by said secondary selecting-relays, said groups of printing and operating-magnets controlled by said circuit-making relays, the magnets in the first group of printing and operating-magnets controlled by said secondary selecting-relays of the last cluster, a relay for completing a circuit through the closed contacts of said secondary selecting-relays, and a restoring-relay and means controlled thereby for restoring the primary relays, both controlled by a sunflower-contact which is operated after the selecting-contacts of said sunflower are operated.

5. In a printing-telegraph, the combination with an electrically-controlled sunflower, said sunflower having a plurality of selecting-contacts arranged to be operated successively, and a corresponding plurality of primary polar selecting-relays each in a circuit with one of said selecting-contacts, of a plurality of secondary selecting-relays arranged in clusters corresponding to and controlled by the primary selecting-relays, each primary relay arranged when operated by its sunflower-contact to complete a circuit through the secondary relays of the corresponding cluster, a plurality of groups of printing and operating-magnets, a plurality of said operating-magnets being magnets of circuit-making relays, said groups of printing and operating-magnets controlled by said circuit-making relays, the magnets in said first group controlled in circuits by the primary selecting-relays in conjunction with the secondary selecting-relays, a main-line relay, an entrance-relay coöperating with said main-line relay for controlling all said relays and the sunflower, and a final pulse-relay and a restoring-relay, the former completing the circuit through the contacts of the selecting-relays and the printing and operating-magnets, the latter controlling a restoring-circuit of the primary relays and the entrance-relay, both the final-pulse and the restoring-relays controlled by a sunflower-contact which is operated after the selecting-contacts of said sunflower are operated.

6. In a printing-telegraph, the combination of an electrically-controlled sunflower, an entrance-relay, primary polar selecting-relays having separate actuating-circuits controlled by sunflower-contacts and having also together with the entrance-relay a common restoring-circuit, secondary relays connected in geometrical progression, each cluster of such relays operated by a circuit controlled by one of said primary relays, a plurality of groups of printing and operating-magnets, a plurality of the operating-magnets of the first group being magnets of circuit-making relays, said groups of printing and operating-magnets controlled by said circuit-making relays, the magnets in each group controlled by the secondary selecting-relays, and a final pulse-relay and restoring-relay, both in circuit controlled by a contact of the sunflower.

7. In a printing-telegraph, the combination with a main-line relay, an entrance-relay, a sunflower, and a retarding-set, said entrance-relay sunflower and retarding-set controlled by said main-line relay, said retarding-set embracing a plurality of relays operated successively in the transmission of relatively long pulses and controlling a circuit passing through selecting-contacts of the sunflower, a switch and a plurality of shunt circuits controlled thereby, whereby one or more of said relays may be cut out of circuit, thus adapting said retarding-set to adjustment to a variation in the length of said pulses, of a plurality of primary selecting-relays controlled each by one of said selecting-contacts of the sunflower, secondary selecting-relays arranged in clusters corresponding each to one of said primary selecting-relays, the relays of each cluster controlled by a circuit controlled by the corresponding primary relay, a plurality of groups of printing and operating-magnets, a plurality of said operating-magnets of the first group being magnets of circuit-making relays, said groups controlled by said circuit-making relays, the magnets in said first group controlled by the secondary selecting-relays, and means controlled by a further contact of the sunflower, for restoring the primary selecting-relays and the entrance-relay, and means for completing a circuit through contacts of the secondary selecting-relays to whichever of the printing or operating-magnets is selected.

8. In a printing-telegraph system, the com-

bination of a transmitter capable of impressing short and long pulses and combinations of short and long pulses on a line-circuit when operated, said pulses representing characteristic signals of a code, all of said signals comprising the same number of pulses, a main-line relay, a receiving instrument controlled by said main-line relay, said receiving instrument having a plurality of printing and operating-magnets, arranged in groups, each of said printing and operating-magnets corresponding to a particular characteristic signal of the code, an electrically-controlled sunflower having selecting-contacts less in number than the number of pulses in each signal, primary selecting-relays corresponding in number to the number of sunflower selector-contacts and each controlled by one of said sunflower selector-contacts, secondary selecting-relays arranged in clusters corresponding to the several primary selecting-relays, each such cluster in a circuit controlled by one of said primary relays, printing and operating-magnets controlled by said secondary selecting-relays, at least one of said operating-magnets controlling the character of the print, a dash-relay sensitive only to pulses of one character, said dash-relay and sunflower controlled by said main-line relay, and a final pulse-relay and a restoring-relay, the one arranged when operated to complete a circuit through contacts of the secondary selecting-relays and the printing or operating-magnets selected thereby, the other adapted to restore the primary selecting-relays, the sunflower having a contact, operated by the final pulse of each signal, for controlling said final pulse-relay and restoring-relay, an entrance-relay cooperating with said main-line relay for controlling said receiving instrument, said entrance-relay controlled by said main-line relay; and a line-circuit connecting said transmitter and said main-line relay.

9. In a printing-telegraph system, the combination with a transmitter constructed and arranged to produce in a line-circuit when said transmitter is operated a characteristic signal corresponding to each letter of the alphabet, and other characteristic signals corresponding to each character of a code, of a receiving instrument having a separate printing-magnet for each letter of the alphabet, and a separate operating-magnet for each character of the code, selecting-relays comprising relays connected in geometrical progression for selecting and energizing the particular printing or operating-magnet corresponding to whichever letter or character is transmitted, said printing and operating-magnets being in groups, a plurality of subsequent groups of printing and operating-magnets, a plurality of said operating-magnets in the first group being magnets of circuit-making relays, said groups of printing and operating-magnets controlled by said circuit-making relays, and means adapted to be controlled by a single line-circuit connecting the transmitter and receiver, controlling the action of said selecting-relays; and the said line-circuit.

10. In a printing-telegraph system, the combination with a transmitter constructed and arranged to produce in a line-circuit when said transmitter is operated a characteristic signal corresponding to each letter of the alphabet, and other characteristic signals corresponding to each character of a code, of a receiving instrument having a separate printing-magnet for each letter of the alphabet, and having a separate operating-magnet for each character of the code, an electrically-controlled sunflower, selecting-relays in branch circuits controlled by said sunflower and comprising relays connected in geometrical progression, said relays arranged to select the particular magnet corresponding to whichever letter or character is transmitted, said printing and operating-magnets arranged in groups, a plurality of said operating-magnets of the first group being magnets of circuit-making relays, said groups controlled by said circuit-making relays, and means adapted to be controlled by a single line-circuit, controlling said sunflower; and the said line-circuit.

11. In a printing-telegraph system, the combination with a transmitter constructed and arranged to produce in a line-circuit when said transmitter is operated, a characteristic signal corresponding to each printing and operating-magnet in a receiving instrument, of a receiving instrument having printing and operating-magnets corresponding to the several characteristic signals, an electrically-controlled sunflower, primary selecting-relays controlled by said sunflower, secondary selecting-relays arranged in clusters corresponding to the several primary relays, each cluster in a circuit controlled by one of said primary relays, contacts of the selecting-relays of the different clusters connected to control the circuits through said printing and operating-magnets, groups of printing and operating-magnets for making different characters of print, a plurality of said operating-magnets being magnets of circuit-making relays, at least one of said circuit-making relays controlling the character of the print, and means for operating said sunflower adapted to be controlled by a single line-circuit connecting the transmitter and receiver; and the said line-circuit.

12. In a printing-telegraph system, the combination with a transmitter constructed and arranged to produce in a line-circuit when said transmitter is operated, a characteristic signal corresponding to each printing and operating-magnet in a receiving in-

strument, or a receiving instrument having printing and operating-magnets corresponding to the several characteristic signals, an electrically-controlled sunflower, primary selecting-relays controlled by said sunflower, secondary selecting-relays arranged in clusters corresponding to the several primary relays, each cluster in a circuit controlled by one of said primary relays, the contacts of the selecting-relays of the different clusters connected in geometrical progression and the contacts of the last cluster connected to their individual printing and operating-magnets, whereby a selecting-circuit may be formed to each said magnet, at least one of said operating-magnets controlling the character of the print, a dash-relay controlling the circuits of the primary selecting-relays passing through the sunflower-contacts, a main-line relay, and an entrance-relay cooperating with said main-line relay for controlling the sunflower and the dash-relay; and a line-circuit connecting the transmitter and said main-line relay of the receiver.

13. A printing telegraph comprising printing and operating-magnets, a plurality of selecting relays and circuits controlling selective circuits to said printing and operating-magnets, selector mechanism and circuits for controlling the circuits of said selecting-relays, a retarding-set including relays operated *seriatim*, the final relay of said set arranged, when operated, to complete an energizing circuit of at least one of said selecting-relays and means for sending an energizing impulse through the selected printing or operating circuit.

14. A printing telegraph comprising printing and operating-magnets, selecting means and circuits controlling selective circuits to said printing and operating-magnets, relays controlling said circuits, selector mechanism and circuits including a retarding-set comprising relays actuated *seriatim*, the last relay of said set when actuated closing an energizing circuit through one of said relays.

15. A printing telegraph comprising printing and operating-magnets, selecting means including relays and circuits controlling selective circuits to said printing and operating-magnets, selector mechanism and circuits including a retarding-set comprising relays actuated *seriatim*, the last relay of said set when actuated closing an energizing circuit through at least one of said relays.

16. A printing-telegraph comprising printing and operating-magnets, a plurality of selecting-relays and circuits controlling selective circuits to said printing and operating-magnets, an electrically-controlled sunflower and circuits operated thereby for controlling the circuits of said selecting-relays, and a retarding-set including relays actuated *seriatim*, the final relay of said set operating to close an energizing circuit through at least one of said selecting-relays.

17. A printing telegraph comprising printing and operating-magnets, selecting means including relays and circuits controlling selective circuits to said printing and operating-magnets, selector mechanism and circuits including a retarding-set comprising relays actuated *seriatim*, the last relay of said set when actuated closing an energizing circuit through at least one of said relays and means for varying the number of relays in said retarding-set.

18. A printing-telegraph comprising groups of printing and operating-magnets, a plurality of selecting-relays and selecting-circuits controlling selective circuits to said printing and operating-magnets, selector mechanism and circuits for controlling the circuits of said selecting-relays, and printing mechanism for each group of printing and operating-magnets for making prints of different kinds, at least one of said operating-magnets controlling the selection of one of said groups of magnets and thereby the kind of print.

19. A printing-telegraph comprising printing and operating-magnets arranged in groups, printing and operating-mechanism controlled by each group, a plurality of selecting-relays and circuits controlling selective circuits to the magnets of said groups, at least one of the operating-magnets of one of said groups controlling the selection of the group to be operated, and selector mechanism and circuits for controlling the circuits of said selecting-relays and for completing the selection of a printing or operating-circuit.

20. A printing-telegraph comprising printing and operating-magnets arranged in groups, printing and operating-mechanism controlled by each group, a plurality of selecting-relays and circuits controlling selective circuits to the magnets of said groups, at least one of said operating-magnets of one of said groups controlling the selection of the group to be operated and another of said magnets in the same group controlling the restoration after the selected group has been operated, and selector-mechanism and circuits for controlling the circuits of said selecting-relays and for completing the selection of a printing or operating-circuit.

21. A printing-telegraph receiving instrument comprising printing and operating-magnets, a plurality of selecting-relays and circuits controlling selective circuits to said printing and operating-magnets, selector-mechanism and circuits for controlling the circuits of said selecting-relays and for completing the selection of a printing or operating-circuit, a main-line relay, and an en-

trance-relay coöperating with said main-line relay to control said receiving instrument.

22. A printing-telegraph receiving instrument comprising printing and operating-magnets, a plurality of selecting-relays and circuits controlling selective circuits to said printing and operating-magnets, selector-mechanism and circuits for controlling the circuits of said selecting-relays and for completing the selection of a printing or operating-circuit, a main-line relay, branch circuits leading from the contacts of said main-line relay to at least a portion of said selector-mechanism, and an entrance-relay controlled from one of said branch circuits and itself controlling the other of said branch circuits.

23. A printing-telegraph receiving instrument comprising printing and operating-magnets, a plurality of selecting-relays and circuits controlling selective circuits to said printing and operating-magnets, selector-mechanism and circuits for controlling the circuits of said selecting-relays and for completing the selection of a printing or operating-circuit, a main-line relay, two branch circuits controlled thereby and leading to at least a portion of said selector mechanism, one of said branch circuits being connected to normally closed contacts of said main-line relay, and an entrance-relay normally maintaining open the branch circuit which is connected to the normally closed contacts of said main-line relay and itself controlled from the other of said branch circuits.

24. A printing-telegraph comprising printing and operating-magnets, a plurality of selecting-relays and circuits controlling selective circuits to said printing and operating-magnets, selector mechanism and circuits for controlling the circuits of said selecting-relays comprising a retarding-set including relays actuated *seriatim*, the last relay of said set when operated closing an energizing circuit through a selecting-relay, a main-line relay, two branch circuits controlled thereby and controlling the selector mechanism, one of said branch circuits being connected to normally closed contacts of said main-line relay, and an entrance-relay normally maintaining open the branch circuit which is connected to the normally closed contacts of said main-line relay and itself controlled from the other of said branch circuits.

25. A printing-telegraph receiving instrument comprising printing and operating-magnets, a plurality of selecting-relays and circuits controlling selective circuits to said printing and operating-magnets, selector mechanism and circuits for controlling the circuits of said selecting-relays and for completing the selection of a printing or operating-circuit, a main-line relay, an entrance-relay, coöperating with said main-line relay to control said receiving instrument, a restoring-circuit for said entrance-relay, and means controlled by said selector mechanism for completing and energizing said restoring-circuit.

26. A printing-telegraph receiving instrument comprising a plurality of primary selecting-relays, printing and operating-magnets, selecting-mechanism and circuits controlled by said primary selecting-relays and controlling selective circuits to said printing and operating-magnets, selector mechanism and circuits for controlling the circuits of said primary selecting-relays and for completing the selection of a printing or operating-circuit, a main-line relay, an entrance-relay coöperating with said main-line relay to control said receiving instrument, a restoring-circuit including said primary selecting-relays and said entrance-relay, and means controlled by said selector mechanism after the operation of a printing or operating-magnet for completing and energizing said restoring-circuit.

27. A printing telegraph comprising printing and operating-magnets, secondary selecting means and circuits controlling selective circuits to said printing and operating-magnets, primary selecting-relays controlling the circuits of said secondary selecting means, selector mechanism and circuits including a retarding-set comprising relays actuated *seriatum*, the last relay of said set when actuated in response to a long pulse closing an energizing circuit through one of said primary selecting relays, and means for energizing the selected printing or operating circuit.

28. A printing telegraph comprising operating-magnets and groups of printing magnets, a plurality of selecting-relays and selecting-circuits controlling selective circuits to said printing and operating-magnets, selector mechanism and circuits for controlling the circuits of said selecting-relays, and printing mechanism for each group of printing magnets, for making prints of different kinds, at least one of said operating-magnets controlling the selection of one of said groups of magnets and thereby the kind of print.

29. A printing telegraph comprising operating-magnets and groups of printing magnets, a plurality of selecting relays and selecting-circuits controlling selective-circuits to said printing and operating-magnets, selector mechanism and circuits for controlling the circuits of said selecting-relays, and printing mechanism for each group of printing magnets for making prints of different kinds, at least one of said operating-magnets being the magnet of a circuit-making relay and controlling the circuit shift from one group of printing magnets to another, and

means for shifting the circuit back to the first group.

30. A printing telegraph comprising operating-magnets and groups of printing magnets, a multiple circuit connection for each of said groups, a plurality of selecting-relays and selecting-circuits controlling selective circuits to said printing and operating-magnets, one of said groups being normally associated with the selective circuit, selector mechanism and circuits for controlling the circuits of said selecting-relays, printing mechanism for each group of printing magnets for making prints of different kinds, at least one of said operating magnets controlling contacts for shifting from the multiple circuit connection of the normally connected group to the multiple circuit connection of another group, and means for restoring the first multiple circuit connection.

In testimony whereof I affix my signature in the presence of two witnesses.

CHARLES K. JONES.

Witnesses:
MYRTLE M. JACKSON,
E. C. CAHILL.