No. 758,732. PATENTED MAY 3, 1904.

J. C. BARCLAY.

PRINTING TELEGRAPH.

APPLICATION FILED JULY 24, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

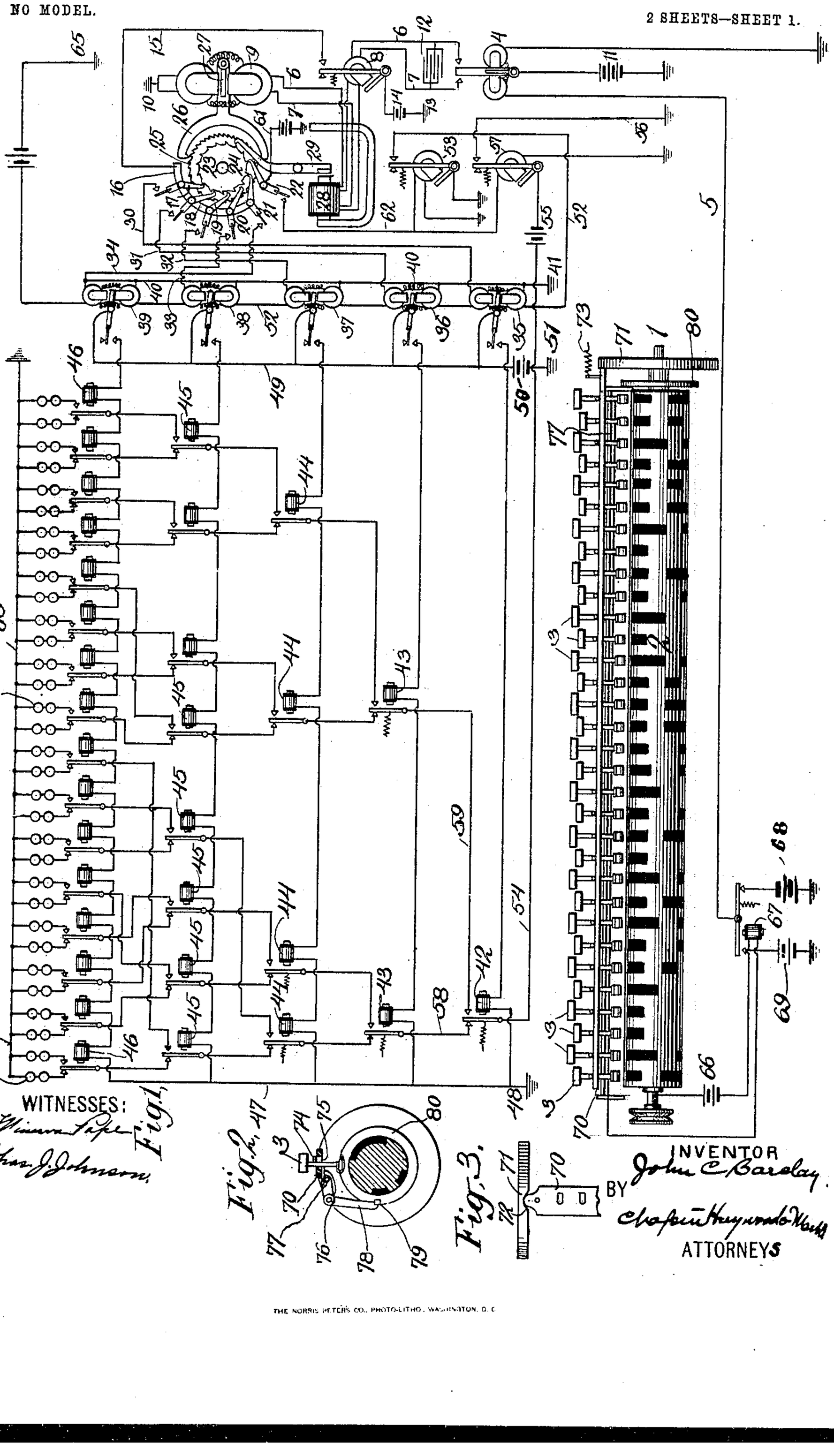

Fig. 1.

Fig. 2.

Fig. 3.

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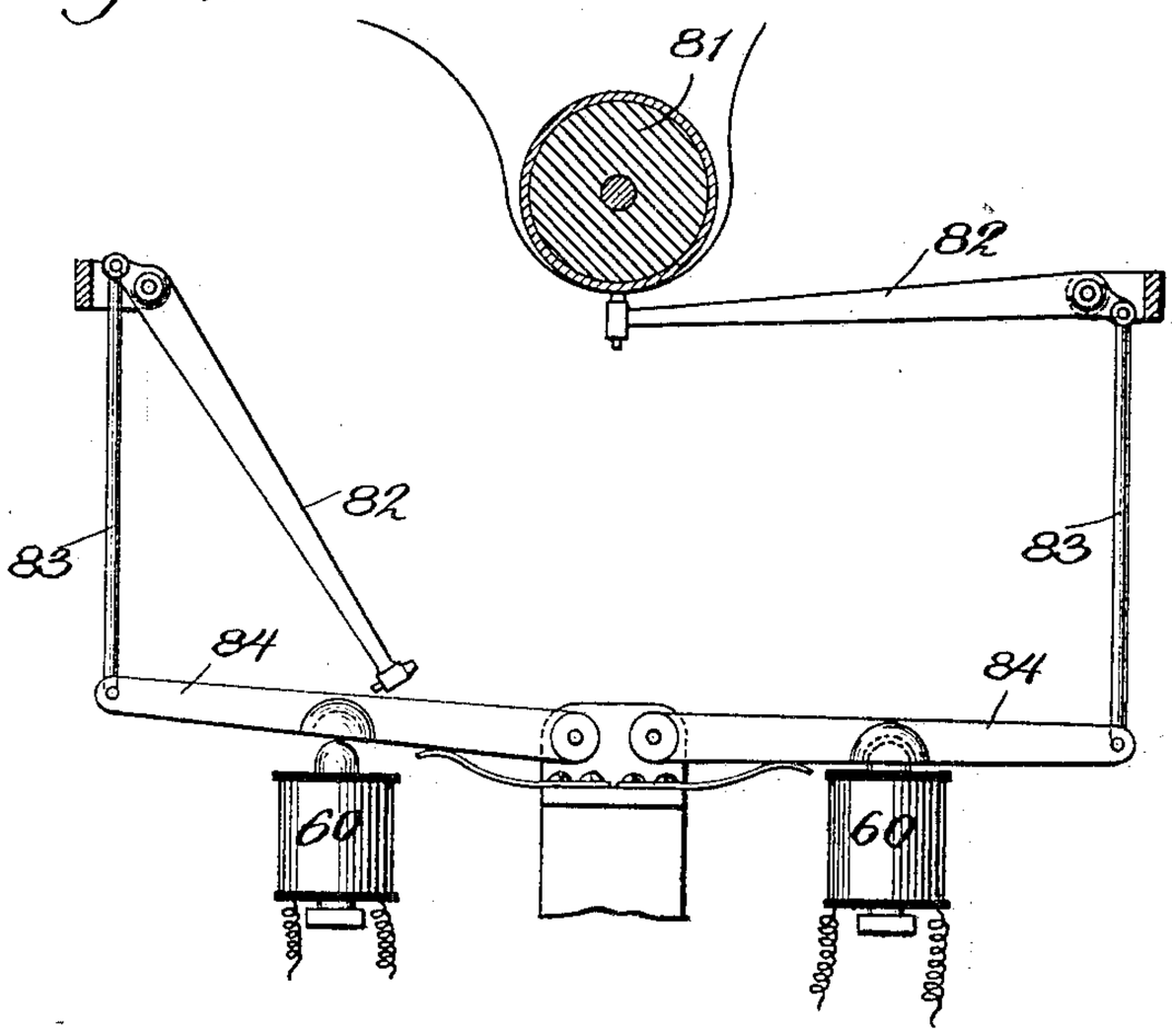
2 SHEETS—SHEET 2.

Fig. 4.



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No. 758,732. Patented May 3, 1904.

UNITED STATES PATENT OFFICE.

JOHN C. BARCLAY, OF NEW YORK, N. Y.

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 758,732, dated May 3, 1904.

Application filed July 24, 1903. Serial No. 166,787. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. BARCLAY, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Printing-Telegraphs; and I do hereby 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.

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

My invention consists, further, in the combination, with the receiver or printer, of a transmitter comprising a plurality of finger-keys or equivalent operating devices corresponding, respectively, to the several letters or characters to be transmitted and contact mechanism directly actuated thereby arranged to produce in the transmitting-circuit the combinations of current pulses making up the several characters transmitted according to the code employed. By means of such transmitter I avoid the complications involved in the use of a Wheatstone or similar transmitter with a perforated tape for operating the same and special mechanism for perforating the messages on said tape and enable the operator to transmit the message directly by operating the keys of the transmitter; 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 from a suitable keyboard-transmitter to the line without the intervention between the keyboard and the line of perforating mechanism, perforated tape, and a Wheatstone or similar transmitter, 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 a keyboard transmitting instrument and the various relays, associated devices, type-bar magnets, and circuits of the corresponding receiving instrument or printer. Fig. 2 is a detail cross-section of the transmitter, illustrating the construction of the contact-roller, the universal bar, and the roller-detent. Fig. 3 is a detail top view of a portion of this transmitter. Fig. 4 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.

Referring now to the drawings and at first to Fig. 1, the said figure shows a transmitting instrument 1, comprising, essentially, a contact-roller 2 and a plurality of finger-keys 3, which transmitting instrument will be de-

scribed 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 transmitting instrument 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 operated by the finger-keys, as hereinafter described. At the receiving end the line-wire 5 passes through the 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, termed the "separator-relay," and through a synchronizer-magnet 28 and opposing coils of a magnet 9, operating escapement mechanism of the sunflower hereinafter described, to ground at 10. A battery 11 or other suitable source of electric energy 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. A condenser 12 is connected across the contact-points of the relay 4 to reduce sparking.

The main-line relay 4 is very rapid in action and operates for each pulse produced in the main line, whether short or long. The separator-relay is more sluggish in action and completes the circuit which it controls only when a long pulse is sent over the line. Being a neutral relay, however, it completes its circuit each time there is a long pulse, whether it be positive or negative. The circuit controlled by separator-relay 8 passes from ground at 13, through battery 14, the armature of separator-rely 8, and conductor 15 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 18, 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 of separator-relay 8 to the coils of magnet 9.

It was stated above that the metal frame 16, carrying contact-points 17 to 21, is connected by conductor 15 passing through contacts of separator-relay 8 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 separator-relay 8 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 separator-relay 8 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 series, forming an arithmetical progression. The relays of each series 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 select-

ing-relay completes the circuit through the secondary selecting-relays which it controls, thereby energizing all of said relays of its series.

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, breaking 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 series 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 series 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 series 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 series 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, space 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 battery 61, and when said contact is actuated by ratchet-wheel 23 a circuit is completed from battery 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 ground.

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 through conductor 52, the restoring-coils of primary relays 35 to 39, inclusive, and battery 64 to ground at 65.

Referring now to the transmitting instrument, the same, as shown in the drawings, consists of a rotary cylinder 2, of conducting material, provided in rings opposite the ends of the various keys 3 with insulating-segments, so that when each key is depressed into contact with the cylinder the circuit formed between the key and the cylinder will be successively made and broken, the pulses thereby produced being short or long, according to the length of the insulating-segments and of the conducting-spaces on the cylinder between these segments. In each such ring opposite a key there are three conductive segments and three insulating-segments, so that there will be six pulses in all, there being thirty-two different signals which may be produced by varying the number and order of the long pulses. I have shown the keys connected to one side and the cylinder 2 connected to the other side of a circuit including a battery 66 and an ordinary pole-changer 67, which pole-changer in its operation places alternately in the line-circuit batteries 68 and 69 of opposite polarity, thereby producing in the line conductor 5 current impulses of opposite polarity. To insure that each key shall remain in contact with the cylinder for a sufficient interval of time, I have provided a multiple locking-bar 70, adapted to engage with a cam 71, which rotates with the cylinder and has a recess 72, which when opposite the end of the multiple bar permits said bar to be drawn to the right by spring 73. The key-stems have pins 74 adapted to play through slots 75 when said slots are in registry with the pins. This is the case only when the multiple bar is at the extreme right or normal position, the slots 75 being just wide enough to permit the pins to pass. The key-stems have also pins 76 normally resting upon a second multiple bar 77, carried by a locking bell-crank 78. This bell-crank normally engages a tooth 79 of a locking-disk 80, carried by the contact-roller 2. The construction of these parts is such that when one of the keys is depressed the bell-crank 78 is moved out of the path of tooth 79, permitting contact-roller 2 to begin to rotate, and thereupon the multiple bar 70 is caused by the rotation of cam

71 to move to the left, thereby locking the key which has been depressed in its depressed position in contact with the contact-roller 2, until the rotation of the roller being nearly completed cam-disk 71 permits multiple bar 70 to move to the right, permitting the finger-key to rise and at the same time moving bell-crank 78 in position to arrest tooth 79 as soon as the rotation of the roller is completed. By this mechanism it is impossible to operate more than one key at a time and each key is kept in contact with the contact-roller until the corresponding signal has been transmitted. I do not limit myself, however, to any particular construction of keyboard-transmitter or to any particular means for preventing simultaneous operation of two keys and for insuring the complete transmission of each signal.

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, as follows: ———— — — — ———— (which is the signal indicated on the contact-roller at the point where the section is taken in Fig. 2,) as soon as the finger-key corresponding to this signal is depressed so that it makes contact with the contact-roller said contact-roller begins to rotate, and the magnet of the pole-changer 67 being energized battery 69 is placed to the line, and one of the circuits 6 and 7—say, for example, circuit 6—is completed through separator-relay 8, synchronizer-magnet 28, and sunflower-magnet 9 to ground at 10. The first pulse being a long pulse or dash, the circuit of battery 14 through the contact of separator-relay 8 is completed, and as escapement-wheel 25 rotates through half the space of a tooth selector-contact 17 of the sunflower completes the circuit through primary selecting-relay 35, thus completing the circuit of secondary selecting-relay 42. On the sending of the next pulse transmitter-battery 69 is disconnected from the line and battery 68 connected to the line, the line-relay 4 completes circuit 7, and the sunflower escapement-wheel 26 rotates through the space of another half-tooth; but since this pulse is a dot the separator-relay 8 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 separator-relay 8 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 are returned to their normal condition.

In Fig. 4 I have shown mechanism for operating type-bars by electromagnets, the parts there shown being an ordinary type-writer 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.

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.

Since it is possible to operate a keyboard-transmitter much more rapidly than messages can be transmitted by hand-keys, I am able by the invention thus described to greatly increase the speed of transmission.

The principal reason for transmitting messages by current pulses of alternately-opposite direction is that polar instruments work better on a long line than do neutral instruments. When preferred, the main-line relay of the receiver may be a neutral relay, and in such case the transmitter need not be so constructed as to reverse current polarity.

It will be understood that the main-line relay of the receiver may be wound with coils for main and artificial lines, thus permitting this printing system to be operated duplex or quadruplex, the same as if transmission were by hand-keys.

What I claim is—

1. In a printing-telegraph, the combination with an electrically-controlled sunflower, a plurality of selecting-circuits controlled thereby, and a plurality of corresponding primary selecting-relays, one for each such circuit, of a plurality of secondary selecting-circuits, controlled by said primary selecting-relays, secondary selecting-relays in said secondary selecting-circuits, connected in tandem, each such selecting-relay of each series but the last controlling the circuits through the contacts of a plurality of relays of the next series, printing-magnets, in tandem with the last

series of secondary selecting-relays, a restoring-relay, a restoring-circuit operated thereby passing through said primary selecting-relays, and means operated by the sunflower after the operation of said primary and secondary relays, for completing a circuit through the secondary selecting-relays to the selected printing-magnet, and for operating the restoring-relay.

2. In a printing-telegraph, the combination with 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 also restoring-coils, of a plurality of secondary selecting-circuits, controlled by said primary selecting-relays, secondary selecting-relays in such secondary selecting-circuits, constituting an arithmetical progression, and having their contacts connected in tandem, printing-magnets controlled by said secondary selecting-relays, a restoring-relay and a circuit therefor including the restoring-coils of the primary selecting-relays, and means operated by the sunflower, after the operation of the primary and secondary relays, for completing a circuit through the secondary selecting-relays to the selected printing-magnet, and for operating the restoring-relay.

3. In a printing-telegraph, the combination with an electrically-controlled sunflower having a plurality of selecting-contacts arranged 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 series corresponding to and controlled by the primary selecting-relays, said secondary selecting-relays of each series succeeding the first connected in groups to relays of the preceding series, printing-magnets controlled by the secondary selecting-relays of the last series, and means for completing a circuit through the secondary selecting-relays and the selected printing-magnet, and for restoring the primary selecting-relays, 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 having a plurality of selecting-contacts arranged 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 series corresponding to and controlled by the primary selecting-relays, said secondary selecting-relays of each series succeeding the first connected in groups to relays of the preceding series, printing-magnets controlled by the secondary selecting-relays of the last series, a relay for completing a circuit through the secondary selecting-relays, and a restoring-relay and means operated 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 having a plurality of selecting-contacts arranged to be completed successively, and a corresponding plurality of primary polar selecting-relays each in circuit with one of said selecting-contacts, of a plurality of secondary selecting-relays arranged in series 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 series, printing-magnets in circuits controlled by the primary selecting-relays in tandem, and a final pulse-relay and a restoring-relay, the former controlling the circuit through the selecting-relays and printing-magnets, the latter controlling a restoring-circuit of the primary relays, 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 the electrically-controlled sunflower, the primary polar selecting-relays having separate actuating-circuits controlled by sunflower-contacts and having also a common restoring-circuit, the secondary relays connected in arithmetical progression, each series of such relays operated by a circuit controlled by one of said primary relays, the printing-magnets, controlled by the secondary selecting-relays, and the final pulse-relay and restoring-relay, both in a circuit controlled by a contact of the sunflower.

7. In a printing-telegraph, the combination with a main-line relay, and a sunflower and a separator-relay controlled thereby, the latter sensitive only to long pulses and controlling a circuit passing through selecting-contacts of the sunflower, of a plurality of primary selecting-relays controlled each by one of said selecting-contacts of the sunflower, secondary selecting-relays arranged in series corresponding each to one of said primary selecting-relays, the relays of each series controlled by a circuit controlled by the corresponding primary relay, printing-magnets controlled by the secondary selecting-relays in tandem, and means operated by a further contact of the sunflower, for restoring the primary selecting-relays and completing a circuit through the secondary selecting-relays in tandem to whichever of the printing-magnets is selected.

8. In a printing-telegraph system, the combination with a keyboard-transmitter having keys and contact devices operated thereby and adapted to produce in a line-circuit when said keys are operated a characteristic signal cor-

responding to each letter of the alphabet, of a receiving instrument having a separate printing-magnet for each letter of the alphabet, selecting-relays comprising relays connected in arithmetical progression for selecting and energizing the particular printing-magnet corresponding to whichever letter is transmitted, 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.

9. In a printing-telegraph system, the combination with a keyboard-transmitter having keys and contact devices operated thereby and adapted to produce in a line-circuit when said keys are operated a characteristic signal corresponding to each letter of the alphabet, of a receiving instrument having a separate printing-magnet for each letter of the alphabet, an electrically-controlled sunflower, selecting-relays in branch circuits controlled by said sunflower and comprising relays connected in arithmetical progression, said relays arranged to select the particular magnet corresponding to whichever letter is transmitted, and means adapted to be controlled by a single line-circuit, controlling said sunflower; and the said line-circuit.

10. In a printing-telegraph system, the combination with a keyboard-transmitter having keys and contact devices operated thereby and adapted to produce in a line-circuit, when each key is operated, a characteristic signal corresponding to that key, of a receiving instrument having printing-magnets corresponding to the several transmitter-keys, an electrically-controlled sunflower, primary selecting-relays controlled by said sunflower, secondary selecting-relays arranged in series corresponding to the several primary relays, each series in a circuit controlled by one of said primary relays, the contacts of the selecting-relays of the different series connected in tandem with the several printing-magnets, 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.

11. In a printing-telegraph system, the combination with a keyboard-transmitter having keys and contact devices operated thereby and adapted to produce in a line-circuit, when each key is operated, a characteristic signal corresponding to that key, of a receiving instrument having printing-magnets corresponding to the several transmitter-keys, an electrically-controlled sunflower, primary selecting-relays controlled by said sunflower, secondary selecting-relays arranged in series corresponding to the several primary relays, each series in a circuit controlled by one of said primary relays, the contacts of the selecting-relays of the different series connected in tandem with the several printing-magnets, a separator-relay controlling the circuits of the primary selecting-relays passing through the sunflower-contacts, and a main-line relay controlling the sunflower and the separator-relay; and a line-circuit connecting the transmitter and said main-line relay of the receiver.

12. In a printing-telegraph system, the combination with a keyboard-transmitter having keys and contact devices operated thereby and adapted to produce in a line-circuit, when each key is operated, a characteristic signal corresponding to that key, said signals all comprising the same number of pulses, of a receiving instrument having printing-magnets corresponding to the several transmitter-keys, 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 series corresponding to the several primary selecting-relays, each such series in a circuit controlled by one of said primary relays, the contacts of the selecting-relays of the different series connected in tandem with the several printing-magnets, a separator-relay sensitive only to pulses of one character, a main-line polar relay controlling said separator-relay and sunflower, and a final pulse-relay and a restoring-relay, the one arranged when operated to complete a circuit through the secondary selecting-relays and the printing-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 operating said final pulse-relay and restoring-relay; and a line-circuit connecting said transmitter and the main-line relay of the receiver.

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

JOHN C. BARCLAY.

Witnesses:
B. STEIN,
H. M. MARBLE.