No. 875,643.

PATENTED DEC. 31, 1907.

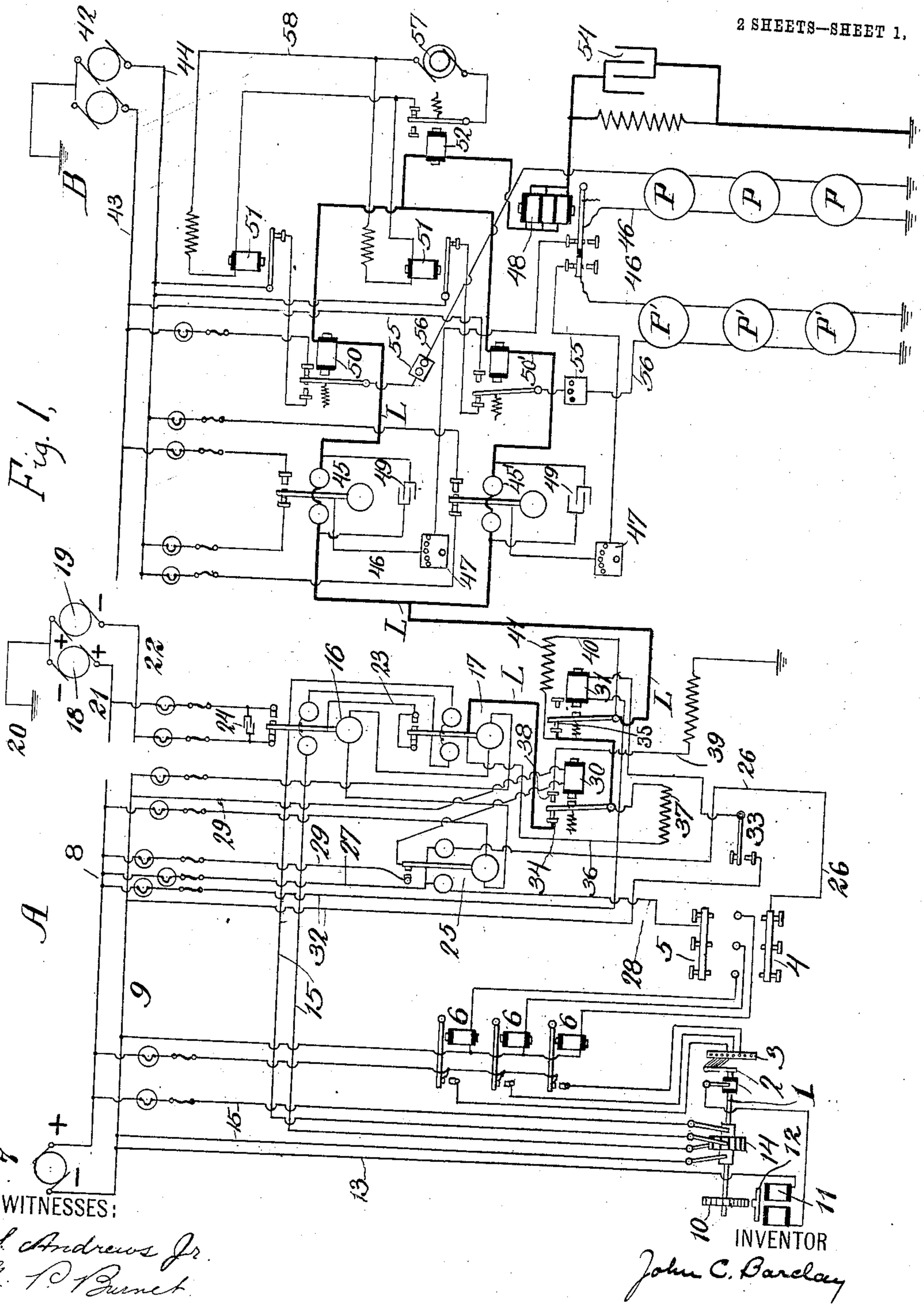
J. C. BARCLAY.

PRINTING TELEGRAPH.

APPLICATION FILED APR. 22, 1905.

2 SHEETS—SHEET 1.

Fig. 1.



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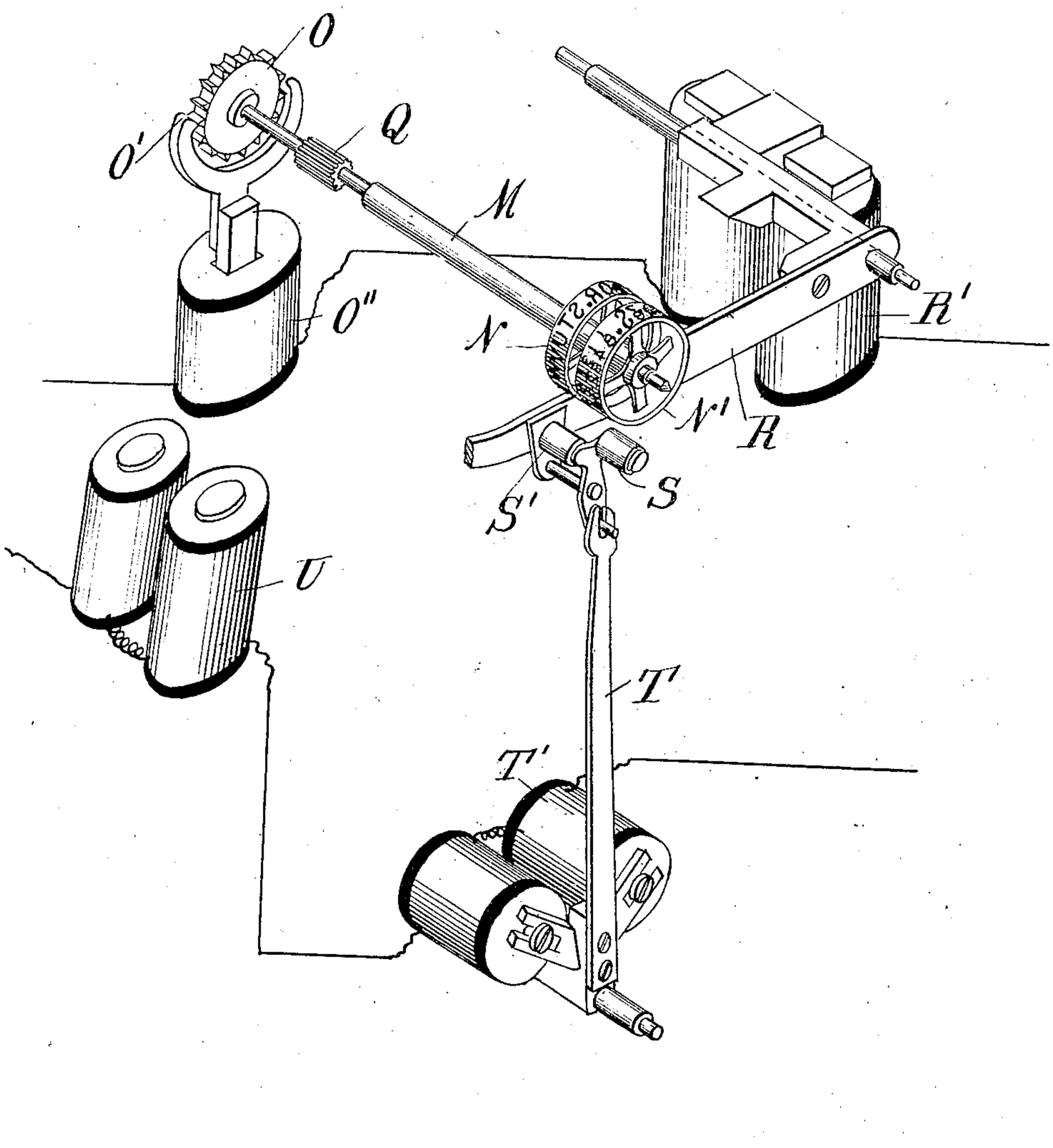
2 SHEETS—SHEET 2.

Fig. 2.



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PRINTING-TELEGRAPH.

No. 875,643. Specification of Letters Patent. Patented Dec. 31, 1907.

Application filed April 22, 1905. Serial No. 256,867.

To all whom it may concern:

Be it known that I, JOHN C. BARCLAY, a citizen of the United States, residing in the city, county, 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 same, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in printing telegraph systems, and particularly to what are known as "stock-ticker" systems, and my invention consists in means whereby a "two-wire" ticker or printer circuit may be operated from a distant transmitter over a single line circuit.

The objects of my invention are, to facilitate the operation of telegraph printers requiring more than one operating circuit, from a distant transmitter; to permit use of a single circuit to transmit all of the signals required for the operation of such multiple-circuit printers; and generally, to produce a simple, reliable and efficient printing telegraph system.

In the accompanying drawings Figure 1 is a diagrammatic view showing the circuits and instruments of one embodiment of my invention; Fig. 2 is a diagrammatic perspective illustrating diagrammatically the essential features of a "two-wire" ticker such as that referred to herein.

I will describe my invention with particular reference to the "two-wire" printing telegraph illustrated and described in United States Letters Patent to Phelps, No. 726,566, dated April 28, 1903. The printing instrument shown in said patent is of the general stock-ticker type, comprising two type-wheels mounted on a common shaft and driven by a spring-motor, their rotation being controlled by an escapement-magnet and escapement mechanism controlled hereby. Said printer also comprises a press magnet in the same circuit as the escapement magnet and arranged to be operated by a prolonged pulse in said circuit; and said printer further comprises a shift magnet and a spring-winding magnet, both located in the same circuit, which is separate and distinct from the circuit of the escapement and press magnets; the spring-winding magnet being operated by periodic current pulses in said second circuit, independent of their direction, and the shift magnet being operated by reversal of direction of current in said second circuit. In the present system, the various signals from the transmitter are transmitted through a single line circuit to translating mechanism, by which the signals for the operation of the escapement and press magnets of the printer or printers are transmitted through the corresponding local circuit, and the signals for the operation of the shift magnets are transmitted through their corresponding local circuit. The employment of a single line circuit for transmitting all of the signals from the transmitter to the translating apparatus renders it economically practicable to operate circuits of printing telegraphs or "tickers" in one locality from a distant city or locality.

In Fig. 1 of the accompanying drawings I illustrate one embodiment of my said invention diagrammatically. Said drawing shows diagrammatically, at A, the transmitting apparatus and circuits, and at B the translating apparatus and circuits, and a series of printers controlled thereby, the two stations being connected by a line wire L which may be of considerable length. The various parts of the transmitting mechanism are illustrated only diagrammatically, as the construction of these parts is well understood; and I do not illustrate the construction of the receiving printers as these are fully illustrated and described in the said Phelps patent No. 726,566.

Referring first to the transmitting apparatus, at A, 1 designates a revoluble shaft, driven in any suitable or customary manner, and 2 designates the rotary contact arm of a sunflower 3, said arm being carried by shaft 1.

4 and 5 designate two banks of keys of a suitable key-board, only three keys of each bank being shown, though it will be understood that in practice there will be a much greater number. The keys of both banks are shown arranged to make contact, when depressed, with a common row of contact points located between the banks of keys. 6, 6, 6 designate neutral relays each electrically connected to and controlled by a corresponding key of bank 4 and also a corresponding key of bank 5; the contact point of each such relay 6 being connected to a corresponding contact segment of sunflower 3. Obviously, the arrangement is such that

when a key of either bank is depressed the corresponding relay 6 is energized and the circuit to the corresponding sunflower segment completed. In the said Phelps patent above mentioned, the transmitter keys are connected in circuit with their corresponding sunflower segments directly; but in practice it is preferred to cause the keys to operate relays controlling the circuits of the sunflower segments, as here shown.

7 designates a generator supplying current for local purposes, and 8 and 9 positive and negative current leads thereof.

10 designates a ratchet wheel on shaft 1, 11 a stop magnet, and 12 the armature of said magnet, adapted, when the magnet is energized, to engage said ratchet wheel and arrest the rotation of shaft 1. Said magnet is in a local circuit 13 passing from current lead 9 through magnet 11, to the rotating arm 2 of the sunflower and thence, when said arm makes contact with a sunflower segment the circuit of which is completed by the corresponding relay 6, through such sunflower segment and relay contact to current lead 8. It follows therefore, that when one of the transmitter keys, of either bank, is depressed, as soon as the sunflower contact arm makes contact with the sunflower segment corresponding to that key, stop magnet 11 is energized, and the rotation of shaft 1 is stopped until said key is released.

Shaft 1 carries a commutator, 14, of well-known construction, the brushes of which commutator are included in a circuit 15 passing from current lead 9 through the commutator and the magnets of two polar relays 16 and 17 back through the commutator to current lead 8. This commutator reverses the direction of the current in circuit 15, as shaft 1 rotates, causing the armatures of relays 16 and 17 to vibrate back and forth.

Numerals 18 and 19 designate two similar generators, for supplying current to the line, having unlike brushes connected to ground at 20, their other brushes being connected through wires 21 and 22 to opposing contact stops of relay 16. The armature of this relay is connected by wire 23 to the two contact stops of relay 17; and the armature of said latter relay is connected, through means hereinafter described, to the line circuit L. Since the armatures of relays 16 and 17 are vibrating back and forth rapidly while transmitter shaft 1 is rotating, generators 18 and 19 are connected to the line alternately, and thus the current in the line is reversed rapidly while shaft 1 is rotating. So far as the alternate connection of the two generators 18 and 19 to the line is concerned, a single polar relay might be used; but it is found that by employing two relays, arranged as shown, and by connecting a condenser 24 across the stops of relay 16, as shown, the sparking at the contact points and brushes may be reduced greatly.

Numeral 25 designates a polar relay employed for effecting the operation of the shifting devices of the receiving printers. A circuit 26 passes from a universal contact bar of the bank of keys 4 through one of the two opposed magnets of this relay to wire 27 and thence to current lead 8. This circuit is completed whenever one of the keys 4 is depressed. A similar circuit 28 passes from a universal contact bar of the bank of keys 5 to the other of the said two opposed magnets of relay 25 and thence to wire 27 and so to current lead 8. This circuit will be completed when any one of the keys of bank 5 is depressed. Relay 25 controls the circuit 29 from current lead 8 through the contact of said relay to the magnet of a relay 30, which may be termed the "shift relay" and thence back to current lead 9. This circuit is broken when circuit 26 is complete but is closed when circuit 28 is complete. Another relay 31, termed the "repeat relay" is in a circuit 32 which passes from current lead 8 to the magnet of relay 31 and thence to a repeat key 33, arranged when operated to close said circuit, and back to current lead 9.

A line circuit L passes from the armature of relay 17 to the back stop 34 of shift relay 30 and thence through the armature of said relay to the back stop 35 of repeat relay 31, and thence through the armature of relay 31 to the translating apparatus of station B. There is a shunt connection 36 from the armature of relay 17 to the armature of shift relay 30, this shunt connection containing a resistance 37 which in practice is of about 400 ohms. Because of this shunt connection, the line circuit is complete so far as relay 30 is concerned whether the armature of said relay be in contact with its rear or with its front stop; though when said armature of relay 30 is in contact with its front stop the resistance 37 is in circuit, and therefore the line current is weakened. The front stop 38 of relay 30 is connected to a leak 39, the resistance of which is in practice about 1550 ohms; and this leak coöperates with the resistance 37 in shunt circuit 36 to reduce the line current when the armature of shift relay is in contact with its front stop. Repeat relay 31 is provided with a shunt connection 40 between its back stop and its armature, said shunt connection containing a very high resistance 41—in practice a resistance of about 12000 ohms. Therefore, when the magnet of the repeat relay is energized the line circuit is not broken at said relay, but the resistance in the circuit is increased so enormously that the effect is very nearly the same as it would be if the circuit were broken. It is preferable to introduce a high resistance by the operation of the repeat relay rather than to break the circuit,

in order to hold stationary the armature of relay 45 of the translating apparatus.

Referring now to the circuits and instruments of the translating apparatus at station B, current for such apparatus is supplied by local generators 42 and current leads 43 and 44. The line wire L is connected to a polar relay 45, the stops of which are connected to the two current leads and the armature of which is connected to a circuit 46 passing through a rheostat 47 to the front stop of a relay 48 termed the "local repeat relay." Said circuit 46 passes from the armature of relay 48 through the printers or "tickers" of the system, said circuit in practice passing through the escapement and press magnets of such printers (not shown) and serving to control the rotation of the type wheels and the operation of the press arms thereof. Said circuit is hereinafter termed the "printing circuit." It will be noted that relay 45 repeats in circuit 46 the current reversals produced in the line circuit by transmitting relays 16 and 17. A condenser 49 is shunted around the magnets of relay 45.

The line circuit L passes from the magnet of relay 45 through the magnet of a neutral relay 50, termed the "local shift relay," and through magnets of relays 52 and 48, hereafter mentioned, to ground; the ground connection including a shunted condenser 54, as shown. Local shift relay 50 is so adjusted that when the armature of relay 30 is against its back stop, and the current in the line circuit L is relatively strong, the armature of said local shift relay 50 is in contact with its front stop, and a circuit 56 is completed from current lead 43 through the shift relay contact and through a regulating rheostat 55 to the printers or "tickers" of the system. In practice, this circuit 56 works the shift and spring-winding mechanisms of the said printers, and is hereinafter termed the "shift circuit." The operation of the shift mechanisms of the several printers is accomplished by reversing the direction of the current in this circuit 56, which reversal occurs when relay 30 is energized, so that resistance 37 is included in the line circuit and the leak 39 is connected to said line circuit. When this occurs, the strength of the line circuit is so reduced that the armature of relay 50 is pulled back, and circuit 56 is connected to the opposite current lead, 44. When relay 30 again operates and cuts resistance 37 out of the line circuit and disconnects the leak 39, the armature of relay 50 is again attracted, and the direction of current in circuit 56 again reversed, thus operating again the shift mechanism of the printers.

For winding up the spring or other motors of the printers, current pulses are transmitted at intervals through the "shift circuit." For this purpose a relay 51, operated automatically by an intermittent current produced by a generator 57 or otherwise, is employed. This relay is adapted to complete connection from current lead 44 through the back contact of local shift relay 50, if such back contact be complete, to shift circuit 56. To avoid complication, I cause this spring-winding relay to operate only when the shift relay armature is in one of its two positions; though it is easy to cause the spring-winding relay to operate with the said armature of relay 50 in either position. However, it is sufficient to operate the spring-winding mechanism at intervals only, and the connections and apparatus are somewhat simplified by employing current of one direction only to operate the spring winding mechanism, and by permitting this current to be transmitted only when the armature of the shift relay is in a corresponding position, so that the shift mechanism of the printers will not be affected by the spring-winding pulses.

The controlling circuit 58 of the spring-winding relay passes through a contact of a line relay 52 which breaks said circuit whenever a prolonged pulse, such as causes the operation of the shift mechanism of the printers, passes through the line circuit; the spring of this relay being so adjusted that during the normal alternation of current pulses in the line circuit, circuit 58 remains closed. This relay 52 insures that the back stop of the local shift relay 50 shall be connected to current lead 44 whenever the shifting mechanism is to be operated.

Local repeating relay 48 is so adjusted that it operates only when the current in the line falls nearly to zero, as is the case when, through the operation of the repeat key 33, the very high resistance 41 is included in the line circuit. When this occurs, the armature of relay 48 falls back and opens the printing circuit. When repeat key 33 is released and the high resistance 41 cut out of the circuit, the armature of relay 48 is again attracted, and the printing circuit is again connected to one of the current leads, thus producing in said circuit a second long pulse and causing the operation of the press mechanism, whereby the character last printed will be printed a second time. In this way, by operating the key 33, a character may be repeated as often as desired.

If the repeat key 33 be operated while the armature of shift relay 50 is against its front stop, said armature falls back, thus operating the shift mechanism of the printers: but since the repeated character is not printed until the release of key 33, and since relay 50 is very much more rapid in operation than relay 48, upon the release of the key 33 the armature of relay 50 moves forward again and brings the shift mechanisms of the printers back to their normal condition before the

press mechanisms of the said printers operate. In this way, a character of either bank of keys may be repeated by means of key 33.

When a number of printers are to be operated from the same line circuit and translating apparatus, I preferably employ a plurality of separate printer circuits, each including merely the number of printers which can be worked to advantage in series. Each such printer circuit then has its corresponding line polar relay and line shift relay, said line polar relays and shift relays connected in multiple branches of the line circuit, as indicated in the drawing, in which 45′ and 50′ designate another line polar relay and shift relay for a second printer circuit. In this way I avoid excessive impedance, self-induction etc. in the line circuit, and excessive sparking at the contact points of the relays.

In the diagram I illustrate diagrammatically two series of printers, P, P, P, and P′, P′, P′, without attempt to illustrate the mechanism of said printers, which is well known.

Fig. 2 shows the essentials of one of the many forms of two-wire tickers which may be used in my system. In said drawings, M designates the main or type wheel shaft, N and N′ designate type wheels thereon, O an escapement wheel, O′ an escapement anchor and O″ a magnet for such anchor. Q designates a pinion on said shaft through which the shaft may be driven from a motor not shown. R designates a press arm operated by magnet R′ and carrying pads S and S′ mounted to be shifted alternately into operative position by the shifting arm T operated by shift magnet T′. U is a magnet for winding a spring motor, not shown, for driving the type wheel shaft. As shown, type wheel magnet T′ and spring winding magnet U are in the same circuit, which is circuit 56 of Fig. 1; and the escapement magnet O″ and press magnet R′ are in another circuit, which is the circuit 46 of Fig. 1.

The operation of this system is as follows: Supposing the commutator and sunflower shaft 1 to be in rotation, and the parts to be in the positions shown, the armatures of relays 16 and 17 at station A and the armature of relay 45 at station B will be in rapid vibration owing to the rapid reversal of the current in circuit 15 by commutator 14. When one of the transmitter keys, for example, one of the keys of bank 4, is depressed, as soon as the contact arm of the sunflower makes contact with the corresponding contact segment the stop magnet 11 will be energized, the rotation of shaft 1 arrested, thus arresting the vibration of the armatures of relays 16 and 17 and the consequent vibration of the armature of relay 45, and thus producing in circuit 46 a prolonged pulse which will energize the press magnets of the several printers in circuit 46, causing said printers to print the character corresponding to the key depressed. If, instead of a key of bank 4, a key of bank 5 be depressed, the same operations will occur, but in addition, the armature of relay 25 will be reversed, closing circuit 29 and thus energizing the magnet of shift relay 30. The shift relay when it operates introduces resistance 37 into the line circuit and connects the leak 39 to such line circuit, thereby decreasing considerably the strength of the line current; and such decrease will so reduce the strength of the magnet of relay 50 that the spring of said relay will draw back the armature thereof, thus reversing the direction of current in circuit 56. As soon as the key operated is released, shaft 1 and commutator 14 begin to rotate, the armatures of relays 16, 17 and 45 begin to vibrate again, and the armature of relay 51 breaks contact with its front stop. After the depression of one of keys 5 and consequent operation of the shifting devices, said devices remain in their shifted condition until one of keys 4 is depressed, whereupon the armature of relay 25 will be deflected to the right, breaking the circuit of shift relay 30 and throwing out of circuit resistance 37 and leak 39, and thus increasing the strength of current in the line so that relay 50 will attract its armature and, relay 51 operating simultaneously, the polarity in circuit 55 will be reversed again, and the shifting mechanism of the several printers operated accordingly.

It is obvious that the system herein described is susceptible of many variations and modifications and I do not limit myself to the particular details of construction, arrangement and operation herein illustrated and described.

In the diagram I have shown the various current leads provided with fuses, resistance and indicating lamps, etc. These parts and their functions are well known and it is not necessary to describe them in detail.

What I claim is:

1. A printing telegraph system comprising in combination, a line circuit, one or more multi-circuit printers comprising printing and shift mechanisms each having independent controlling means, printing and shift circuits for said printers, a transmitter for said printers comprising means for producing a pulsating current in such line circuit and for prolonging the pulses therein at will, and comprising also means for producing another class of signals in said line circuit, and a translating apparatus separate and distant from said transmitter and printers, but connected with said transmitter through said line circuit, and comprising means operated by said pulsatory current and the prolongation of pulses therein, controlling the printing circuit of said printers and comprising also means operated by the other class of signals in said line circuit for controlling the shift circuit of said printers.

2. In a printing telegraph system, the combination of a transmitter, translating apparatus and a connecting line circuit, said translating apparatus comprising means operated by one class of signals in said line circuit for operating printing mechanism in a printer, and further comprising means controlled by another class of signals in the line circuit for operating shift mechanism of a printer, and further comprising means operated by a third class of signals in said line circuit for causing repetition of the character last printed.

3. In a printing telegraph system, the combination of a transmitter, translating apparatus, a connecting line circuit, and printing and shift circuits for a printer controlled by said printing apparatus, said translating apparatus comprising means operated by one class of signals in said line circuit for producing an alternating current in such printing circuit and for prolonging one pulse of such current at will, said translating apparatus further comprising means controlled by another class of signals in the line circuit for controlling said shift circuit, and further comprising means controlled by a third class of signals in the line circuit for transmitting through such printing circuit an additional pulse of the same direction as the preceding pulse.

4. In a transmitter for printing telegraph systems, the combination of means for transmitting an alternating current through a line circuit, a sunflower and contact arm therefor passing over the contacts of said sunflower in synchronism with the alternations in said circuit, a keyboard and means operated by the several keys thereof for arresting said sunflower contact arm in corresponding positions and simultaneously prolonging the corresponding current pulse in said circuit, and shift and repeat relays, arranged when operated to vary the current strength, one to a greater extent than the other, and means for operating said relays.

5. In a transmitter for printing telegraph systems, the combination of means for transmitting an alternating current through a line circuit, a sunflower and a contact arm therefor passing over the contacts of said sunflower in synchronism with the alternations in said circuit, a keyboard and means operated by the several keys thereof for arresting said sunflower contact arm in corresponding positions and simultaneously prolonging the corresponding current pulse in said circuit, and a shift relay arranged when operated to connect a leak to said line circuit.

6. In a transmitter for printing telegraph systems, the combination of means for transmitting an alternating current through a line circuit, a sunflower and a contact arm therefor passing over the contacts of said sunflower in synchronism with the alternations in said circuit, a keyboard and means operated by the several keys thereof for arresting said sunflower contact arm in corresponding positions and simultaneously prolonging the corresponding current pulse in said circuit, a shift relay arranged to decrease or increase the strength of the line current according to the position of its armature, and a second relay controlling said shift relay, and controlled by the keyboard.

7. In a transmitter for printing telegraph systems, the combination of means for transmitting an alternating current through a line circuit, a sunflower and contact arm therefor passing over the contacts of said sunflower in synchronism with the alternations in said circuit, a keyboard and means operated by the several keys thereof for arresting said sunflower contact arm in corresponding positions and simultaneously prolonging the corresponding current pulse in said circuit, a repeat relay and a high resistance conductor arranged to be introduced thereby into the line circuit, and a circuit for said relay and a repeat key controlling the same.

8. In a printing telegraph system, the combination with a line circuit, and a transmitter comprising means for transmitting an alternating current and for prolonging one of the current pulses at will, and further comprising means for reducing at will the strength of the line current, of translating apparatus comprising a line polar relay in such line circuit arranged to repeat the alternations in such circuit into a local printer circuit, and a line neutral shift relay in the said line circuit, operated by increase and decrease of line current strength, and controlling a local printer shift circuit.

9. In a printing telegraph system, the combination with a line circuit, and a transmitter comprising means for transmitting an alternating current and for prolonging one of the current pulses at will, and further comprising two independent means for reducing the strength of the line current, one to a greater extent than the other, of translating apparatus comprising a line polar relay in such line circuit arranged to repeat the alternations in such circuit into a local printer circuit, and comprising further line neutral shift and repeat relays, the repeat relay operated by a relatively great decrease in strength of the line current and arranged by its operation to transmit through the local printer circuit controlled by said line polar relay an additional prolonged current pulse of the same polarity as the preceding pulse, the shift relay operated by a relatively smaller decrease in strength of the line current and controlling a local printer shift circuit.

10. In a printing telegraph system, the combination with a line circuit, and a trans-

mitter comprising means for transmitting an alternating current and for prolonging one of the current pulses at will, and further comprising means for reducing at will the strength of the line current, of translating apparatus comprising a line polar relay in such line circuit arranged to repeat the alternations in such circuit into a local printer circuit, and comprising further a line neutral shift relay operated by increase and decrease of line current strength, and controlling a local printer shift circuit, and comprising further a motor winding relay automatically operated and arranged to transmit periodically through said shift circuit current pulses to operate motor winding mechanism of said printers.

11. In a printing telegraph system, the combination with a line circuit, and a transmitter comprising means for transmitting an alternating current and for prolonging one of the current pulses at will, and further comprising means for reducing at will the strength of the line current, of translating apparatus comprising a line polar relay in such line circuit arranged to repeat the alternations in such circuit into a local printer circuit, and comprising further a line neutral shift relay operated by increase and decrease of line current strength, and controlling a local printer shift circuit, and comprising further a motor winding relay automatically operated and arranged to transmit periodically through said shift circuit current pulses to operate motor winding mechanism of said printers, and means preventing interference between the shift and motor winding relays.

12. In a printing telegraph system, the combination with a line circuit, and a transmitter comprising means for transmitting an alternating current and for prolonging one of the current pulses at will, and further comprising means for reducing at will the strength of the line current, of translating apparatus comprising a line polar relay in such line circuit arranged to repeat the alternations in such circuit into a local printer circuit, and comprising further a line neutral shift relay operated by increase and decrease of line current strength and arranged to reverse current direction in a local printer shift circuit, and comprising further a motor winding relay automatically driven and arranged to render intermittent the current in said local printer shift circuit without change of the direction of the current therein.

13. In a printing telegraph system, the combination of a transmitter, translating apparatus, and a connecting line circuit, said translating apparatus comprising means controlled by signals in the line circuit for controlling printing mechanism of a printer through a local printing circuit, and comprising further means controlled by other signals in the line circuit for reversing the direction of current in a local shift circuit of such local printer, and comprising further a motor winding relay automatically driven and arranged to render intermittent the current in said local printer shift circuit without change of the direction of the current therein.

14. In a printing telegraph system, the combination of a transmitter, translating apparatus, and a connecting line circuit, said translating apparatus comprising means controlled by signals in the line circuit for controlling printing mechanism of a printer through a local printing circuit, and comprising further a relay controlled by other signals in the line circuit having opposed contacts connected to sources of current supply of opposite polarity, said relay arranged thereby to reverse the direction of current in a local shift circuit of said printer, said translating apparatus comprising further a motor winding relay automatically driven and having a contact interposed between one of the contacts of said first relay and the corresponding source of current supply.

15. In a printing telegraph system, the combination with a line circuit, and a transmitter comprising means for transmitting an alternating current and for prolonging one of the current pulses at will, and further comprising means for reducing at will the strength of the line current, of translating apparatus comprising means operated by current reversal in such line circuit for operating printing mechanism of a local printer through a local printer circuit, and comprising further a relay controlled by other signals in the line circuit having opposed contacts connected to sources of current supply of opposite polarity, said relay arranged thereby to reverse the direction of current in a local shift circuit of said printer, said translating apparatus comprising further a motor winding relay automatically operated through a local circuit and having a contact interposed between one of the contacts of said first relay and the corresponding source of current supply, and another relay located in said line circuit, but adjusted to respond only to prolonged pulses therein, said last-named relay comprising a contact through which the operating circuit of said motor winding relay passes, which contact is broken when the last-named relay responds to a prolonged pulse.

16. In a printing telegraph system, the combination of a transmitter arranged to transmit an alternating current through a line circuit comprising means for prolonging one of the current pulses at will, translating apparatus and a connecting line circuit, said

translating apparatus comprising a shift relay controlled by appropriate signals in the line circuit and arranged to control shift mechanism of a printer through a local shift circuit, said translating apparatus further comprising a motor winding relay automatically operated through a local circuit and arranged to produce a pulsatory current in the circuit controlled by said shift relay, and another relay located in said line circuit, but adjusted to respond only to prolonged pulses therein, and comprising means rendering said motor winding relay ineffective upon such shift circuit during the transmission of a long pulse through such line circuit.

17. In a printing telegraph system, the combination of a transmitter, arranged to transmit signals for operating printing and shift mechanism of a printer, translating apparatus and a connecting line circuit, said translating apparatus comprising a plurality of sets of printing circuit and shift circuit relays, a plurality of two-circuit printers comprising printing mechanism adapted to be operated by a printing circuit and shift mechanism adapted to be operated by a shift circuit, and separate printing and shift circuits for each of said printers, controlled by corresponding printing circuit and shift circuit relays of said translating apparatus; said sets of relays connected in multiple to the line circuit.

18. In a printing telegraph system, the combination of a transmitter, arranged to transmit signals for operating printing and shift mechanism of a printer, translating apparatus and a connecting line circuit, said translating apparatus comprising a plurality of sets of printing circuit and shift circuit relays, a plurality of two-circuit printers comprising printing mechanism adapted to be operated by a printing circuit and shift mechanism adapted to be operated by a shift circuit, separate printing and shift circuits for each of said printers, controlled by corresponding printing circuit and shift circuit relays of said translating apparatus; said sets of relays connected in multiple to the line circuit; and a single repeat relay likewise connected to the line circuit and arranged to cause repetition of printing in all of the said printers controlled by said translating apparatus.

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

JOHN C. BARCLAY.

Witnesses:
B. STEIN,
C. A. VAN BRUNT.