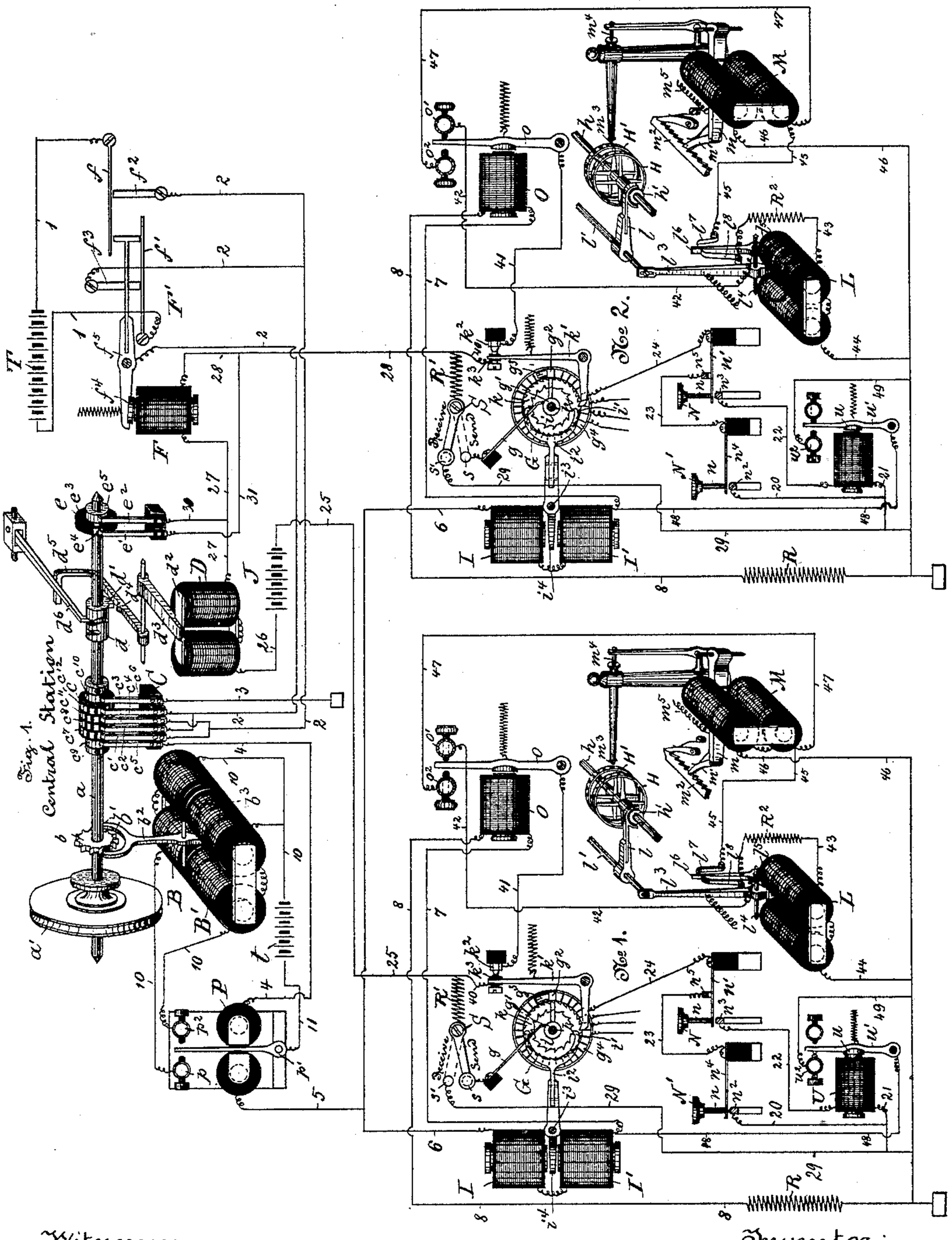
(No Model.) 3 Sheets—Sheet 1.

S. R. LINVILLE.

PRINTING TELEGRAPH.

No. 450,631. Patented Apr. 21, 1891.



Witnesses:
Hermann Bornmann.
Thomas M. Smith

Inventor:
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Att'y.

(No Model.)

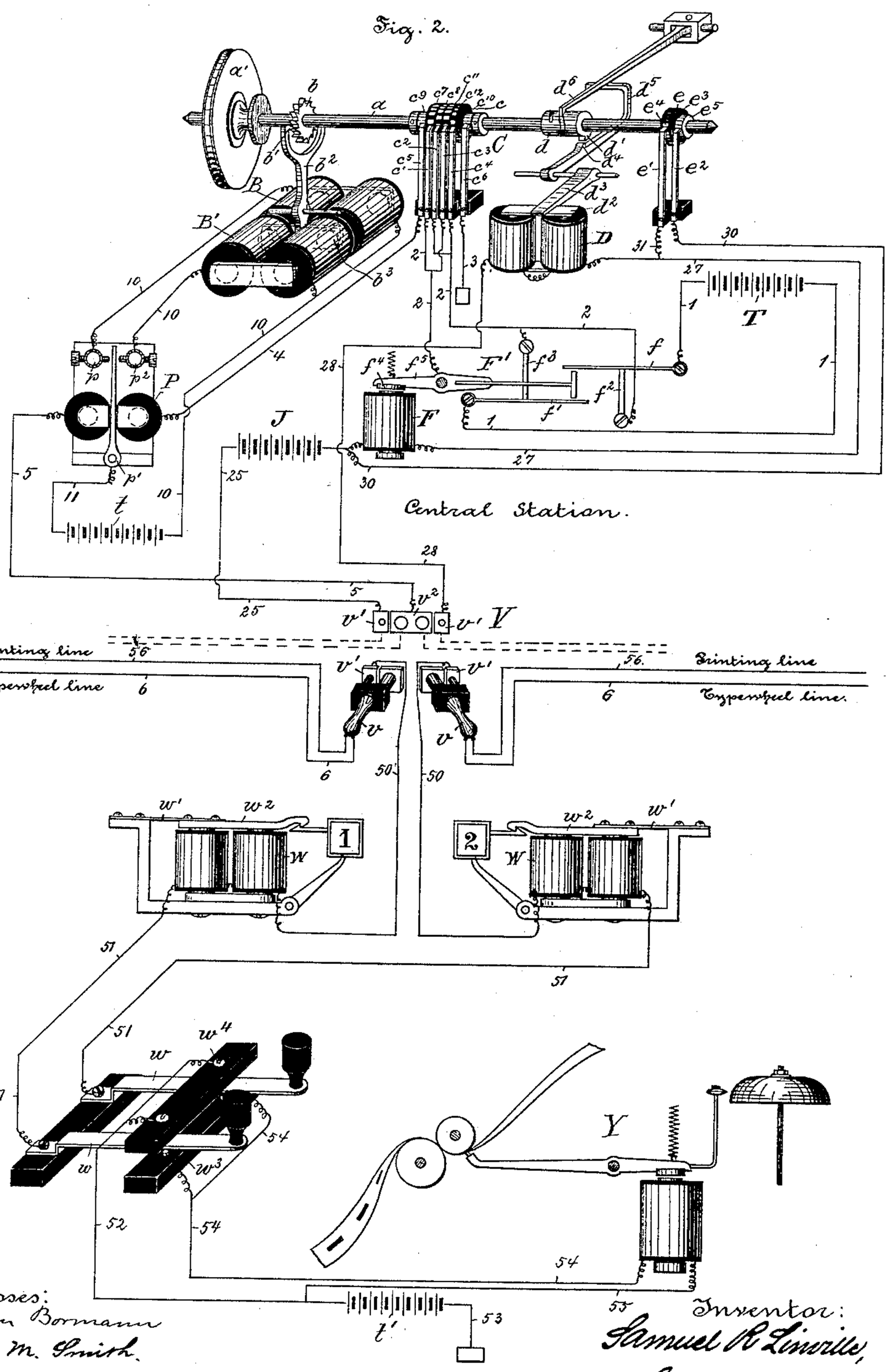
3 Sheets—Sheet 2.

S. R. LINVILLE.

PRINTING TELEGRAPH.

No. 450,631. Patented Apr. 21, 1891.

Fig. 2.



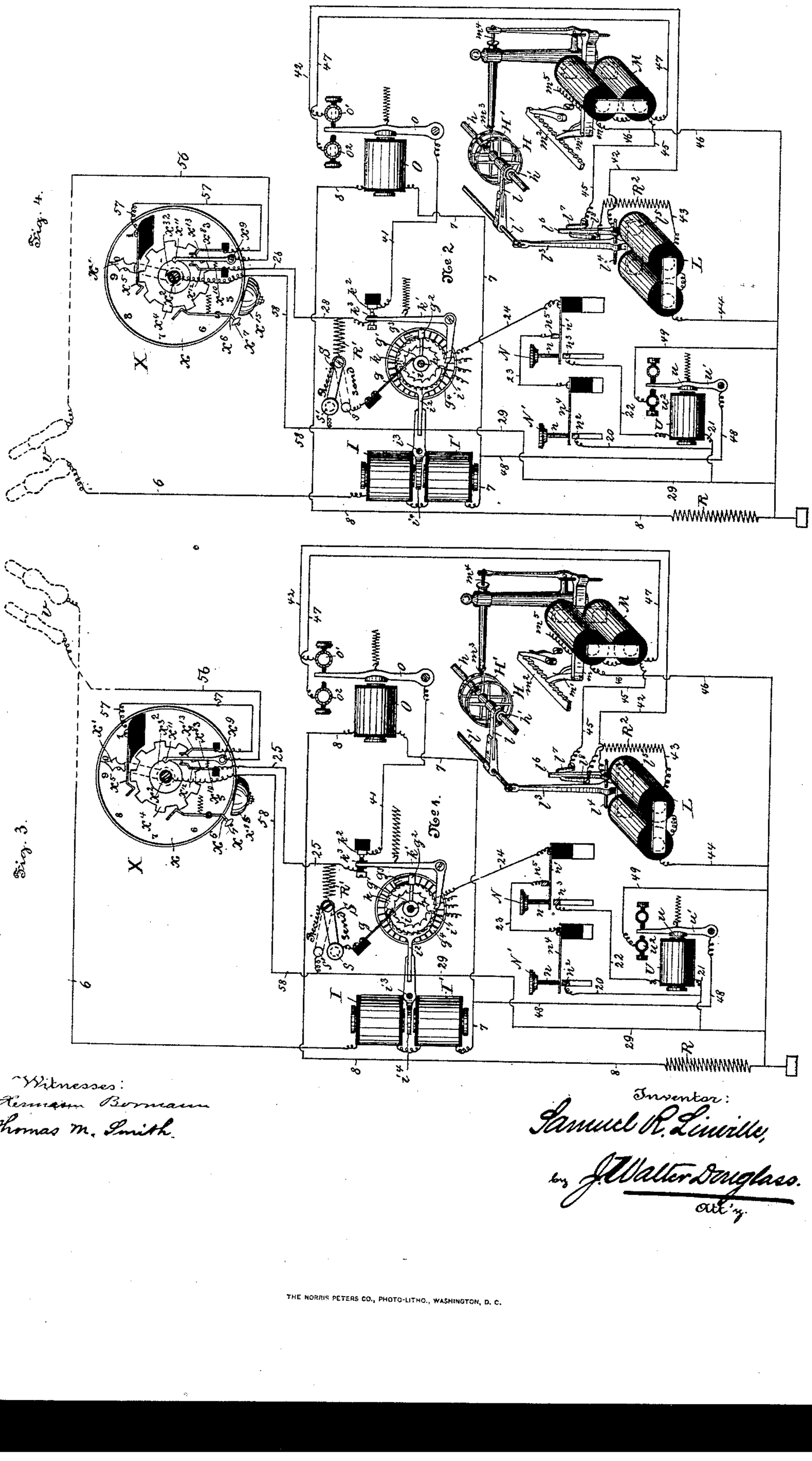
(No Model.)

3 Sheets—Sheet 3.

S. R. LINVILLE.

PRINTING TELEGRAPH.

No. 450,631. Patented Apr. 21, 1891.



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UNITED STATES PATENT OFFICE.

SAMUEL R. LINVILLE, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE KEYSTONE BATTERY AND ELECTRIC SUPPLY COMPANY, OF CAMDEN, NEW JERSEY.

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 450,631, dated April 21, 1891.

Application filed August 12, 1890. Serial No. 361,769. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL R. LINVILLE, a citizen of the United States, residing at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Printing-Telegraphs, of which the following is a specification.

My invention relates in general to a novel system of printing telegraphy affording a convenient and rapid means of intercommunication between subscribers in business offices when the telegraph-instruments located thereat and adapted either for transmitting or receiving messages are connected by suitable conductors with a central station at which are located the source of electrical energy, the apparatus for alternating the direction of the current, the devices controlling the alternator, the switch-boards, and the signal and registering apparatus indicating to an attendant the conventional symbols or numbers of the respective subscribers desiring to be placed in telegraphic communication with one another. The combined transmitting and receiving instruments are similar to those fully illustrated and described in the application for United States Letters Patent, Serial No. 356,382, filed June 23, 1890, by myself and Louis F. Hettmansperger, to which reference is made.

The improvements embraced in the present application relate more particularly to the electrical circuits and means employed to operate such instruments, as shown and described in said application, when connected by a main line for operating the type-wheels and a main line for arresting the alternator and effecting the impressions.

In carrying my present invention into effect preference is given to the employment of two lines and to the dispensing with local batteries at subscriber-instruments; but I do not wish to confine myself to the use of two lines, as it is practical to employ only one main line and to effect the impression by means of a local battery at each subscriber-instrument.

The instruments described in the aforesaid application have each two type-wheels, with characters arranged in the same radial line on the peripheries thereof. Each instrument is connected by double-line conductors to switching devices at a common or central station through a register and to earth through a visible or audible annunciating device in order that signals sent by any subscriber may be announced and registered at the central station. When two lines are employed, the printing-line is switched to earth through the key-board of an instrument used as a transmitter and to earth around the key-board of an instrument employed as a receiver, and vice versa, the instruments being adapted for use either as transmitters or receivers.

My invention consists, first, of the electric circuits for controlling the alternating and unison devices located at a central station when the same are controlled by means of the printing-line.

My invention consists, secondly, in connecting any two subscriber-instruments in parallel circuit through their type-wheel lines in which alternating currents of like polarity simultaneously circulate, thereby obviating the great complication of switches involved at subscriber-instruments and the consequent danger of errors and confusion that would arise if the instruments operated by alternating currents were connected to different electrodes of the type-wheel battery at a central station and through the instruments to earth. The lines leading from the respective instruments have a predetermined connection with the magnetic devices controlling the type-wheels, and unless the currents circulating simultaneously in the two lines connecting the instruments to the alternator have the same direction the unison position of the type-wheels will vary, depending upon the mode of connection of the respective lines to the battery-terminals. This source of confusion and error is obviated by operating the instruments in parallel circuit.

My invention consists, thirdly, in the method employed for controlling the neutral relays operating the printing-circuits at two connected instruments by means of a resistance and devices at a transmitter for cutting out the resistance in one branch of the parallel circuit, thereby increasing at will the current

to the transmitter and at the same instant diminishing the current to the receiver.

My invention consists, fourthly, in the method employed for sending a signal from a subscriber-station and recording the same by means of registering apparatus and an annunciator at a central station. The alternating apparatus is driven by power frictionally applied to a shaft carrying a device for alternating the direction of the current in the type-wheel line from a source of electric energy located at some convenient station centrally situated with relation to the subscribers desiring to communicate with one another. The said shaft carries also a unison device with which the unison-latch engages, and also an escapement-wheel controlled automatically by pallets vibrated by magnetic devices included in the type-wheel line. The type-wheel-line circuit is normally closed and the alternator consequently runs automatically until means are employed to arrest the same. The printing-line battery, located also at the central station, is normally in open circuit through the sunflower and keys of a transmitter and to earth around the keys of a receiver. This circuit traverses the magnet controlling a pole-changer at the central station, and also the unison-magnet thereat. The electrodes of the type-wheel-line battery are connected through the springs, contacts, and lever of the pole-changer to the springs of the alternator, so that when a key of a transmitter in circuit is depressed, closing the printing-line to earth at said transmitter, the pole-changer and unison-magnets included in said circuit will be energized and the alternator arrested in consequence of a change in polarity in the current energizing the escapement-magnets or the polarized relay which may be employed to control the escapement-magnets by means of a local-battery circuit. When the key is released, breaking the printing-line, the normal succession of alternating impulses is restored by the pole-changer and the alternator again revolves automatically until another key is depressed, and if a key is not depressed the unison-latch will arrest the alternator at the termination of two or more revolutions. The lines controlling the magnetic devices for operating the type-wheels of a transmitter and receiver in circuit with the alternating devices are not connected to the opposite electrodes of the battery through the alternator; but one line from the alternator is to earth and the other line divides at the alternator in parallel circuit through the two diverging lines connecting any transmitter and receiver. The pulsations, therefore, to two instruments connected in circuit through the alternator are simultaneously in the same direction through the magnetic devices controlling said instruments. The type-wheel lines pass through the double-contact neutral relays controlling the printing and type wheel shifting magnets, and also through a resistance at each instrument. The neutral relay closes by one contact the printing-circuit in parallel with a resistance in the printing-line when a key in one range of keys is depressed, and by its other contact, when a key in another range of keys is depressed, the printing-line is closed in parallel with said resistance and the shifting-magnet. To effect this a second relay at a transmitter cuts out the resistance, and also the double-contact relay in the type-wheel line at said transmitter, thereby greatly reducing the strength of the current to a receiver electrically connected with said transmitter, so as to cause the neutral double-contact relays at both instruments to simultaneously close the printing-line circuit at their back contacts. The printing-line battery, located at a central station, consequently energizes the printing and type wheel shifting magnets at any two instruments electrically connected with the central-station batteries without the intervention of local batteries at subscriber-instruments. The printing-lines to all instruments are normally to earth through a switch at each instrument, and also at the switch-board of the central station, through a register and the annunciator magnets sustaining visual signals indicating the conventional symbols or numbers of the subscriber-instruments connected with the respective lines. When a subscriber wishes to indicate his symbol or number and the symbol or number of the subscriber with which communication is required, he turns the switch at his instrument to transmit. This breaks the line at the key-contacts of the transmitter, thereby causing his annunciator-drop to fall and indicate his symbol or number at the central station. A call-box at each instrument is automatically connected to the printing-line by a circuit-closing device, preferably operated by the handle of the call-box. The printing-line to the subscriber-instrument sending the call is connected through the magnet of preferably a Morse register and bell. By turning the pointer of his call-box successively to the numbers indicating the conventional designation of the subscriber called and allowing the machinery of the box to return the pointer to zero from each successive number the number of dashes recorded on the tape of the register and also the number of taps on the bell will indicate the number of the subscriber called, whereupon the respective lines from the two subscriber-instruments are connected by an attendant to a terminal of the alternator and the electrodes of the printing-line, and the subscribers can immediately communicate by operating their respective instruments. Any transmitter is so constructed and arranged as to permit of a message being sent and impressed simultaneously on the paper of a transmitter and a receiver without the presence of the person to whom the message is sent being required at the receiving-instrument.

The nature and particular characteristic

features of my invention will be more fully understood from the following description, taken in connection with the accompanying drawings, forming part thereof, and in which—

Figure 1 is a diagrammatic view of the operative parts of a central station, showing a circuit-alternator and electro-magnetic devices employed in connection therewith, a printing-instrument (numbered 1) organized as a transmitter, an instrument (numbered 2) organized as a receiver, the electro-magnetic and mechanical devices, and complete circuits necessary to effect their operation. Fig. 2 is a similar view of the operative parts of a central-station circuit-alternator and the electro-magnetic devices, the line and printing batteries and circuits connected with terminals, also the annunciating devices and local battery, switches, and circuits. Figs. 3 and 4 are respectively similar views of the circuits of two instruments organized, respectively, as transmitters and receivers, and showing, also, a call-box and a modification of the circuits illustrated in Fig. 1 required to connect the printing-lines with the instruments through the said call-box.

Referring now to the drawings for a further and more detailed description of my invention, in which the alternator-shaft a, Fig. 1, carries a pulley a', frictionally mounted thereon, an escape-wheel b, alternating disks c, a unison-spiral d, unison cut-out disk e, and a unison one-toothed detent-disk d', which are rigidly mounted on said shaft. Two insulated springs c' and c^2 bear on alternate contacts and insulations on the disks c^7 and e^8, electrically connected with the metallic disk c^9, and two springs c^3 and c^4 bear on alternate contacts and insulations on the disks c^{11} and c^{12}, the contacts being electrically connected with the metallic disk c^{10}. Springs c^5 and c^6 bear, respectively, on the metallic disks c^9 and c^{10}. All of the said springs c', c^2, c^3, c^4, c^5, and c^6 are insulated from one another. Two insulated springs e' and e^2 bear, respectively, on a disk e^3, of insulating material, provided with a single metallic contact e^4, and on a metallic disk e^5, insulated from the shaft a. The metallic disk e^5 is in electrical connection with the metallic contact e^4, which constitutes a cut-out for the circuit at the unison position. The friction-pulley a' is driven continuously by suitable power. The speed of the alternator C is automatically controlled by escapement-pallets b', and the escape-wheel b is arrested by these pallets, secured to a lever b^2, mounted on trunnions and carrying a neutral armature b^3, vibrated by alternate pulsations of the electric current through the coils of the electro-magnets B and B'. The unison electro-magnet D is provided with an armature d^2, a lever d^3, a detent d^4, and a bent arm d^5, which impinges against the unison-latch d^6.

A pole-changer F', of the usual form, is employed in connection with the alternator to reverse the direction of the current through the alternator C when it is required to arrest the same.

The instruments designated, respectively, by numbers 1 and 2 are precisely similar, the printing-circuit at No. 1 being directed by the switch S to the sunflower-brush and at No. 2 directly to earth around the sunflower. Both instruments are combined transmitters and receivers and are in all respects similar to the instruments shown and described in the said application, Serial No. 356,382, filed June 23, 1890, by myself and the said Louis F. Hettmansperger, excepting that a printing-line is employed in addition to a type-wheel line, and the keys are all open-circuit keys, as is clearly shown in the drawings accompanying this specification. The instruments consist, esentially, of a type-wheel shaft h, positively driven and on which are mounted an escape-wheel i, an interrupter ratchet-wheel k, and an insulated hub g', carrying an arm g^2 and a trailer g^3. Any suitable unison device may be mounted on the shaft h. A sleeve h', to which are secured two type-wheels H and H', moves freely on and turns with the shaft h. An insulated circuit-spring g bears on the hub g', insulated from the shaft h. The trailer g^3 is adapted to sweep successively over the metallic contacts g^4, insulated from one another in the sunflower G. These contacts g^4 are respectively connected by conductors 24 to the key-levers n'. The escape-wheel i is controlled by anchor-pallets i', connected with a lever i^2, mounted on a trunnion i^3 and carrying a polarized armature i^4, adapted to be vibrated by alternating currents in the coils of the escapement-magnets I and I'. When the type-wheel shaft h rotates, the ratchet-wheel k causes the bent arm or lever k' to vibrate, thereby interrupting the printing-line circuit at the insulated contacts k^2 and k^3. The type-wheels H and H' are shifted by means of an arm l engaging in a groove in the sleeve h'. The arm l is mounted on a shifting-rod l', which is solicited by the lever l^3, supported on a trunnion l^4 and carrying the armature l^5 of a shifting-magnet L. An insulated arm l^6, mounted on the trunnion l^4, makes contact with the insulated circuit-springs l^7 and l^8. The electro-magnet L actuates the shifting-lever l^3 to shift the type-wheels H and H'. A printing electro-magnet M controls a lever m, to which at its extremity is pivoted a pawl m', engaging in a rack m^2, attached to the usual devices for presenting a sheet of paper to the impression devices. The printing-hammer m^3, mounted on the rod m^4, is actuated by the lever m through the intervention of devices controlled by the printing-magnet M, as fully shown and described in the application to which previously attention has been directed.

The characters are arranged on the peripheries of the respective type-wheels H and H' in the same radial line, so as to deliver the impressions in one and the same line on a

sheet of paper. The keys *n* are arranged in two ranges or series N and N′, one series having relation to the type-wheel H and the other series having relation to the type-wheel H′. These keys, devices, and circuits connected therewith and brought into operation thereby determine from which type-wheel any character represented by one of said keys shall be impressed.

The electrical circuits will first be traced and the operation of printing a message simultaneously on both instruments will be hereinafter fully described.

The electrodes of the type-wheel line-battery T are connected by conductors 1 to the springs *f* and *f′* of the pole-changer F′, and thence by the conductor 2 from the anvils f^2 and f^3 to the springs *c′* and c^3 and from the lever f^5 to the springs c^2 and c^4 of the alternator C. The alternator-spring c^6 is connected to earth by the conductor 3, and the spring c^5 is connected by the conductor 4 to the coils of the electro-magnet of the polarized relay P; thence the circuit is directed by the conductor 5, which branches by the lines 6 in parallel circuit to the coils of the electro-magnets I and I′ in the instruments numbered 1 and 2, and thence by the conductors 7 to the coils of the double-contact neutral relays O through the same, and thence by the conductors 8 and through the resistances R to earth at the respective instruments.

The circuit of the local battery *t* at the central station is closed alternately through the neutral electro-magnets B and B′ and to one electrode by the lines 10 and the contacts *p* and p^2 of the polarized relay P, the tongue of said relay being connected to the other electrode by the conductor 11.

The circuit of the printing-battery J at the central station is adapted to be connected in series to the respective electro-magnetic devices of the two connected instruments numbered 1 and 2. From earth at instrument No. 1 the circuit passes by the conductors 20 directly to the anvils n^2 of one series of keys N′ and the conductors 21 and 22 and through the coils of a neutral relay U to the anvils n^3 of another series of keys N. The circuit is normally interrupted at these anvils; but when a key in series N′ is depressed said circuit is closed through said key-lever n^4 and the conductor 23 to the contact-bar n^5, and thence to the lever *n′* of a key *n* in the series N and by a conductor 24 to a contact g^4 of the sunflower G. When a corresponding key in series N is depressed, the circuit is closed by the conductor 21, the coils of electro-magnet U, the conductor 22 to the anvil n^3, and thence by the conductor 24 to the same sunflower-contact g^4. When the trailer g^3 rests on said contact, the circuit is through said trailer g^3 of the hub *g′*, brush *g*, switch-point *s*, switch-bar S, resistance R′, and the conductor 25 to one electrode of the printing-battery J, thence from the other electrode by the conductor 26 to the unison electro-magnet D, through the coils of the same, and by the conductor 27 to the pole-changer electro-magnet F, through the coils of the same, and thence by the line-conductor 28 and the resistances R′ to the switch-bar S and from one contact *s′* of said switch to earth by the conductor 29. By reversing the switches at instruments Nos. 1 and 2 the instrument numbered 1 is adapted to receive and the instrument numbered 2 to transmit messages. At the central station the unison cut-out operates to short-circuit the pole-changer magnet F by means of the conductors 27 and 30, the springs e^2 and *e′*, the metallic disk e^5, and the contact e^4 on the insulated disk e^3 when the alternator C is arrested at the unison position.

The branch circuits of the printing-battery J are precisely similar at two connected instruments and will be described by the employment of similar letters and figures to designate like parts at the instruments numbered 1 and 2.

The branch circuits of the printing-battery J have their origin at the resistances R′ and diverge (in parallel with the circuits to earth through said resistances) by the conductors 40 to the insulated contacts k^3 of the interrupter-levers *k′*, and, when the type-wheels H and H′ are at rest, by the insulated anvils k^2 and conductors 41 to the tongues *o* of the double-contact neutral relays O. When said tongues *o* impinge against the back contacts *o′* of said relays, as in Fig. 1, the circuit is closed by the same, through the conductors 42, to the insulated levers l^6 on the trunnions l^4 of the shifting-levers l^3, thence by the insulated spring-conductors l^8, the resistances R^2, and the conductors 43 to the electro-magnets L, and through the coils of the same and the conductors 44 to earth. When the magnets L are energized, the armatures l^5 are attracted, moving the levers l^3 to shift the type-wheels H and H′ and the insulated levers l^6, moving with said levers l^3, and just before the type-wheels H arrive in the required position make contact also with the insulated springs l^7, and the second branch circuits are thereby closed through the conductors 45, the coils of the printing-magnets M, and by the conductors 46 to earth. The circuit by the conductors 47 from the coils of the printing-magnet M to the front contacts of the relays o^2 are open at said contacts.

To clearly understand the operation of the branch circuits above described, it must be observed that the type-wheel line-circuits are always closed with positive or negative currents in parallel through the escapement-magnets I and I′, the relay-magnets O, and resistances R, excepting when one of the resistances and relays are cut out in order to close the branch printing-circuits last traced. To close these branch circuits through the back contacts *o′* of the double-contact relays O, a key *n* in the series N at instrument No. 1 must be depressed, closing the printing-circuit through the anvils n^3, the conductors 22,

coils of the single-contact relay-magnet U, and the conductor 21 to earth. The magnet U is thereby energized, attracting its armature u, causing the lever u' to close a short circuit from the escapement-magnets I, by the conductor 48, to said lever u', thence through the front contact u^2 and the conductor 49 to earth. This short-circuits the double-contact relay O and the resistance R in the type-wheel line-circuit at the transmitting-instrument No. 1. The type-wheel line-circuits being in parallel, the currents divide in proportion to the relative conductivity of the two branch lines, the greater portion of the current going to earth at the instrument numbered 1, and a weak current passing through the relay-magnets O at the instrument numbered 2. The levers o of the relays O will consequently fall against their back contacts o' at both instruments, as shown, and the local shifting and printing circuit will be in this case closed, as described.

To print with the type-wheels H′ in their normal positions, it is necessary to close a branch circuit only through the printing-magnets M. When a key n in the series N′ is depressed, the printing-line circuit is closed directly to earth through the anvil n^2 and the conductor 20. The similar resistances in the type-wheel lines are in parallel circuit at both instruments. The normal strong currents in these circuits energize equally the magnets of the relays O at both instruments, causing their levers o to close the branch printing-circuits through their front contacts o^2, thence by the conductors 47 to the printing-magnets M, through the coils of the same, and by the conductors 46 to earth, and an impression is taken from the type-wheels H′ normally in such position.

The operation of printing on one and the same line on a sheet of paper from two type-wheels in each of two connected instruments will be readily understood. The type-wheel line-circuits being connected to earth through the resistances R, the escapement-magnets I and I′, and double-contact relays O at the instruments numbered 1 and 2, and through the polarized relay P, the alternator C, and pole-changer contacts f^2 and f^3 and springs f and f' to the electrodes of the battery T at a central station, the alternator-shaft a being solicited continuously by a suitable driving force acting on the frictionally-attached pulley a', the current through one pair of contacts p or p^2 on the alternator-disks will be in one direction through the polarized relay-magnet P, causing the tongue p' to vibrate to one of its contacts p, which will close the local circuit of the battery t, through one escapement-magnet B, energizing the same and causing one pallet b' to release one tooth of the escape-wheel b. The alternator C then revolves one step, and another pair of contacts thereon reverse the circuit through the polarized relay P. Its tongue consequently moves to the opposite contact p^2, and the escapement-magnet B′ is energized by the local circuit, causing the other pallet b' to release another tooth, so that the alternator C will run automatically as long as the line-circuit is closed and until the regular order of alternating currents is interrupted. The speed can be controlled by the proper regulation of the friction of the pulley attachment and by changing the lead of the contact-springs bearing on the alternator-disks c.

To print a character on the type-wheel H, to be shifted into position, a key n in the series N is depressed at the transmitting-instrument numbered 1. When the trailer g^3 arrives at the sunflower-contact g^4, electrically connected with this key, the printing-circuit is consequently closed, as hereinbefore described, and the electro-magnet F of the pole-changer F′ attracts its armature f^4 on the lever f^5, thereby reversing in a well-understood manner the direction of current through the polarized relay P. Its tongue p' consequently remains against one of the contacts of said relay, the armature b^3 of the escapement-magnets B and B′ at the alternator C is permanently attracted to one magnet, and the escape-wheel b on the alternator-shaft a is consequently arrested. Currents of one and the same polarity attract the armatures of the escapement-magnets I and I′ at both instruments, and the type-wheels H and H′ are arrested at the same character corresponding to the key depressed at the transmitting-instrument. The type-wheels H and H′ being arrested, the interrupters k' close the circuit between the contacts k^3 and k^2. The relays O close circuit at their back contacts o', and the branch printing-circuits hereinbefore first described now actuate the shifting-magnets L and the printing-magnets M, and an impression is given from the type-wheels H after shifting the same into a position corresponding to the printing-hammer m^3. When the key n is released, the printing-circuits are interrupted between the key-lever n' and its anvil n^3, the shifting and printing magnets are demagnetized, and the pawls m', engaging in the racks m^2 and solicited by the springs m^5, move the paper-presenting devices one notch equal to a space between two characters. The pole-changer magnet F is simultaneously demagnetized, and the normal direction of current is thereby restored. The alternator C again revolves until arrested in consequence of the depression of a key n, say, in the series N′, which causes the arrest of the alternator C and type-wheels H and H′ with equal and strong currents in the parallel circuit-lines through the magnets of the double-contact relays O. The relays now close branch printing-circuits through their front contacts o^2 and through the printing-magnet M only, as hereinbefore described, and a character is impressed from the type-wheel H′ normally in position. Suitable unison devices may be connected with the type-wheel shafts h of the instru-

ments and additional devices operated by the printing-magnets M for releasing said unison devices each time the printing-circuit is closed simultaneously with the release of the unison-latch at the alternator C. When a key is not depressed, the alternator and all instruments connected in line automatically run to unison and are then arrested by the respective unison-latches. At this position a key, when depressed, will close the printing-line through the trailer g^3, and consequently release the unison-latches.

To adapt the instruments to a general system of intercommunication between numerous subscribers, each having a combined transmitting and receiving instrument at the place of business, a system of call, annunciating devices, and means for connecting the various subscriber-instruments through their respective lines to the electrodes of the type-wheel and printing batteries at a central station become necessary adjuncts of the system. Such devices and the circuits for controlling the same are fully illustrated in Figs. 2, 3, and 4.

In Fig. 2 the batteries, circuits, and devices controlling the alternator are identical with those illustrated in Fig. 1, as hereinbefore described, with the exception that the electrodes of the batteries are connected with terminals. The type-wheel lines from subscriber-instruments are adapted to be connected in parallel circuit with the terminal v^2 and the printing-lines in series with the terminals v', and these line conductors are preferably combined, respectively, with a double plug v, the conducting portions of the plugs to which the lines are connected being insulated from one another. The plugs v of the switch-board V at the central station are inserted in double holes in metallic blocks v'. The blocks for each printing-line are in electrical connection by the conductor 50 with an annunciator-magnet W through the coils thereof and by the conductors 51 to the switch-bars w, thence by a contact w^4 and the conductor 52 to one electrode of a local battery t', thence by the conductor 53 to earth. Any number of lines may in this manner be connected to the annunciator-magnets in multiple arc, so that when the lines are to earth at the respective instruments a circuit of a local battery will be closed through the annunciator-magnets W, which will permanently attract their armatures w^2 and maintain out of sight the visual signals, as 1 and 2, on the drops. When any printing-line—from instrument No. 1, for instance—is broken, as illustrated by the devices in Fig. 3, the branch circuit through the annunciator-magnet W, to which the printing-line may be electrically connected, will be interrupted, and the spring w', attached to the armature w^2, will withdraw said armature, and the drop marked 1 will fall, rendering the figure thereon visible to an attendant in charge at the central station. The attendant may then press the lever w into contact with the anvil w^3 closing a branch circuit of the battery J through said lever w, anvil w^3, and the conductors 54 to the coils of a self-actuating Morse register Y, with a bell attachment through said coils, and to the battery t' by the conductor 55. The attendant maintains contact between the lever w and the anvil w^3 until he has determined by the number of taps received on the bell or dashes on the tape of the register the conventional number of the subscriber with whom instrument numbered 1 requires a connection and communication.

The apparatus for sending signals is illustrated in Figs. 3 and 4, and consists of an ordinary call-box X, of any known type, in which the shaft is usually driven by a spring and gearing wound by a ratchet-connection. (Not shown.) The box is provided with a dial x, on which are visible numerals from 1 to 9, inclusive. An index-finger x' is attached to the shaft x^2. This shaft carries a metallic disk x^3 and a toothed metallic circuit-wheel x^4. An insulated spring x^5 bears on the teeth of the wheel x^4, and a vibrating brake x^6, insulated from the case, also bears on said wheel and may be provided with a hammer x^7 to actuate the bell x^{15}. When the shaft x^2 is turned by a suitable handle, the index will point to the required numeral, and the index will return to zero when the handle is released, and the circuit-spring x^5 will make the number of contacts and breaks of circuit indicated by that numeral. The shaft x^2 and the circuit-wheel x^4 are in electrical connection within the case of the call-box X. A lever x^8, which is pivoted at x^9 and solicited by the spring x^{10}, constantly bears against the disk x^3. A projection x^{11} on the lever x^8 falls into a notch in the disk x^3 at the zero position of the index, in which position the lever x^8 contacts with stop x^{12}. When the shaft x^2 and the disks x^3 and x^4 are turned by the handle so that the index x' points to the required numeral on the dial, the projection x^{11} will ride on the periphery of the disk x^3, and the lever x^8 will consequently be maintained by the disk in contact with the stop x^{13} during the time a signal is being given by the mechanism of the call-box X.

The type-wheel line-circuits in Figs. 3 and 4 are the same as those illustrated in Fig. 1, except that the printing-line circuit is shown terminating in a plug v at a central station. The printing-line from the plug v at the central station is by the conductor 56 to the lever x^8 of the call-box X and through the front stop x^{12} to the resistance R', and then as in Fig. 1, hereinbefore described.

In order that any subscriber may be called, the switch S must stand on the point s' to "Receive," and the printing-circuit will be to earth at each instrument and to earth at the central station through corresponding annunciator-magnets W. The subscriber wishing to transmit a message turns the switch S on point s to "Send." The printing-line is then

broken between the keys and anvils. The annunciator-drop at central station falls, and the attendant thereat then presses the lever w, connected with the said line and annunciator-magnet circuit, and the subscriber indicates the conventional number of the subscriber-instrument on which it is desired to print a message. This is effected by the subscriber call-box X by the turning of the index-finger x' successively to the numerals on the dial indicating the number, and each time allowing the mechanism of the box to return to its initial position. When the circuit-wheel x^4 revolves, the circuit is through the lever x^8, the back-stop x^{13}, the conductor 57, the insulated spring x^5, the circuit-wheel x^4, the shaft x^2, and the conductors 58 and 29 to earth, and the pulsations in line by the makes and breaks of the current at the circuit-wheel x^4 cause taps on the bell and indentations or dashes on the tape of the register at the central station. The attendant may then connect the instruments by inserting the respective line-plugs r in the terminals at said station.

The circuits of the batteries shown at the central station and the appliances at the respective instruments are such that local batteries can be dispensed with at subscriber-instruments. I do not wish, however, to confine this invention exclusively to this method of operating the instruments, since it will be apparent to those skilled in the art to which it appertains that the escapements may be controlled by local batteries closed by the contacts of polarized relays included in the type-wheel line and that local batteries may also be employed in a well-understood manner to control the magnetic devices operating the mechanism effecting impressions.

Having thus described the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A printing-telegraph system comprising sources of electric energy, parallel and series circuits, electrical and mechanical devices located at a station for alternating the currents in parallel circuits, arresting devices at said station responding to electrical impulses in a series circuit, transmitting and receiving instruments included in said circuits, keys in said instruments, and electrical and mechanical devices responding to said keys to close said series circuit and to arrest said alternator, substantially as and for the purposes described.

2. A printing-telegraph system comprising sources of electric energy, electrical and mechanical devices located at a station for alternating the direction of the current in parallel circuits, arresting devices at said station responding to pulsatory currents in a series circuit, transmitting and receiving instruments, keys therein, and electrical and mechanical devices responding to said keys to close said series circuit, arrest said alternator, and vary the intensity of the current in said parallel circuits, substantially as and for the purposes described.

3. A printing-telegraph system comprising sources of electric energy at a central station, parallel and series circuits therefor, electrical and mechanical devices located at said station for alternating the current in said parallel circuits, arresting devices at said station responding to electrical impulses in said series circuits, transmitting and receiving instruments, sunflower devices and keys at the transmitting-instruments included in said series circuits, electro-magnetic devices and resistances at said instruments in parallel circuits, and electrical devices responding to said keys to close said series circuits to cut out the resistance in said parallel circuit at a transmitting-instrument and to simultaneously decrease the strength of current in the parallel circuit to a receiving-instrument, substantially as and for the purposes described.

4. A printing-telegraph system comprising sources of electric energy, parallel and series circuits, electrical and mechanical devices located at a station for alternating the currents in the parallel circuits, arresting devices at said station responding to electrical impulses in the series circuits, transmitting and receiving instruments in said series circuits, sunflowers and keys at the transmitting-instruments, electro-magnetic devices at said instruments in the parallel circuit, and devices included in the series circuit to close the same by the depression of one of said keys through said arresting devices to increase the strength of the current in the parallel circuit to a transmitting-instrument and to simultaneously decrease the strength of current in said series circuit to a receiving-instrument, substantially as and for the purposes described.

5. A printing-telegraph system comprising sources of electric energy at a central station, parallel and series circuits therefor, electrical and mechanical devices located at said station for alternating the currents in said parallel circuits, arresting and unison devices at said station and responding to electrical impulses in said series circuits, transmitting and receiving instruments provided with sunflower devices and keys at transmitters included in said series circuits, electro-magnetic devices and resistances at said instruments in the parallel circuits, and electrical devices responding to said keys to close said series circuits, whereby the resistances in said parallel circuits are cut out at the transmitters and the strength of the current in said parallel circuits simultaneously decreased to the receivers, substantially as and for the purposes described.

6. A printing-telegraph system comprising sources of electric energy at a central station, parallel and series circuits, electrical and mechanical devices located at said station for alternating the currents in said parallel circuits, arresting, unison, and annunciator de-

vices at said station and responding to impulses in said series circuits, transmitting and receiving instruments provided with sunflowers and keys at the transmitters included in said series circuits, electro-magnetic devices, resistances at said instruments in the parallel circuits, and electrical devices responding to said keys to close said series circuits, substantially as and for the purposes described.

7. A printing-telegraph system comprising sources of electric energy at a station, parallel and series circuits, electrical and mechanical devices frictionally propelled by suitable power at said station and adapted to automatically alternate the currents in said parallel circuits, electro-magnetic devices at said station and responding to electrical impulses in said series circuit, transmitting and receiving instruments, each provided with two type-wheels and sunflowers, two ranges of keys at the transmitters, resistances at said instruments included in said parallel circuits, a relay with contacts adapted to short-circuit said resistances, and devices for arresting said type-wheels and for including said relay in said series circuit by the depression of a key in one of said ranges, substantially as and for the purposes described.

8. A printing-telegraph system comprising sources of electric energy at a station, parallel and series circuits, electrical and mechanical devices frictionally driven by suitable power at said station and adapted to automatically alternate the currents in said parallel circuits, arresting and unison devices at said station in said series circuit, electro-magnetic devices at said station responding to electrical impulses in said series circuit, transmitting and receiving instruments provided with type-wheels and sunflower devices, two ranges of transmitting-keys, resistances at said instruments in said parallel circuit, a relay provided with contacts adapted to short-circuit said resistances, and means for arresting said type-wheels, substantially as and for the purposes described.

9. A printing-telegraph system comprising sources of electric energy at a station, parallel and series circuits, electrical and mechanical devices frictionally driven by suitable power at said station and adapted to automatically alternate the currents in said parallel circuits, arresting, unison, and annunciating devices at said station in said series circuit, electro-magnetic devices at said station responding to electrical impulses in said series circuit, transmitters and receivers provided with sunflowers and keys, resistances at said instruments, and a relay provided with contacts adapted to short circuit said resistances in said parallel circuit, substantially as and for the purposes described.

10. A printing-telegraph system comprising sources of electric energy at a station, parallel and series circuits, electrical and mechanical devices frictionally propelled by suitable power at said station and adapted to automatically alternate the currents in said parallel circuits, electro-magnetic arresting and unison devices at said station responding to impulses in said series circuits, transmitting and receiving instruments, sunflowers, trailers, and two ranges of keys at a transmitter included in said series circuit, electrical devices, resistances, a double-contact neutral relay at said instruments in said parallel circuits, and a relay with contacts adapted to short-circuit said double-contact relay and resistances at a transmitter included in said series circuit by the depression of a key in one of said ranges, substantially as and for the purposes described.

11. A printing-telegraph system comprising sources of electric energy at a station, parallel and series circuits, electrical and mechanical devices frictionally propelled by suitable power at said station and adapted to automatically alternate the currents in said parallel circuits, electro-magnetic arresting, unison, and annunciating devices at said station responding to impulses in said series circuit, transmitters and receivers, sunflowers, trailers, and two ranges of keys at each transmitter included in said series circuit, electrical devices and resistances, a double-contact relay at said instruments in the parallel circuits, and a relay having contacts adapted for short-circuiting said double-contact relay and resistances at a transmitter, substantially as and for the purposes described.

12. A double-line printing-telegraph system comprising sources of electric energy at an alternating station, parallel circuits and a series circuit therefor, electro-magnetic and mechanical devices at said station for simultaneously alternating the direction of the current in the parallel circuit, electrical devices in the series circuit adapted to arrest the alternator, transmitting and receiving instruments, a sunflower, trailer, and a relay included in said series circuit at a transmitter, electro-magnetic devices included in said parallel circuits both at the transmitter and receiver, type-wheel shafts in both instruments positively driven by suitable power and controlled by said electro-magnetic devices, two type-wheels adjustably mounted on said shafts, electrical and mechanical devices at said instruments adapted to shift said type-wheels and to effect impressions, and keys in said series circuit adapted to short-circuit resistances in the parallel circuits at said transmitter, substantially as and for the purposes described.

13. A printing-telegraph system comprising sources of electric energy, parallel and series circuits, electrical and mechanical devices located at a station for alternating the direction of the current in the lines in parallel circuit, arresting devices at said station responding to pulsatory currents in said series circuits, transmitting and receiving instruments included in said circuits and each having two type-wheels, keys and impression

devices in said instruments, means at said instruments for controlling said arresting devices, type-wheel, shifting, and impression devices, and mechanical and electrical devices at each instrument responding to equal or varying conditions of the current in said parallel circuit by the depression of any key at a transmitter to arrest said type-wheels at a position to present a character thereon, as indicated by the depressed key, to the impression device, substantially as and for the purposes described.

14. A printing-telegraph system comprising type-wheel and printing batteries, parallel and series circuits, alternating devices for alternating the current in said parallel circuit, arresting devices for said series circuit, and both devices located intermediately in said parallel and series circuits, transmitters and receivers, escapement-magnets, sunflowers at the transmitters, their contacts, brushes, and trailers connected in said series circuit, keys normally in open circuit to earth and the escapement-magnets of the transmitters and receivers normally in parallel circuit through said alternating devices and to earth, resistances at said instruments included in said parallel circuits, and a relay adapted to cut out said resistances, substantially as and for the purposes described.

15. A printing-telegraph system comprising transmitters and receivers, each having a shaft driven by suitable power, escapement devices on said shafts, escapement-magnets controlling polarized armatures, two type-wheels mounted on sleeves adjustably connected with said shafts, fixed sunflower contacts and insulations concentric with said shafts or moving synchronously therewith, a contact-brush bearing on hubs insulated from said shafts, trailers mounted on said hubs and adapted to sweep over said contacts, two ranges of keys electrically connected with said sunflower contacts and with one another and normally in open circuit, anvils and earth connections for keys of one range, anvils, a neutral relay, and earth connections to the keys of the other range, sources of electric energy, parallel and series circuits, alternating and arresting devices located intermediately between said transmitters and receivers, and said escapement-magnets actuated by alternating currents in parallel circuit from said alternator, substantially as and for the purposes described.

16. A printing-telegraph system comprising transmitters and receivers, each having a shaft driven by suitable power, escapement devices on said shafts, escapement electro-magnets controlling polarized armatures, two type-wheels mounted on sleeves adjustably connected with said shafts, fixed sunflower contacts and insulations concentrically arranged on said shaft or on shafts moving synchronously therewith, contact-brushes bearing on hubs insulated from said shafts, trailers mounted on said hubs and adapted to sweep over said contacts, two ranges of keys electrically connected with said sunflower contacts and with one another and normally in open circuit, anvils and earth connections for the keys of one range, anvils, a neutral relay, and earth connections to the keys of the other range, sources of electric energy, parallel and series circuits, alternating and arresting devices located intermediately between said transmitters and receivers, and the said escapement-magnets actuated by alternating currents in parallel circuit from said alternator and the series circuit normally to earth through said arresting devices at a receiver and adapted to be connected to earth through said sunflower devices by the keys of said transmitter, substantially as and for the purposes described.

17. A printing-telegraph system comprising instruments adapted to operate interchangeably as transmitters or receivers, escapements and polarized armatures controlling type-wheels, electro-magnets controlling said armatures, type-wheel line parallel circuits to earth through said magnets, a source of electric energy having the electrodes thereof connected through alternating devices located between said instruments to earth thereat and in parallel circuit by said type-wheel lines and through the escapement-magnets of any two transmitters and receivers and resistances and to earth, and means at said transmitting-instruments for cutting out said resistances, substantially as and for the purposes described.

18. A printing-telegraph system comprising transmitting and receiving instruments, type-wheels, and printing-lines, escapements and type-wheels, polarized armatures controlling said type-wheels, escapement-magnets, sunflowers, electrical devices, and keys adapted to be connected therewith, sources of electric energy, parallel and series circuits therefor, current-alternating, pole-changing, and electro-magnetic controlling and arresting devices located at a station between said instruments, the electrodes of one source of energy connected through said pole-changing and alternating device to earth at said station and in parallel circuit through said type-wheel lines and escapement-magnets to earth at any two instruments, the electrodes of the other source of energy adapted to be connected in series through pole-changer magnetic devices, sunflower and electrical devices, and keys to earth at said instruments, substantially as and for the purposes described.

19. A printing-telegraph system comprising transmitters and receivers having shafts positively driven, escape-wheels, and two type-wheels mounted thereon, escapement-magnets and polarized armatures controlling said type-wheels, sunflower devices, two ranges of keys adapted to be electrically connected therewith, type-wheel and printing lines to each instrument, resistances and a double-contact

neutral relay interposed in the type-wheel line at each instrument, a single-contact neutral relay included in the printing-line at a transmitter between one range of keys and earth, and a short circuit for the type-wheel line through the front contact of said relay around said resistance and said double-contact relay at a transmitter, substantially as and for the purposes described.

20. In a double-line printing-telegraph system, the combination, with combined transmitting and receiving instruments, of escapement-magnets traversed by alternating currents in the parallel circuit of a battery, a sunflower device normally in a series circuit of a battery, electrical devices for said sunflower, two ranges of keys, the adjacent keys in each series connected to the same segments of said sunflower device and normally in open circuit in said series circuit, resistances in said parallel circuit, means for short-circuiting said resistances by the depression of a key of one of said ranges, and electrical devices for interrupting said series circuit to the other range of keys by the depression of said key, substantially as and for the purposes described.

21. In a two-line printing-telegraph system, a double-contact neutral relay included in parallel circuits of a line-battery to earth both at the transmitters and receivers, in combination with a printing-line battery-circuit to earth at transmitters and receivers, a type-wheel shaft, two type-wheels adjustably mounted on the sleeve of said shaft, means for shifting said type-wheels, resistances in said circuit, impression devices, a printing-magnet the circuit of which is closed by one contact of said relay in parallel circuit with said resistances, a shifting-magnet, and electrical devices adapted to close said printing-line circuit by the other contact of said relay through said shifting-magnet in parallel with said printing-magnet and resistances, substantially as and for the purposes described.

22. In a printing-telegraph, the combination of a type-wheel line-battery circuit, a double-contact neutral relay included therein, a printing-line battery-circuit, a resistance therein, a printing magnet and devices, a circuit-interrupter, and means for actuating the same, the printing-line circuit being closed through said interrupter and printing-magnet by one contact of said relay in parallel circuit with said resistance, substantially as and for the purposes described.

23. In a printing-telegraph, the combination of a type-wheel-line battery-circuit, resistances therein, a double-contact neutral relay included in said circuit, a printing-line battery-circuit, resistances therein, a printing magnet and devices, a shifting magnet and devices, a circuit-interrupter, means for actuating the same, the printing-line battery-circuit closed by one contact of said relay through said interrupter, and printing and shifting magnets in parallel circuit with the resistances in said printing-circuit, substantially as and for the purposes described.

24. In a printing-telegraph, the combination of a type-wheel-line battery parallel circuit, resistances therein, a double-contact neutral relay included therein, sunflower devices, two ranges of keys, electrical devices, a shifting and a printing magnet and devices, a circuit-interrupter, means for actuating the same, the printing-line circuit adapted to be closed through said sunflower devices, single-contact neutral relay and resistances by one of the ranges of said keys and by said double-contact neutral relay through said interrupter, and printing and shifting magnets in parallel circuit with the resistance in said printing-circuit, substantially as and for the purposes described.

25. In a printing-telegraph, the combination of a suitably-driven type-wheel shaft, mechanical and electrical devices actuated by alternating currents in the parallel circuit of a line-battery, type-wheels adjustably mounted on said shaft, a double-contact neutral relay included in said circuit, a printing battery and circuit, sunflower devices, keys electrically connected with said devices and resistances in said circuit, printing and type-wheel shifting magnets and devices, impression devices, circuit-interrupting devices and means for actuating the same, said keys adapted to close the printing-circuit through said resistances, and said relays adapted to close the printing-circuit in parallel through said printing and shifting magnets in parallel circuit with said resistances, substantially as and for the purposes described.

26. A printing-telegraph system comprising a type-wheel-line battery and circuit, a printing battery and circuit, alternating and arresting devices located at a central station, indicating devices at said station, transmitting and receiving instruments, type-wheel lines in parallel circuit to earth at said instruments, printing-lines to earth at said instruments, sunflowers and electrical devices, keys at the transmitters connected electrically therewith in said printing-battery circuit to earth and normally open at said keys, a call-box and electrical devices adapted to be included in said circuit, a switch in said circuit, annunciator-magnets and visual signals at said station, a local battery and circuit through the annunciator-magnets at said station, one electrode to earth at said station, and the other electrode to earth through said printing-line and adapted to interrupt the printing-line through said annunciator-magnet and cause said signals to drop, substantially as and for the purposes described.

27. A printing-telegraph system comprising a type-wheel-line battery-circuit, a printing-line battery-circuit, alternating and arresting devices located at a central station in said circuits, indicating and registering devices at

said station in the circuit of a local battery, with one electrode to earth, transmitting and receiving instruments, type-wheel lines in parallel circuit to earth at said instruments, printing-lines normally to earth at said instruments, sunflowers and electrical devices in said circuit at the transmitters, keys electrically connected with said devices, a switch in said printing-line circuit turned to earth around said sunflower devices and keys, a call-box and electrical devices adapted to be connected in said local circuit and printing line through said registering devices to cause the number at said call-box to be indicated, and a similar number of indentations to be recorded on the paper strip of said register, substantially as and for the purposes described.

28. In a station alternating device for a printing-telegraph system, the combination of a type-wheel-line battery and circuit, a printing battery and circuit, a frictionally-driven shaft, alternating devices, unison devices, and a unison contact-disk, with a single contact at unison position mounted thereon, a disk connected to said contact and insulated from said shaft, insulated springs bearing on said disks, a unison magnet, a detent, a pole-changer magnet, a pole-changer in the circuit of said alternator and type-wheel-line battery, a short circuit around said pole-changer magnet and through said springs, contact, and disk, transmitters and receivers, sunflower devices, a key adapted to be connected in said printing-battery circuit, and operating to short-circuit said pole-changer magnet, release said unison device, and arrest said alternator, substantially as and for the purposes described.

29. In a call system for a printing-telegraph, the combination of a local battery and circuit at a station, one electrode to earth at said station, annunciator-magnets included in multiple arc in said circuit, visual signals, registering and magnetic devices adapted to be connected in said circuit, transmitting and receiving instruments, lines thereto normally to earth at said instruments, switching devices, call-boxes at said instruments, shafts and actuating devices in said boxes, electrical devices, indices, and numerals, disks on said shafts, said disks notched at the zero position, and automatic switches operated by said disks with the said transmitter-line to earth, said disks adapted to be turned to include said electrical devices in the circuit of said battery and to indicate at said station the call sent by any transmitter, substantially as and for the purposes described.

30. In a call-box for a printing-telegraph, the combination of a shaft suitably driven, a circuit-wheel thereon, numerals corresponding to the contacts on said wheel, an index-finger, a disk notched at zero position, an insulated pivoted switch-lever having a V projection bearing on said disk, a retracting-spring and insulating contacts for said lever, transmitting-instruments having sunflower devices and keys, and line-circuits of a local battery at a central station connected to said lever and adapted to be connected through one of said contacts with said circuit-wheel and through the other of said contacts with said sunflower devices and keys, substantially as and for the purposes described.

31. In a printing-telegraph system, the combination of a local battery and circuit, one electrode to earth at a central station, annunciator-magnets at said station in multiple arc in said circuit, transmitting and receiving instruments, conductors normally connected through said magnets and to earth at said instruments, electro-magnetic registering devices at said station in a branch circuit of said battery, and key-levers with two contacts, each lever normally in said circuit with one of said conductors through a back contact and adapted by the depression of said lever to break said circuit and close said branch circuit through a front contact and through said registering devices and one of said conductors, substantially as and for the purposes described.

32. In a printing-telegraph system, the combination of a local battery and circuit, one electrode to earth at a station, annunciator-magnets at said station in multiple arc in said circuit, transmitting and receiving instruments, conductors normally connected through said magnets and to earth at said instruments, bell and registering devices at said station in a branch circuit of said battery, and key-levers with two contacts, each lever normally in said circuit with one of said conductors through a back contact and adapted by the depression of said lever to interrupt said circuit and close said branch circuit through a front contact and through said registering device and one of said conductors, substantially as and for the purposes described.

33. A double-line printing-telegraph system comprising sources of electric energy at a station, parallel and series circuits, electro-magnetic and mechanical devices at said station for simultaneously alternating the direction of the current in the parallel circuit, electrical arresting and unison devices in the series circuit for arresting said alternator, transmitting and receiving instruments, a sunflower, trailer, and contact-springs included in said series circuit at a transmitter, electro-magnetic devices included in said parallel circuits at a transmitter and receiver, type-wheel shafts in said instruments positively driven by suitable power and controlled by said electro-magnetic devices, two type-wheels adjustably mounted on each of said shafts, electrical and mechanical devices at said instruments adapted to shift said type-wheels and to effect impressions, and keys and a relay included in said series circuit to short-circuit a resistance in said parallel circuit through a contact of said relay at the trans-

mitter, substantially as and for the purposes described.

34. A double-line printing-telegraph system comprising sources of electric energy at a station, parallel and series circuits, electro-magnetic and mechanical devices at said station for simultaneously alternating the direction of the current in the parallel circuit, electrical arresting and unison devices in the series circuit for arresting said alternator, transmitting and receiving instruments, a sunflower, trailer, and a relay included in said series circuit at a transmitter, electro-magnetic devices included in said parallel circuits at a transmitter and receiver, type-wheel shafts in said instruments positively driven by suitable power and controlled by said electro-magnetic devices, two type-wheels adjustably mounted on each of said shafts, a unison device mounted on said shaft, electrical and mechanical devices at said instruments adapted to adjust said type-wheels and to effect impressions, and keys included in said series circut to short-circuit a resistance in said parallel circuit at the transmitter, substantially as and for the purposes described.

35. A double-line printing-telegraph system comprising sources of electric energy at a station, parallel and series circuits therefor, electro-magnetic and mechanical devices at said station for simultaneously alternating the direction of the current in the parallel circuit, electrical and mechanical devices included in the series circuit to arrest the alternator, transmitting and receiving instruments, a sunflower device included in said series circuit at a transmitter, electro-magnetic devices included in said parallel circuit at a transmitter and receiver, type-wheel shafts in said instruments positively driven and controlled by said electro-magnetic devices, a unison device, two type-wheels adjustably mounted on each of said shafts, electrical and mechanical devices at said instruments adapted to adjust said type-wheels and to effect impressions, and keys and a relay included in said series circuit to short-circuit resistances interposed in said parallel circuit at the transmitter, substantially as and for the purposes described.

36. A printing-telegraph system comprising a station-alternator mounted on a shaft frictionally driven by suitable power, springs bearing on contacts and insulations in said alternator, a type-wheel-line battery, a pole-changer and its actuating-magnet, a printing-line battery and circuit, a polarized relay, a local battery and circuit, escapement-magnets included therein, a neutral armature actuating escapement-pallets, the electrodes of the type-wheel battery connected through the contacts and lever of the pole-changer to springs of said alternator, one spring connected to earth at said station and the other spring connected in circuit through said polarized relay and then in parallel circuit by two lines to earth, transmitters and receivers having escapement-magnets with polarized armatures, sunflowers at the transmitters provided with brushes, trailers, and contacts and open-circuit keys, said pole-changer magnet included in said printing-circuit, and the escapement-magnets of the transmitter and receiver included in said parallel circuits and operating to automatically control the escapement of said alternator by said polarized relay and local circuit and to arrest said alternator by the depression of any key of said transmitter, substantially as and for the purposes described.

37. A printing-telegraph system comprising a station-alternator and a unison device mounted on a shaft frictionally driven by suitable power, springs bearing on contacts and insulations of said alternator, a type-wheel-line battery, a pole-changer, a unison releasing device and its actuating-magnets, a printing-line battery-circuit, a polarized relay, a local battery and circuit, escapement-magnets included therein, a neutral armature actuating escapement-pallets, the electrodes of the type-wheel battery connected with the contacts and lever of said pole-changer and the springs of said alternator, one spring connected to earth at said station and one spring in circuit with the polarized relay-magnets thereat and in parallel circuit to transmitting and receiving instruments and to earth, said instruments provided with polarized armature escapement-magnets, the transmitters having open-circuit keys and a sunflower device with brush, trailer, and contacts, said pole-changer and unison magnets included in said printing-circuit, and the escapement-magnets of the transmitter and receiver included in said parallel circuits, operating to automatically control the escapement of said alternator by said polarized relay and local circuit and to arrest said alternator and release said unison device by the depression of any key of said transmitter, substantially as and for the purposes described.

38. A printing-telegraph system comprising a station-alternator and a unison device mounted on a shaft frictionally driven, springs bearing on contacts and insulations of said alternator, a type-wheel-line battery, a pole-changer, a unison device and releasing mechanism therefor, a printing-line battery, the pole-changer and unison magnets included in the printing-line, a polarized armature, escapement devices included in the type-wheel line, said line connected in parallel to receiving and transmitting instruments and to earth, said instruments provided with polarized-armature escapement-magnets, the transmitters having open-circuit keys, and a sunflower device with brush, trailer, and contacts, the escapement-magnets of the alternator included in the type-wheel line and operating to automatically control the escapements of said alternator by said polarized-armature escapement-magnets to arrest said

alternator, and a magnet to release said unison device by the depression of any key of said transmitter, substantially as and for the purposes described.

39. A printing-telegraph system comprising transmitters and receivers, each having a shaft driven by suitable power, escapement devices on said shafts, escapement electro-magnets controlling polarized armatures, two type-wheels mounted on sleeves adjustably connected with said shafts, fixed sunflower contacts and insulations concentrically arranged with relation to said shaft or shafts, moving synchronously therewith, contact-brushes bearing on hubs insulated from said shafts, trailers mounted on said hubs and adapted to sweep over said contacts, two ranges of keys electrically connected with said sunflower contact and with one another and normally in open circuit, anvils and earth connections for the keys of one range, anvils, a neutral relay, and earth connections to the keys of the other range, sources of electric energy, parallel and series circuits, and alternating and arresting devices located intermediately between said transmitters and receivers, the said escapement-magnets being actuated by alternating currents in parallel circuit from said alternator, substantially as and for the purposes described.

40. A printing-telegraph system comprising transmitting and receiving instruments, each having a shaft driven by suitable power, escapement devices on said shafts, escapement electro-magnets controlling polarized armatures, two type-wheels mounted on sleeves adjustably connected with said shafts, fixed sunflower contacts and insulations concentrically arranged with relation to said shaft or shafts, moving synchronously therewith, contact-brushes bearing on hubs insulated from said shafts, trailers mounted on said hubs and adapted to sweep over said contacts, two series of keys electrically connected with said sunflower contacts and normally in open circuit, anvils and earth connections in circuit with one series of keys, anvils, a neutral relay, and earth connections to the keys of the other series, sources of electric energy, parallel and series circuits, alternating and arresting devices located intermediately between said transmitters and receivers, the said escapement-magnets actuated by alternating currents in parallel circuit from said alternator, and resistances in said parallel circuits at the transmitters and receivers, substantially as and for the purposes described.

41. A printing-telegraph system comprising transmitting and receiving instruments, each having a shaft driven by suitable power, escapement devices on said shafts, escapement electro-magnets controlling polarized armatures, two type-wheels mounted on sleeves adjustably connected with said shafts, fixed sunflower contacts and insulations concentrically arranged with reference to said shaft or shafts, moving synchronously therewith, contact-brushes bearing on hubs insulated from said shaft, trailers mounted on said hubs and adapted to sweep over said contacts, two series of keys electrically connected with said sunflower contacts and normally in open circuit, anvils and earth connections in circuit with one series of keys, anvils, a neutral relay, and earth connections in circuit with the other series of keys, sources of electric energy, parallel and series circuits, alternating and arresting devices located intermediately between said transmitters and receivers, the said escapement-magnets actuated by alternating currents in parallel circuit from said alternator, said series circuit normally to earth through said arresting devices at a receiver, resistances in said parallel circuit at the transmitters and receivers and adapted to be connected to earth through said sunflower devices and anvils and keys in one series and through anvils and said relay by keys in the other series, and the said relay operating to cut out said resistances at a transmitter, substantially as and for the purposes described.

42. In a printing-telegraph system, the combination of a type-wheel-line battery and circuit, a printing-line battery and circuit, alternating and arresting devices located at a central station, indicating devices at said station, transmitting and receiving instruments, type-wheel lines in parallel circuit to earth at said instruments, a printing-line to earth at said instruments, sunflowers and electrical devices, keys at transmitters connected electrically with said sunflowers in said circuit to earth and normally open, a call-box and electrical devices adapted to be included in said circuit, a switch in said circuit, annunciator-magnets and visual signals at said station, a local battery and circuit through said annunciator-magnets, one electrode to earth at said station, and one electrode to earth through said printing-line, operating by means of said switch to interrupt the printing-line through said annunciator-magnet and cause a visual signal to be given, substantially as and for the purposes described.

43. A printing-telegraph system comprising a station-alternator and a unison device mounted on a shaft frictionally driven, springs bearing on contacts and insulations on said alternator, a type-wheel-line battery, a pole-changer and its magnetic devices, a printing-line battery, a polarized relay, a local battery and circuit, escapement-magnets included therein, a neutral armature adapted to actuate escapement-pallets, the electrodes of the type-wheel-line battery connected through the contacts and lever of the pole-changer to springs of said alternator and to earth at said station and through said polarized relay in parallel circuit by two lines to earth, transmitters and receivers having escapement-magnets and polarized armatures, escapements controlling type-wheels, sunflower devices at the transmitter provided with

brushes, trailers, and contacts, open-circuit keys, and the escapement-magnets of a transmitter and a receiver included in parallel circuit adapted to automatically control the escapement of said alternator by the polarized relay and local circuit and to simultaneously arrest said alternator and the type-wheels of transmitter and receiver by the depression of any key of said transmitter, substantially as and for the purposes described.

44. A printing-telegraph system comprising a station-alternator and a unison device mounted on a shaft frictionally driven, springs bearing on contacts and insulations on said alternator, a type-wheel-line battery, a pole-changer, a unison releasing device and its magnetic devices, a printing-line battery, a polarized relay, a local battery and circuit, escapement-magnets included therein, a neutral armature adapted to actuate escapement-pallets, the electrodes of the type-wheel-line battery connected through the contacts and lever of the pole-changer to springs of said alternator and to earth at said station and through said polarized relay and in parallel circuit by two lines to earth, transmitters and receivers having escapement-magnets and polarized armatures, sunflower devices at the transmitters provided with brushes, trailers, and contacts, open-circuit keys, and the escapement-magnets of transmitter and receiver included in parallel circuit of said type-wheel-line battery, adapted to automatically control the escapement of said alternator by the polarized relay and local circuit and to arrest said alternator by the depression of any key of said transmitters, substantially as and for the purposes described.

45. A printing-telegraph system comprising a station-alternator and a unison device mounted on a shaft frictionally driven, springs bearing on contacts and insulations on said alternator, a type-wheel-line battery, a pole-changer, a unison releasing device and its magnetic devices, a printing-line battery, escapement-magnets included in said type-wheel-line battery, a polarized armature actuating escapement-pallets, the electrodes of the type-wheel-line battery connected through the contacts and lever of the pole-changer to springs of said alternator and to earth at said station and through said escapement-magnets and in parallel circuit by two lines to earth, transmitters and receivers having escapement-magnets and polarized armatures, sunflower devices at the transmitters provided with brushes, trailers, and contacts, open-circuit keys, and the escapement-magnets of a transmitter and a receiver included in said parallel circuit, adapted to automatically control the escapement of said alternator and arrest the same by the depression of any key of said transmitter, substantially as and for the purposes described.

46. A printing-telegraph system comprising a station-alternator and a unison device mounted on a frictionally-driven shaft, springs bearing on contacts and insulations on said alternator, a type-wheel-line battery, a pole-changer and its magnetic devices, a printing-line battery, escapement-magnets included in said printing-line battery-circuit, a polarized armature actuating escapement-pallets, the electrodes of the type-wheel line connected through the contacts and lever of the pole-changer to springs of said alternator, one spring connected to earth at said station and the other spring connected through said escapements and in parallel circuit to earth, transmitters and receivers having escapement-magnets, escapements and type-wheels, sunflower devices at the transmitters provided with brushes, trailers, and contacts, open-circuit keys, and the escapement-magnets of a transmitter and a receiver included in parallel circuit, adapted to control the escapement of said alternator and to simultaneously arrest the same and the type-wheels of said transmitter and receiver by the depression of any key of said transmitter, substantially as and for the purposes described.

47. A printing-telegraph system comprising a station-alternator and a unison device mounted on a frictionally-driven shaft, springs bearing on contacts and insulations on said alternator, a type-wheel-line battery, a pole-changer, its magnetic devices included in a printing-line battery-circuit, escapement-magnets in said type-wheel line, a polarized armature adapted to operate pallets, the electrodes of the type-wheel-line battery connected through the contacts and lever of the pole-changer to springs of said alternator, one spring connected to earth at said station, the other spring connected in parallel circuit to earth, transmitters and receivers provided with escapement-magnets included in said parallel circuit, sunflower devices with their brushes, trailers, and contacts, and normally-open-circuit keys, the said pole-changer magnet and the escapement-magnets of said alternator adapted to control the escapement of the alternator and release the unison device by the depression of a key of a transmitter, substantially as and for the purposes described.

48. A printing-telegraph system comprising sources of electric energy, type-wheel and printing-line circuits, an alternator and pole-changer for alternating the direction of the current in the type-wheel line, a unison device on the alternator-shaft and releasing devices therefor, arresting devices for said alternator, receiving and transmitting instruments in parallel in said type-wheel-line circuit and in series in the printing-line, sunflower devices and open-circuit keys at the transmitting-instrument, and arresting devices for the type-wheel shafts at said receiving and transmitting instruments, unison devices mounted on the type-wheel shafts, and releasing mechanism therefor, substantially as and for the purposes described.

49. A printing-telegraph system comprising

a station, sources of electric energy, printing and type-wheel line circuits, an alternator and pole-changer at said station for alternating the direction of current in the type-wheel line, a polarized relay in the type-wheel line, local battery-circuits adapted to operate neutral escapement-magnets to arrest said alternator, the magnets of the pole-changer included in the printing-line circuit, a magnetic unison releasing device controlled by the printing-line circuit, and a unison cut-out on the alternator-shaft, substantially as and for the purposes described.

50. A printing-telegraph system comprising a station, sources of electric energy, printing and type-wheel line circuits, an alternator and pole-changer and the magnets thereof interposed in the printing-line circuit, a magnetic unison releasing device in said printing-line circuit, a polarized-armature escapement-magnet included in the type-wheel line and adapted to arrest the alternator, transmitting and receiving instruments having polarized armature-escapement magnets included in parallel in the type-wheel line, sunflower devices, and open-circuit keys at said instruments connected in series with the printing-line circuit, substantially as and for the purposes described.

51. A printing-telegraph system comprising a station, printing and type-wheel line circuits, an alternator, its shaft and escape-wheel, a pole-changer, a polarized relay included in said type-wheel-line circuit, a local battery-circuit, neutral escapement-magnets, their armature and pallets, the said magnets adapted to be included in said local battery-circuit by the contacts of said polarized relay to automatically control said alternator, and transmitting and receiving instruments provided with polarized-armature escapement-magnets included in parallel in the type-wheel-line circuit, substantially as and for the purposes described.

52. A printing-telegraph system comprising a station, printing and type-wheel line circuits, an alternator, its shaft and escape-wheel, a pole-changer, a polarized relay included in said type-wheel-line circuit, a local battery-circuit, neutral escapement-magnets, their armature and pallets, the said magnets adapted to be included in said local battery-circuit by the contacts of said polarized relay to automatically control said alternator, transmitting and receiving instruments having polarized-armature escapement-magnets, and double-contact neutral relays included in parallel in said type-wheel-line circuit, substantially as and for the purposes described.

53. A printing-telegraph system comprising a station, printing and type-wheel line circuits, an alternator, its shaft and escape-wheel, a pole-changer, a polarized relay included in said type-wheel-line circuit, a local battery-circuit, neutral escapement-magnets, their armature and pallets adapted to be included in said local battery-circuit by the contacts of said polarized relay to automatically control said alternator, transmitting and receiving instruments, polarized-armature escapement-magnets and double-contact neutral relays included in parallel in said type-wheel-line circuit, and a relay included in the printing-line circuit at each instrument for short-circuiting one of said relays by the depression of any key at the transmitter, substantially as and for the purposes described.

54. A printing-telegraph system comprising a station, printing and type-wheel line circuits, an alternator, its shaft and escape-wheel, a pole-changer for alternating the direction of current in the type-wheel line, a polarized relay included in said type-wheel-line circuit, local battery-circuits, neutral escapement-magnets, their armature and pallets, the said magnets adapted to be included in said local battery-circuit by the contacts of said polarized relay to control said alternator, transmitting and receiving instruments, polarized-armature escapement-magnets, double-contact neutral relays included in parallel in said type-wheel-line circuit, a relay included in the printing-line circuit between a key, anvil, and an earth connection, a sunflower device, and open-circuit keys in the printing-line, substantially as and for the purposes described.

55. A printing-telegraph system comprising a station, printing and type-wheel line battery-circuits, transmitting and receiving instruments having polarized-armature escapement-magnets and neutral relays included in parallel in the type-wheel-line circuits, resistances interposed in said line between said relays and earth connections, a relay in the printing-line circuit adapted to short-circuit one of said relays at a transmitter, sunflower contacts, a brush, and a trailer, open-circuit keys interposed in the printing-line circuit, and a switch and resistance in the type-wheel lines to vary the strength of the current in said parallel line-circuits, substantially as and for the purposes described.

56. A printing-telegraph system comprising a station, printing and type-wheel line circuits, transmitting and receiving instruments, polarized-armature escapement-magnets and double contact neutral relays and resistances interposed in said type-wheel line, sunflower devices with contacts, brushes, and trailers, open-circuit keys, interrupters, and a relay included in the printing-line, the said relay short-circuited by the depression of a key at a transmitter, substantially as and for the purposes described.

57. A printing-telegraph system comprising a frictionally-driven type-wheel shaft, mechanical and electrical devices actuated by alternating currents in parallel circuit of a line-battery, type-wheels adjustably mounted on said shaft, double-contact relays included in parallel circuit of said battery, a printing battery and circuit, resistances included therein, printing and type-wheel shift-

ing magnetic devices, impression devices, sunflower devices, keys electrically connected with said devices and adapted to close said printing-battery circuit through said resistances, said relays adapted to close the printing-circuit in parallel through said printing and shifting magnets in parallel with said resistances, and a single-contact relay adapted to cut out resistance and one of said double-contact neutral relays in one branch of said type-wheel-line parallel circuit, substantially as and for the purposes described.

58. A double-line printing-telegraph system comprising sources of electric energy at a station, combined transmitting and receiving instruments, escapement-magnets traversed by alternating currents in parallel of a battery-circuit, a sunflower device normally in a series circuit of a battery, electrical devices for said sunflower device, two ranges of keys, adjacent keys in each series connected to the same segments of said sunflower device and normally open in said series circuit, resistances in said parallel circuit, means for short-circuiting said resistances by the depression of a key of said ranges, electrical devices for interrupting said series circuit to the other range of keys by the depression of said key, unison magnetic devices at the transmitters and receivers, and unison devices at said station, the keys of the transmitters adapted to permit of the closing of the printing-circuit and simultaneously of the release of the unison devices at the alternating station and of the instruments included in circuit, substantially as and for the purposes described.

59. A printing-telegraph system comprising an alternator, magnetic escapement, and unison devices at a station, printing and type-wheel line circuits, transmitting and receiving instruments having escapement devices and double-contact relays included in parallel in the type-wheel line, open-circuit keys, a sunflower device with contacts, brush, and trailer, an interrupter, resistance, and a switch included in the printing-line circuit, the double-contact relay adapted to close a parallel circuit of the printing-line in parallel with the resistance through the printing-magnet and the shifting-magnet, substantially as and for the purposes described.

60. A printing-telegraph system comprising an alternator, magnetic escapement, and unison devices at a station, printing and type-wheel line circuits, transmitting and receiving instruments having escapement devices and double-contact relays included in parallel in the type-wheel line, open-circuit keys, relays to short-circuit the double-contact relay at a transmitter, sunflower devices with contacts, brushes, and trailers, resistances and switches included in the printing-line circuit, the double-contact relays adapted to close parallel circuits of the printing-line through the resistances, and the printing and shifting magnets, substantially as and for the purposes described.

61. A printing-telegraph system comprising a station, printing and type-wheel line circuits, transmitting and receiving instruments having polarized-armature escapement-magnets, and double-contact neutral relays and resistances included in parallel circuits of the type-wheel line, the neutral relays adapted to close parallel circuits of the printing-line to actuate the printing mechanism, substantially as and for the purposes described.

62. A printing-telegraph system comprising a station, printing and type-wheel line circuits, transmitting and receiving instruments having polarized-armature escapement-magnets and double-contact relays and resistances included in parallel circuits of the type-wheel line, resistances, an interrupter, and switch included in the printing-line, and the neutral double-contact relay adapted to close a parallel circuit through said interrupter and the resistance of the printing-line to actuate the printing devices, substantially as and for the purposes described.

63. A printing-telegraph system comprising a station having an alternator and arresting devices, printing and type-wheel line circuits, transmitting and receiving instruments having arresting devices responding to currents in parallel lines from the arresting devices at the station for automatically controlling the alternator and type-wheels, resistances and printing-magnets in said printing-line circuits, and double contact relays included in said parallel lines and adapted to close a parallel circuit of the printing-line through said resistances and printing-magnet to effect impressions, substantially as and for the purposes described.

64. A printing-telegraph system comprising an alternator, magnetic escapement, and unison devices at a station, printing and type-wheel line circuits, transmitting and receiving instruments having escapement devices and double-contact relays included in parallel in the type-wheel line, open-circuit keys, sunflower devices with contacts, brushes, and trailers, interrupters, printing and shifting magnets, resistances, and switches included in the printing-line circuits, the double-contact relays adapted to close parallel circuits of the printing-line through the resistances, and the printing and shifting magnets, substantially as and for the purposes described.

In witness whereof I have hereunto set my signature in the presence of two subscribing witnesses.

SAMUEL R. LINVILLE.

Witnesses:
GEO. W. REED,
J. WALTER DOUGLASS.