(No Model.) 7 Sheets—Sheet 1.

S. R. LINVILLE & L. F. HETTMANSPERGER.

PRINTING TELEGRAPH.

No. 450,630. Patented Apr. 21, 1891.

Fig. 1.

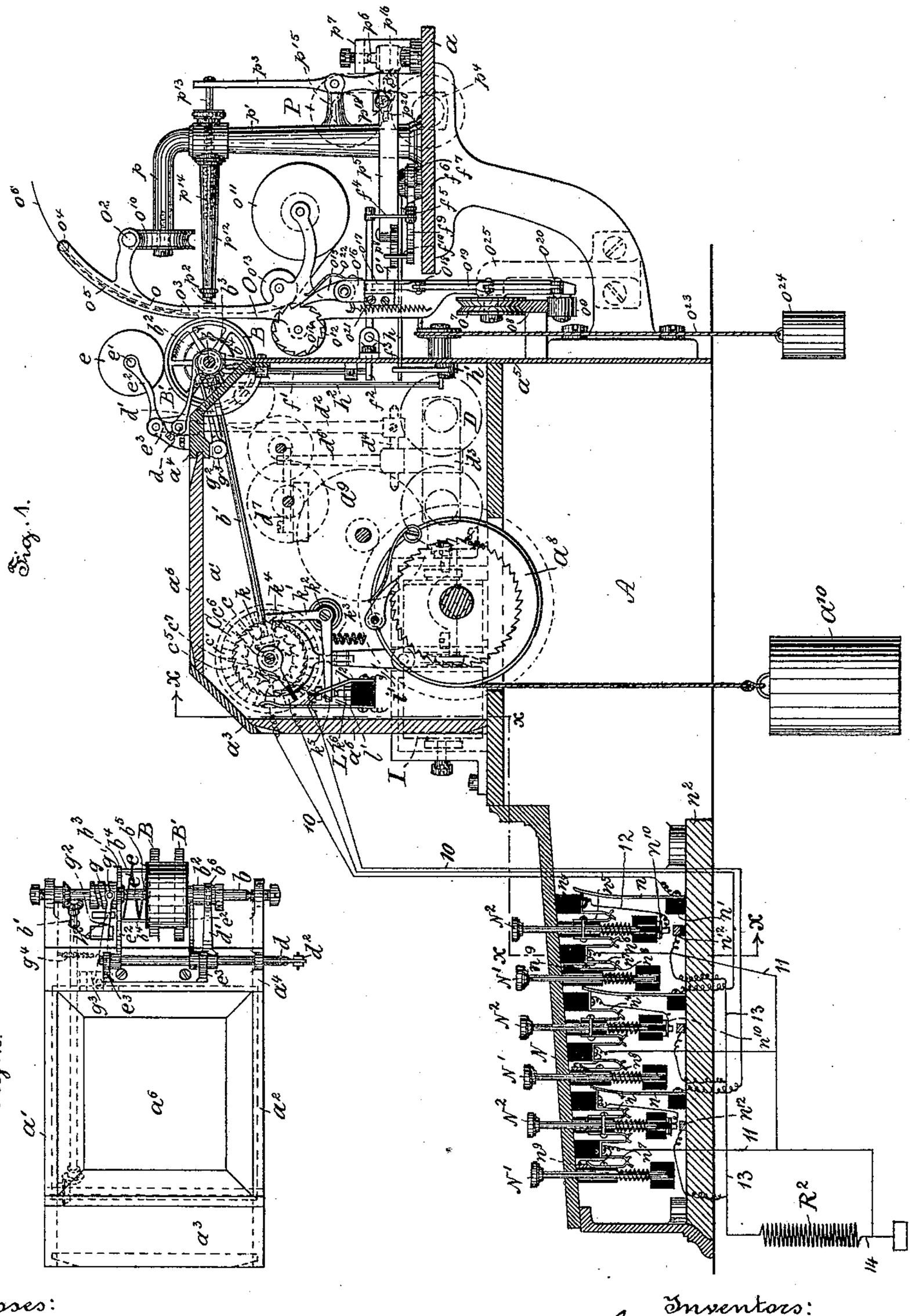


Fig. 2.

Witnesses:
Hermann Bormann.
Thomas M. Smith.

Inventors:
Samuel R. Linville, &
Louis F. Hettmansperger,
by J. Walter Douglass.
Atty.

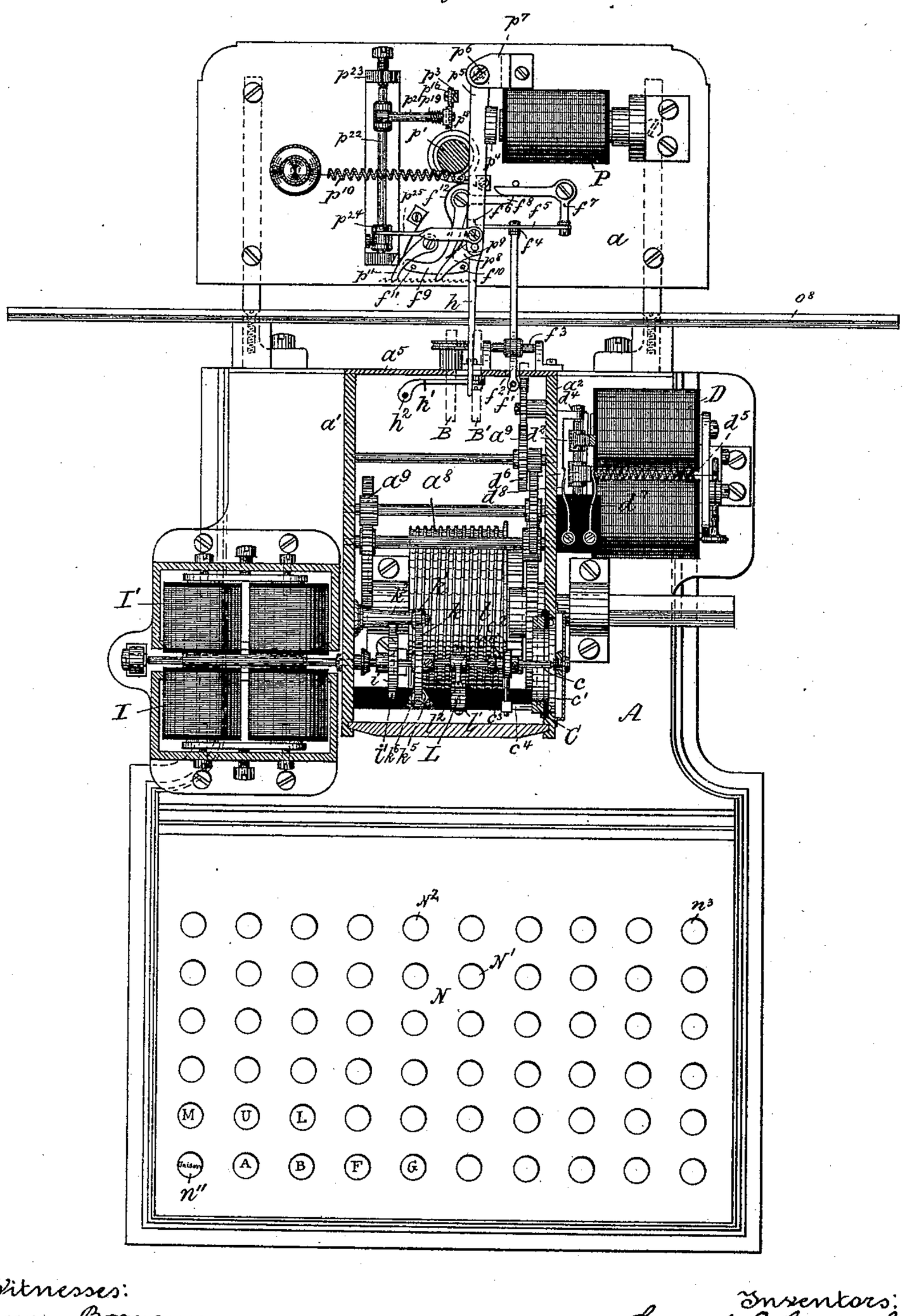
(No Model.) 7 Sheets—Sheet 2.

S. R. LINVILLE & L. F. HETTMANSPERGER.

PRINTING TELEGRAPH.

No. 450,630. Patented Apr. 21, 1891.

Fig. 3.



Witnesses:
Hermann Bornmann
Thomas M. Smith.

Inventors:
Samuel R. Linville, &
Louis F. Hettmansperger,
by J. Walter Douglass.
Att'y.

(No Model.) 7 Sheets—Sheet 3.

S. R. LINVILLE & L. F. HETTMANSPERGER.

PRINTING TELEGRAPH.

No. 450,630. Patented Apr. 21, 1891.

Fig. 4.

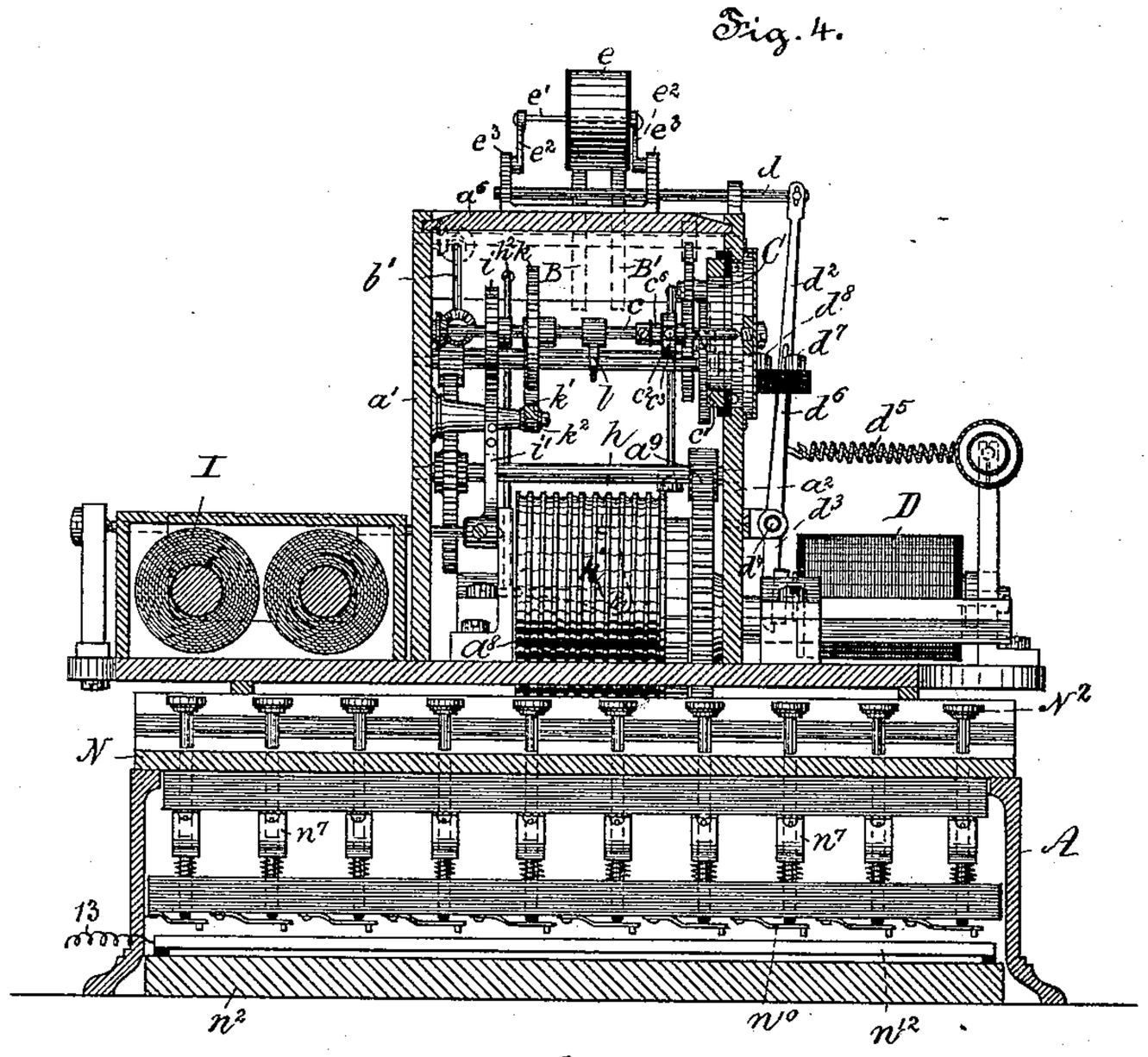
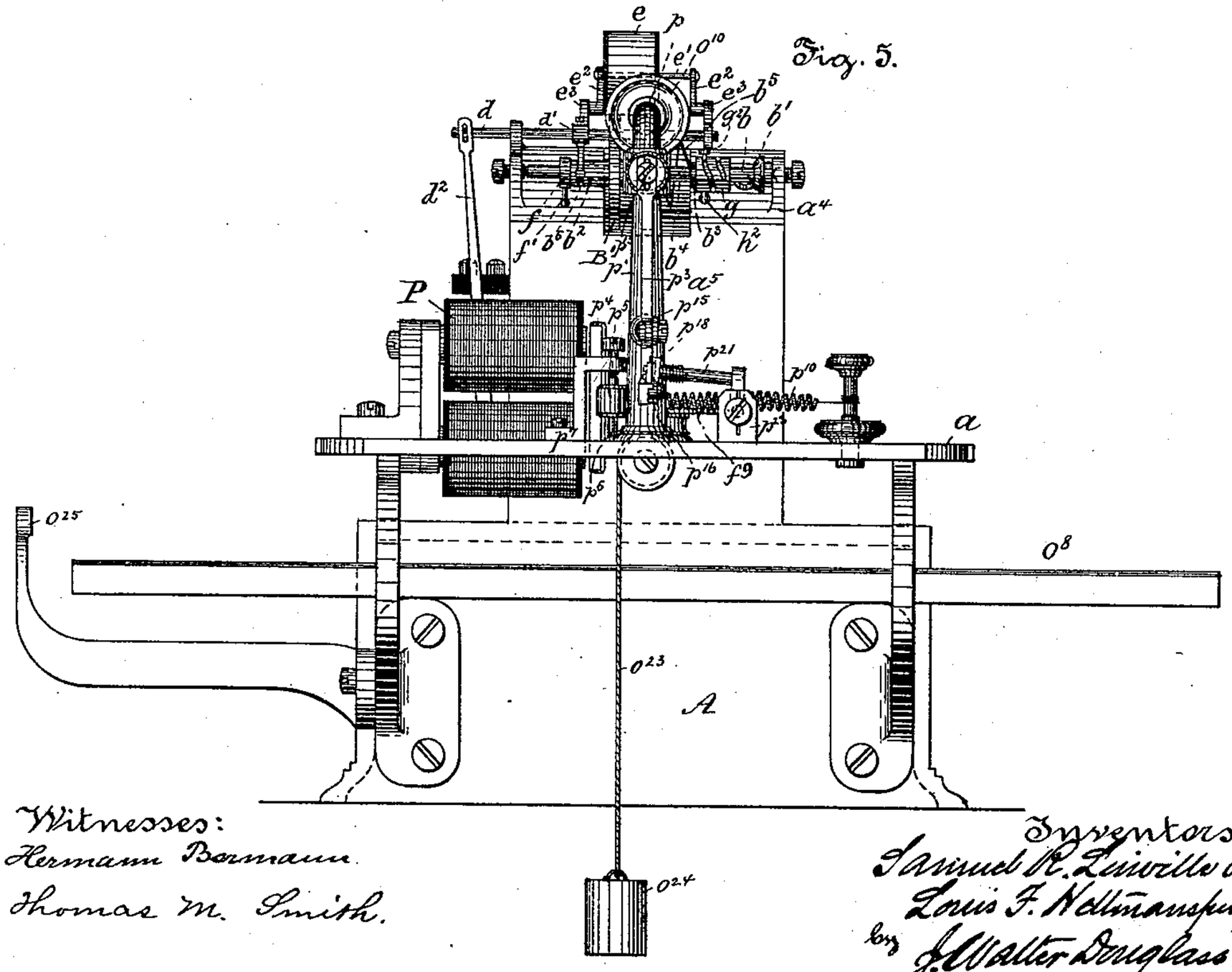


Fig. 5.



Witnesses:
Hermann Bormann.
Thomas M. Smith.

Inventors:
Samuel R. Linville &
Louis F. Hettmansperger
by J. Walter Douglass.
Att'y.

(No Model.) 7 Sheets—Sheet 4.

S. R. LINVILLE & L. F. HETTMANSPERGER.

PRINTING TELEGRAPH.

No. 450,630. Patented Apr. 21, 1891.

Fig. 6.

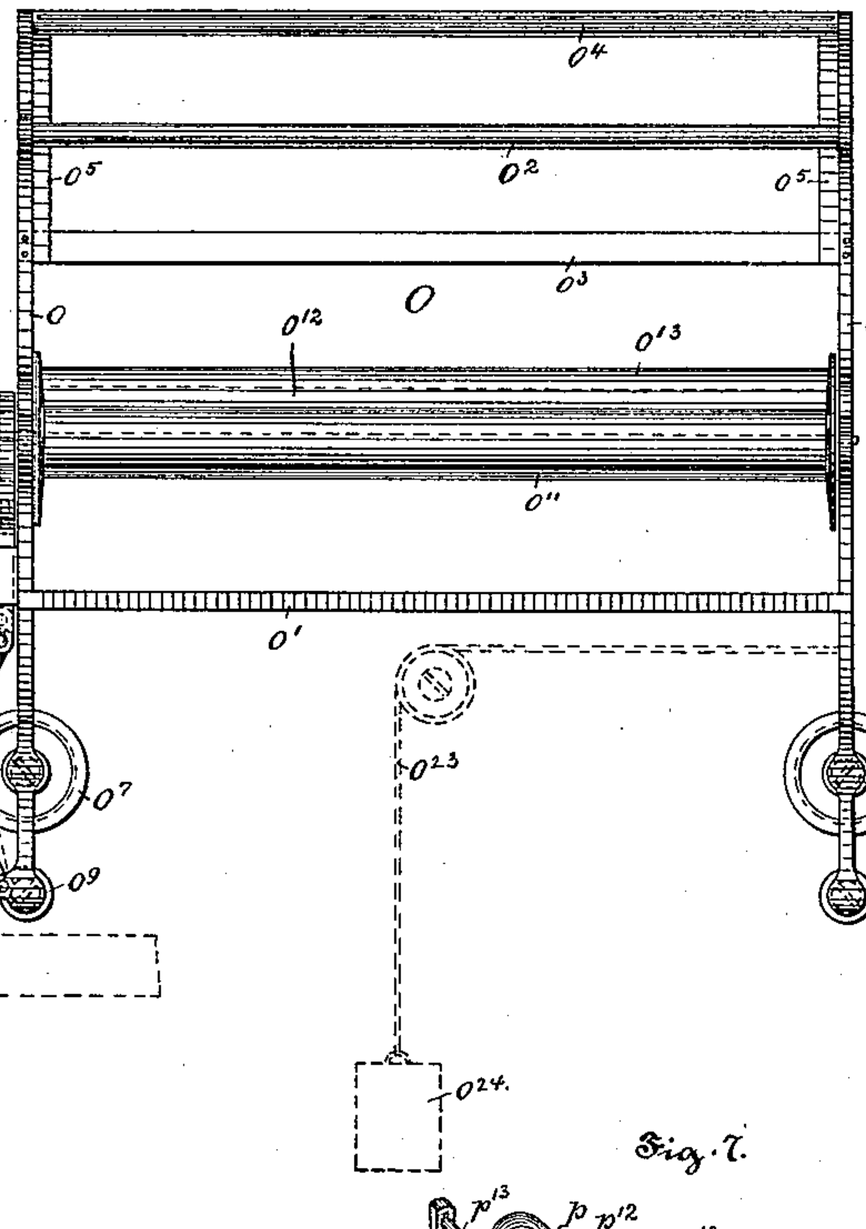
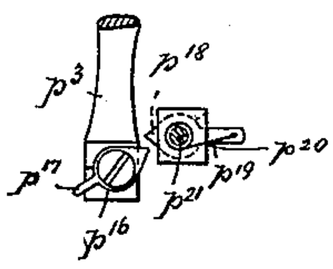
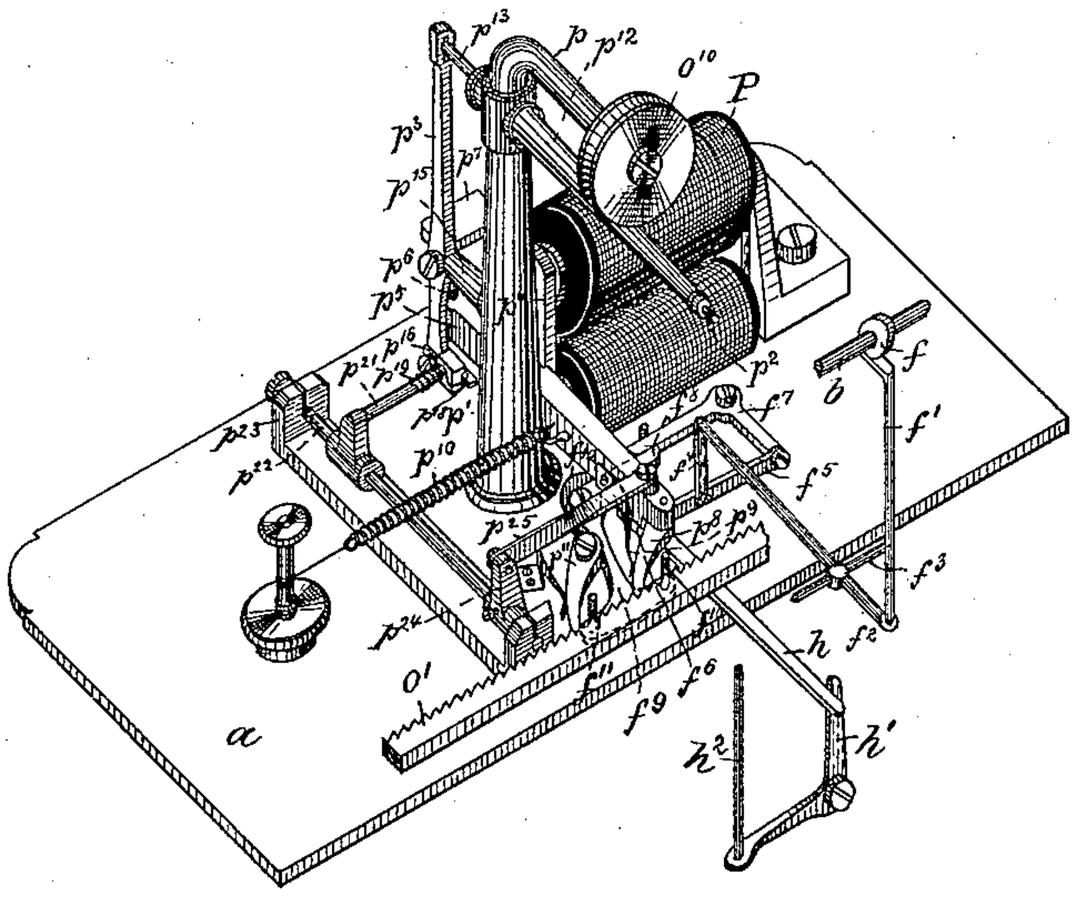


Fig. 7.

Fig. 8.





Witnesses:
Hermann Bannau.
Thomas M. Smith.

Inventors:
Samuel R. Linville &
Louis F. Hettmansperger
by J. Walter Douglass.
Att'y.

(No Model.) 7 Sheets—Sheet 7.

S. R. LINVILLE & L. F. HETTMANSPERGER.

PRINTING TELEGRAPH.

No. 450,630. Patented Apr. 21, 1891.

Fig. 13.

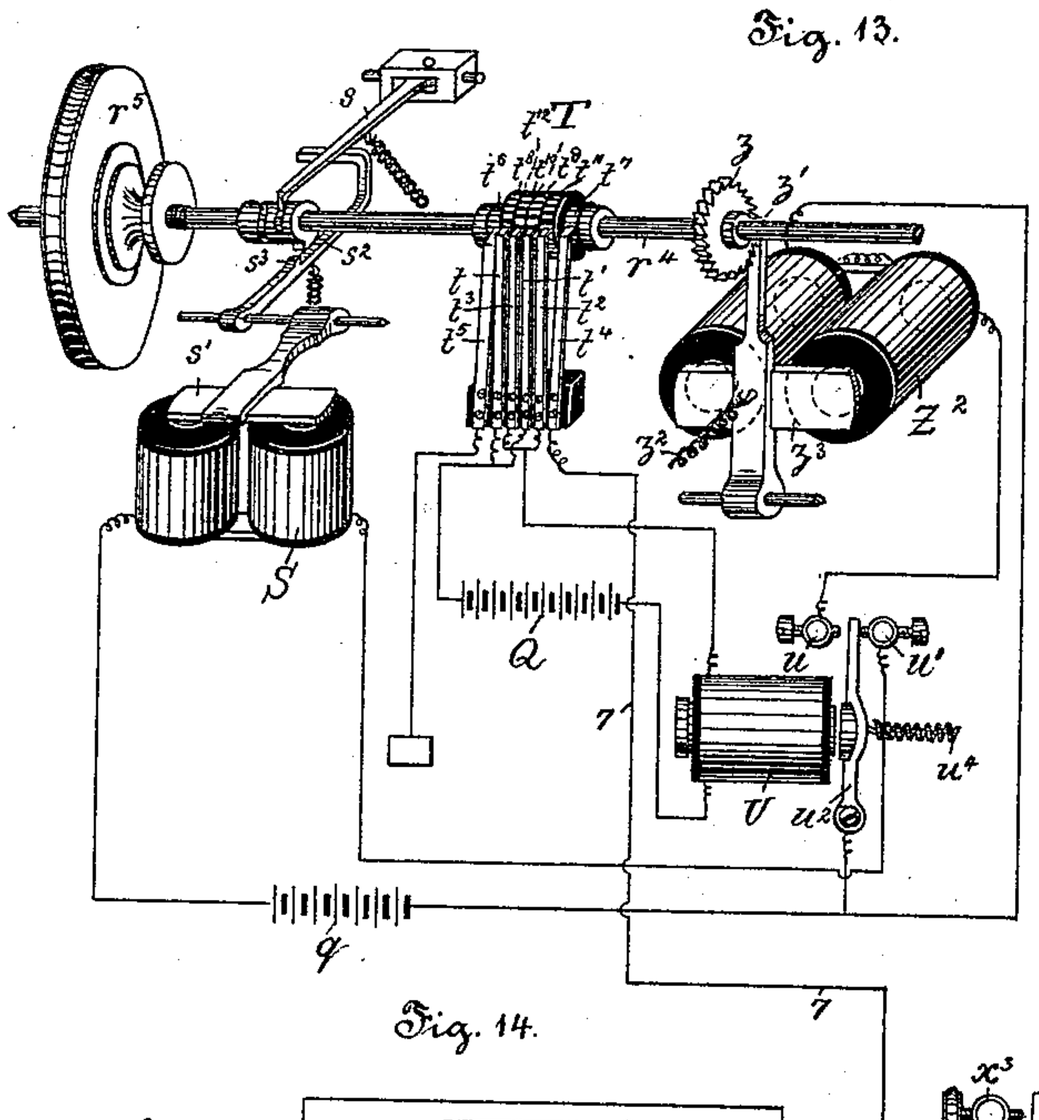
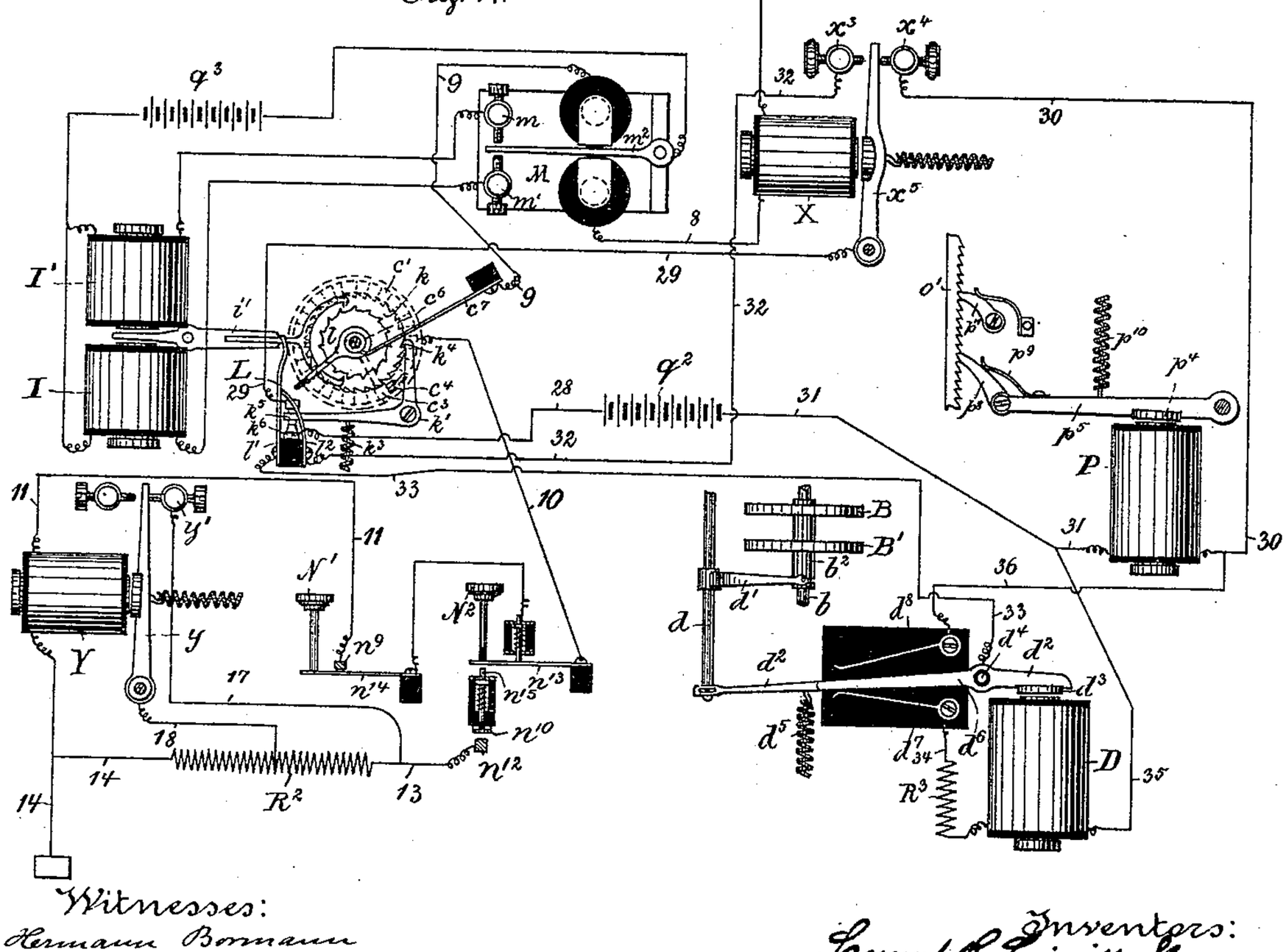


Fig. 14.



Witnesses:
Hermann Bonnann
Thomas M. Smith.

Inventors:
Samuel R. Linville &
Louis F. Hettmansperger.
by J. Walter Douglass.
Att'y.

(No Model.) 7 Sheets—Sheet 5.

S. R. LINVILLE & L. F. HETTMANSPERGER.

PRINTING TELEGRAPH.

No. 450,630. Patented Apr. 21, 1891.

Fig. 9.

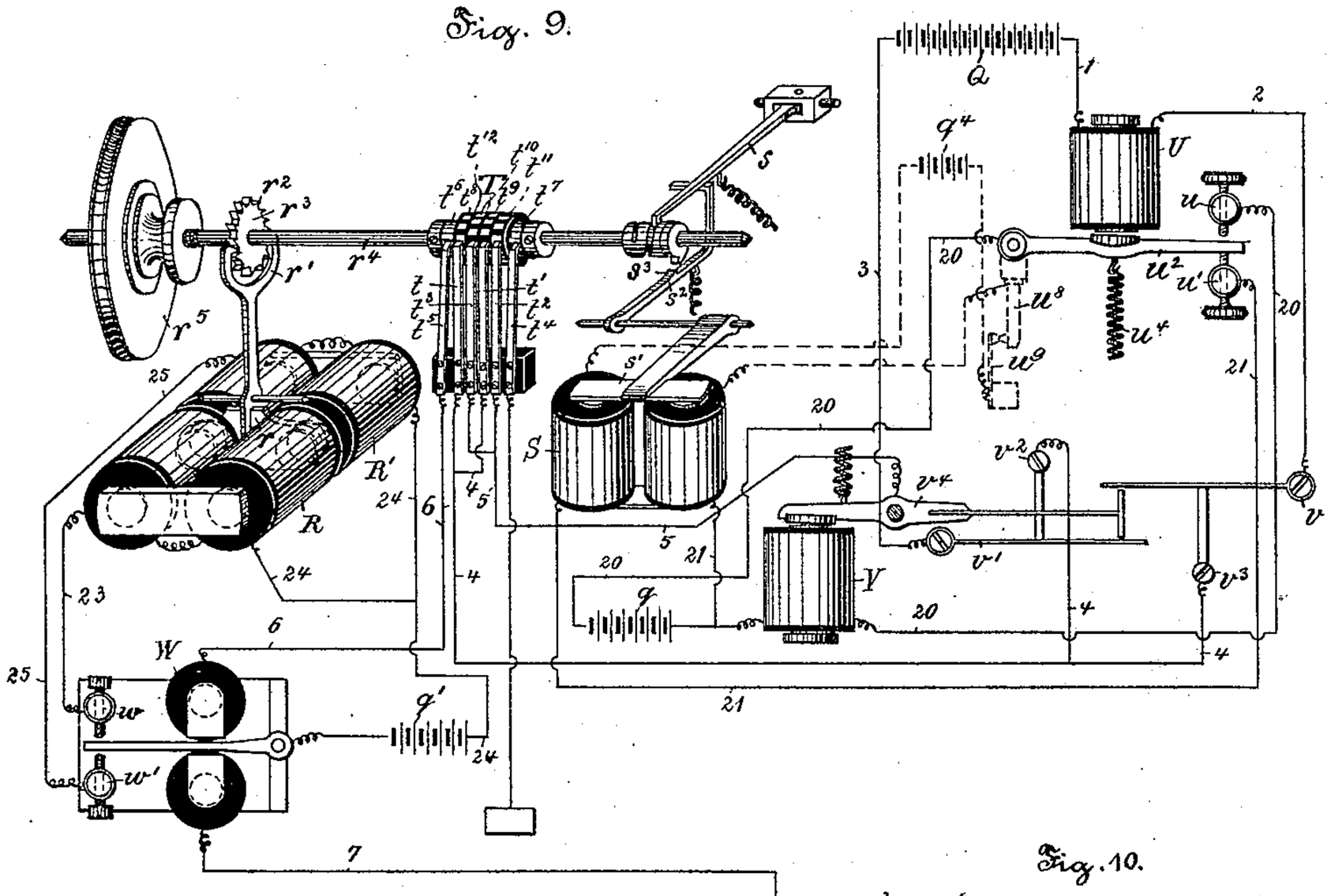


Fig. 10.

Witnesses:
Hermann Bornmann
Thomas M. Smith.

Inventors:
Samuel R Linville &
Louis F. Hettmansperger
by J. Walter Douglass
Atty.

(No Model.) 7 Sheets—Sheet 6.

S. R. LINVILLE & L. F. HETTMANSPERGER.

PRINTING TELEGRAPH.

No. 450,630. Patented Apr. 21, 1891.

Fig. 11.

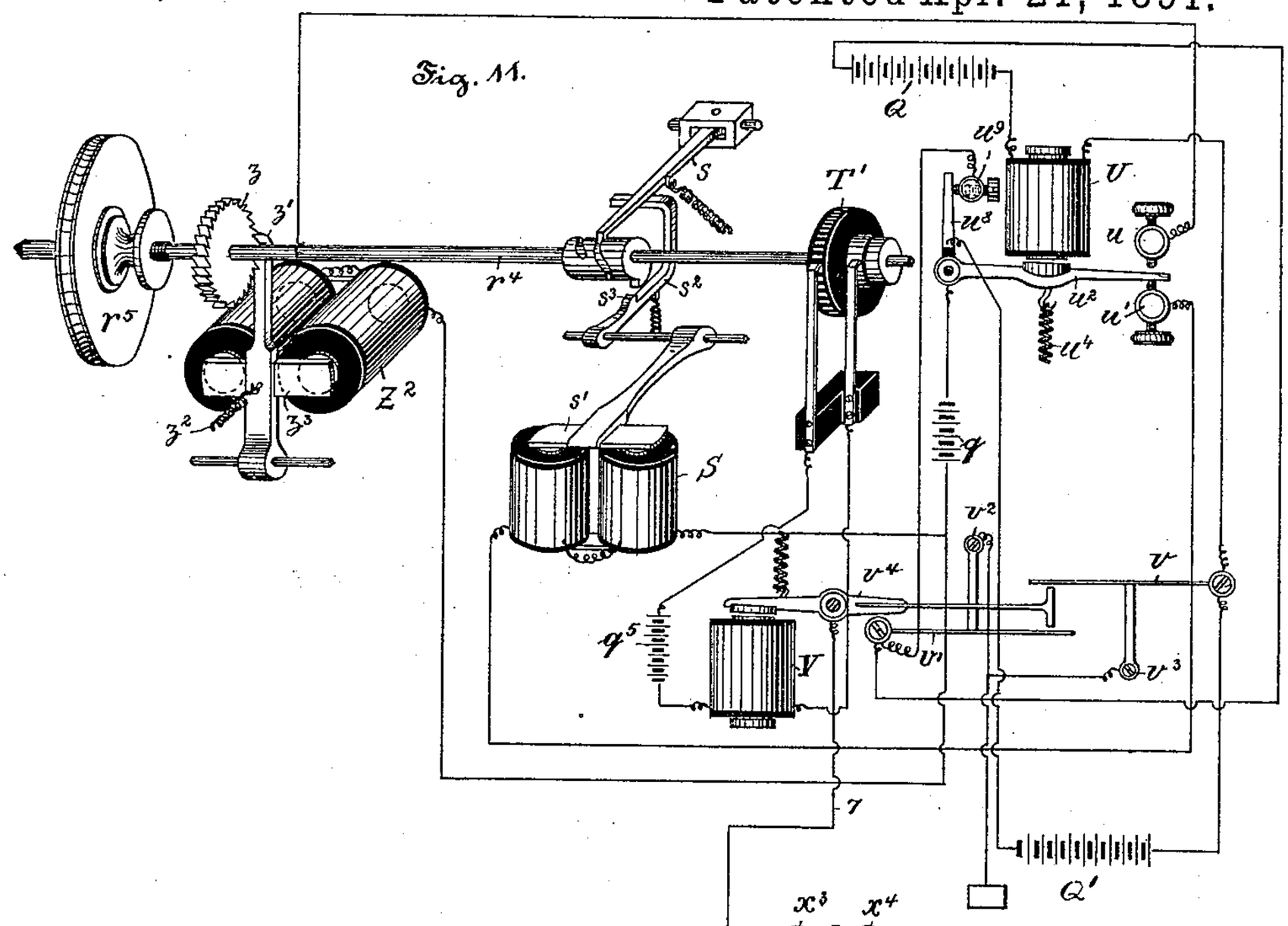
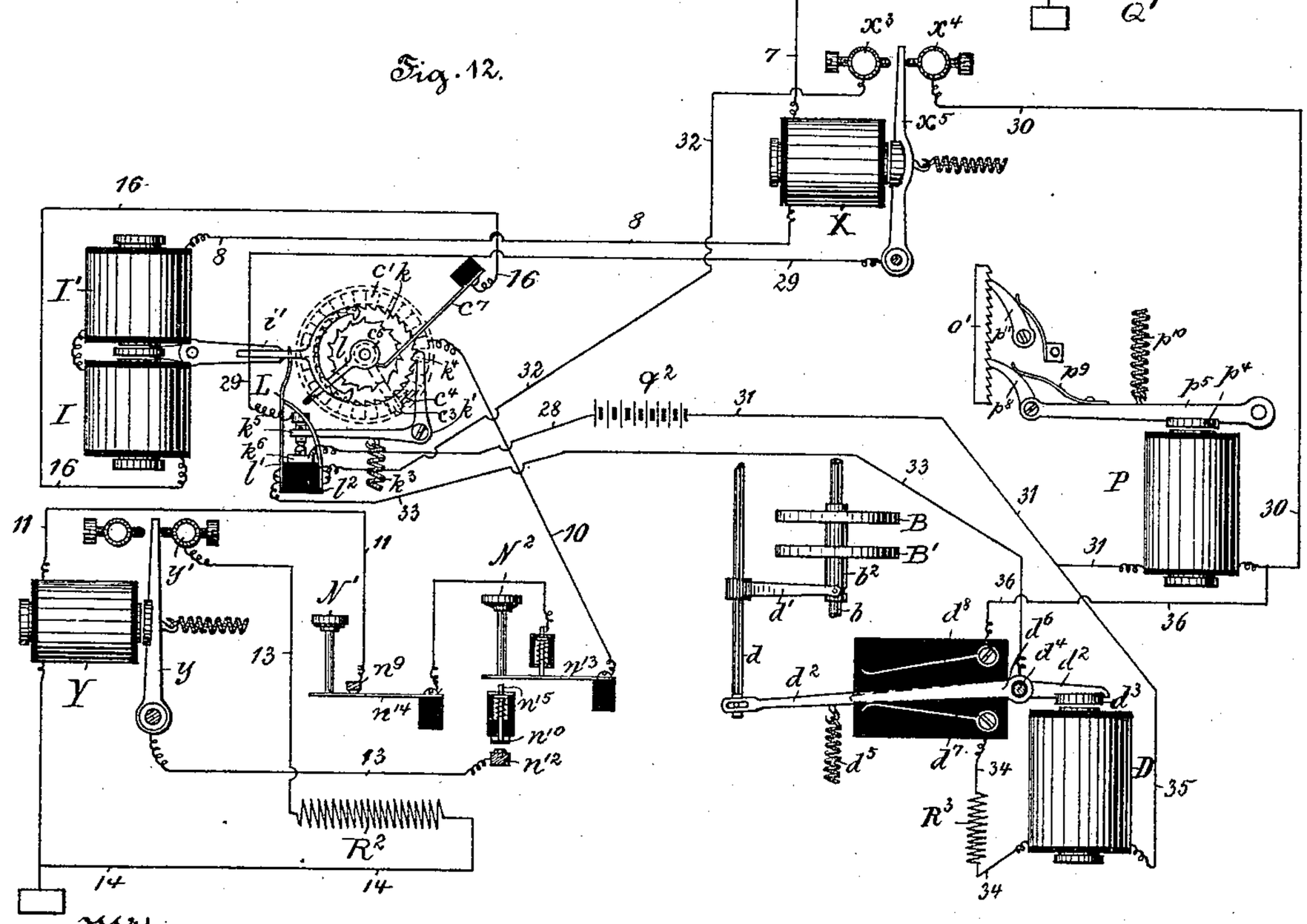


Fig. 12.



Witnesses:
Hermann Bornamn
Thomas M. Smith.

Inventors:
Samuel R. Linville &
Louis F. Hettmansperger.
by J. Walter Douglass.
Att'y

UNITED STATES PATENT OFFICE.

SAMUEL R. LINVILLE AND LOUIS F. HETTMANSPERGER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNORS TO THE KEYSTONE BATTERY AND ELECTRIC SUPPLY COMPANY, OF CAMDEN, NEW JERSEY.

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 450,630, dated April 21, 1891.

Application filed June 23, 1890. Serial No. 356,382. (No model.)

To all whom it may concern:

Be it known that we, SAMUEL R. LINVILLE and LOUIS FREDERICK HETTMANSPERGER, both citizens 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.

Our invention relates in general to a novel system of printing-telegraphy in which the instruments are capable of being operated either as transmitters or receivers by alternating currents transmitted through a single line-conductor from a source of electric energy located at a terminal station where the alternator and the apparatus for controlling the same are preferably located, yet nevertheless the alternator and apparatus for controlling the same may be located in line at an intermediate station instead of at the terminal station. The instruments have each two type-wheels with characters arranged in the same radial line on the peripheries thereof. Each instrument looped in a single main-line conductor through said alternator operates either as a transmitter or as a receiver without the employment of hand-switches or other devices for directing the current or changing the organization of the instruments to adapt them for use as transmitters or receivers, or vice versa. The impressions are effected by means of a local battery located at each instrument. The location of the line-battery, the alternator, and the arresting devices at a terminal station or at an intermediate station obviates the necessity and expense of alternating devices and a line-battery at each transmitter or receiver.

Our invention further relates to improvements in key-boards; in apparatus for presenting the paper in page form from a continuous roll to the type-wheels; in circuits and apparatus for shifting the type-wheels; in determining from which type-wheel the impression is to be made; in operating the impression-hammer; in releasing the paper-carriage; in unison devices and circuits for the printing-instruments and the terminal or intermediate station, and in circuits and electrical devices employed to control the alternating apparatus by means of the keys of any transmitter or receiver connected in the main-line conductor, to enable any transmitter to send and record impressions and messages in page form on any instrument located in the single line simultaneously with the recording of such messages on the instrument used as a transmitter.

Our invention consists, first, in a printing-telegraph system of a terminal or intermediate station-current alternator driven by a frictional attachment from a suitable source or power, the movement and speed of which is regulated automatically by an anchor-escapement or similar device controlled by electro-magnets responding to alternating electric impulses sent to line by the alternator. Both terminals of the source of electric energy are first connected with a pole-changer, and the current passes then to contact-springs bearing on alternating contacts on the shaft of the alternator, and from which contact-springs direct the entire current through the alternator and pole-changer alternately and simultaneously to earth and to line. In a conductor between one of the terminals and the pole-changer the coils of a neutral relay are located, and these are constantly charged by a current of the same polarity while the alternator is in motion. The lever of the relay closes a local circuit through its front stop and the coils of the pole-changer magnet, thereby attracting the armature of the pole-changer lever in position to maintain a fixed polarity in the conductors leading to the alternator while the same is sending alternating currents to line. In this condition the alternator runs automatically and continuously, sending alternating impulses through the coils of a polarized relay for closing the circuit of a local battery alternately through the escapement electro-magnets controlling the alternator. At the same time the alternating impulses in the line traverse the coils of a neutral double-contact relay and a polarized relay located at each instrument in line, and also pass through the sunflower device and key-board on each instrument and then to earth or to line. The double-contact

neutral relay directs the current of a local battery through either the printing electro-magnet or both the type-wheel shifting and printing electro-magnets located at each instrument in the line, and the polarized relay closes the circuit of a local battery at each instrument alternately through its respective contacts and the coils of two neutral electro-magnets which control the escapement-armature and pallets of each transmitter or receiver. Each of the transmitting or receiving instruments has two type-wheels mounted on a loose sleeve on a shaft with letters arranged in the same radial line on both type-wheels. The keys are preferably arranged in transverse parallel lines across the key-board, and are twice as many in number as the characters on one type-wheel and similarly double the number of contacts on the sunflower device. One line of keys relates to one type-wheel and the adjacent line of keys to the other type-wheel. Each key in one line is in electrical connection with an adjacent key in an adjacent line, and with one division of the sunflower device, in order that by the depression of either of the two keys the type-wheels may be arrested at the same position. Each alternate row of keys for one type-wheel is connected to the line and to earth around a resistance, the other row of keys for the other type-wheel being connected to line and to earth through said resistance and adjacent key. When a key of the former row is depressed, the line is thereby broken, and when a key in the latter row is depressed the line to the former is interrupted and diverted through a resistance to line or to earth. While the type-wheels are in motion the uniform alternating current passes to line and to earth. One type-wheel is in such case normally in position to cause impressions to be recorded. When any of the keys relating to this type-wheel is depressed it breaks the line-current, instantly breaking the circuit through the coils of the neutral relay at the terminal station. This relay breaking the local circuit through the electro-magnet of the pole-changer causes it to reverse the current, and the alternator under these conditions is arrested in consequence of a break in the line. The neutral relay contact-lever at each instrument impinges against its back contact and closes the printing-circuit through the coils of the printing-magnet to effect an impression on the type-wheel normally in position. When any of the keys relating to the other type-wheel are depressed, the line-current is broken thereby to the adjacent key connected therewith and directed through a resistance, which so reduces the current in the coils of the relay at the terminal station that its armature suddenly falls back, breaking the circuit through the pole-changer, thereby reversing the currents in the line and causing the alternator and the type-wheels to be arrested in consequence of the change of polarity in a weak line-current. The neutral relay-lever at each instrument will now close the printing-circuit through its front contact, first, through the shifting electro-magnet to shift the type-wheels into such a position that the other of said wheels may be permitted to record impressions, and, secondly, near the termination of the movement of the type-wheel and by means of circuit-closing devices actuated by the lever of the shifting-magnet the printing-circuit will be closed automatically in parallel circuit through the coils of both the shifting electro-magnet and the printing electro-magnet to effect an impression from the type-wheel. After the impression has been made an interrupter breaks the circuits by the first forward movement of the type-wheels, and a spring immediately restores the type-wheels to their normal position.

Our invention consists, secondly, in the circuits and electrical and mechanical devices for effecting the unison of the terminal or intermediate station-alternator and the respective instruments connected in circuit therewith and for simultaneously releasing the unison devices.

Our invention consists, thirdly, in the peculiar arrangement and organization of the key-board, keys, contacts, and circuits for effecting the different conditions of line-current; in the construction of the paper-carriage and impression devices; in the electrical and mechanical devices employed; in releasing the paper-carriage at any point in its excursion, and in apparatus for feeding the paper and for operating the impression-hammer.

Our invention consists, fourthly, of numerous details in electrical devices, circuits, and mechanisms, as hereinafter fully described, and pointed out in the claims.

Telegraph-instruments such as are comprised in the present system will operate either as transmitters or receivers without modification and may be constructed and arranged to operate as receivers only by omitting the sunflower device and key-board, the conductor being connected to ground or to line through a polarized relay or through the electro-magnets controlling directly a polarized escapement-armature.

The nature and particular characteristic features of our invention will be more fully understood from the following description, taken in connection with the accompanying drawings, forming part hereof, and in which—

Figure 1 is a longitudinal section of a combined transmitting and receiving instrument embodying the particular features of our invention, showing a key-board, mechanism for rotating the type-wheel shaft, an escapement, sunflower device, printing mechanism, and a paper-carriage. Fig. 2 is a top or plan view of the upper portion of the housing of the instrument, showing the tppe-wheel shaft, two type-wheels, mechanism for shifting and inking said type-wheels, a unison-latch, and a releasing device employed in all the instru-

ments. Fig. 3 is a top or plan view, partly in section, of a combined transmitter and receiver, showing the escapement, shifting and printing magnets, and devices for advancing and releasing the paper-carriage. Fig. 4 is a vertical section on the line x x of Fig. 1, showing in detail the construction of a combined transmitting and receiving instrument. Fig. 5 is a rear elevation of the instrument, showing the printing mechanism, a track or rail, a roller for guiding the paper-carriage, a bumper for a toggle-lever adapted to cause the paper to be fed between lines, and a weight for returning the paper-carriage to its normal position. Fig. 6 is a rear elevation of a paper-carriage provided with two feed-rollers, and showing at the left-hand side thereof the mechanism for feeding the paper between lines. Fig. 7 is a perspective view of the printing devices, mechanisms for releasing the paper-carriage, and the unison-latch. Fig. 8 is an elevational view of the cams for actuating the printing-hammer. Fig. 9 is a diagrammatic view of an alternating station, showing a single-line main circuit having a polarized relay, an alternator, a pole-changer, a relay, and a main battery interposed therein, and also showing local circuits for controlling the escapement, unison devices, and pole-changer magnet. Fig. 10 is a diagrammatic view of a transmitting-instrument, showing a key-board, resistance-coil, sunflower, pulsator, escapement, polarized relay, a neutral relay, printing and shifting magnets, and the circuits and batteries for actuating and controlling the same. Fig. 11 is a diagrammatic view of a terminal station, showing modifications of the devices and circuits of Fig. 9, and also showing at the lower portion thereof an auxiliary battery adapted to increase the strength of the line-current at the transmitting-instrument. Fig. 12 is a diagrammatic view of the parts of a transmitting instrument, showing a modified key-board, and also a relay for effecting a short break in the line when certain keys are depressed prior to closing the line through a resistance. Fig. 13 is a diagrammatic view of a terminal station, showing a detent-magnet, an alternator, a unison device, a relay, and circuits for actuating and controlling the same; and Fig. 14 is a similar view of the parts of a transmitting-instrument, showing devices for cutting out parts of the resistance included in the line by certain keys.

The combined transmitter and receiver consists, essentially, of a base A, in which the keys and electrical connections with the sunflower-segments and the line are located, and which supports at its rear end a table a, carrying the impression and feeding devices, and on top the frame-plates a' and a^2, containing the drum a^8 and train of gearing a^9, driven by a weight a^{10} for actuating the type-wheel shaft b and the escapement and sunflower shaft c, which are geared to one another by a shaft and miter-gearing b', so as to revolve synchronously.

The frame-plates a' and a^2 are separated by distance-plates a^3 and a^4, a back plate a^5, and glass plates a^6 are inserted in front and on top to exclude dust and to render the internal parts of an instrument accessible at any time.

The type-wheel shaft b carries a sleeve b^2, to which are secured two type-wheels B and B′, having letters and characters arranged in similar radial lines on the peripheries thereof. The sleeve b^2 is free to move longitudinally about one-fourth of an inch on the shaft b, but is prevented from turning on this shaft by a fixed cross-bar b^3, secured to the shaft b and carrying two pins b^4, which pass neatly or snugly through holes in the type-wheels B and B′, and on which the type-wheels freely slide. A spiral spring b^5, attached to the cross-arm b^3 and the type-wheel B, permits longitudinal motion of the type-wheels and constantly tends to rotate the type-wheels in their normal direction, thereby preventing any variation from their correct position that might result from enlargement of the holes through which the pins b^4 pass.

The type-wheel B is shown in normal position for delivering impressions.

To place the type-wheel B′ in position to deliver impressions, a shifting device is employed, which consists of the rod d, sliding in supports secured to the plate a^4, extending between the side plates a' and a^2. This rod carries a fixed arm d', which engages loosely in a groove b^6 in the sleeve b^2, mounted on the type-wheel shaft b. The lever d^2 of the armature d^3 and magnet D is pivoted at d^4 to the side frame a^2 and forked at its upper end to embrace the rod d, to which it is pivotally attached. The electro-magnet D is supported on the base A of the instrument. When the magnet is energized, its armature d^3 is attracted and the type-wheel B′ is shifted into the same vertical plane normally occupied by the type-wheel B, and is immediately restored to its previous position by the retracting-spring d^5 after the impression has been taken and the depressed key has been released, thereby closing the line-circuit and causing the type-wheels to again revolve. The first movement of the type-wheel shaft breaks the local printing-circuit by means of the interrupter k.

An ink-roller e, bearing on the periphery of the type-wheels, freely turns on a rod e' between arms e^2, hinged to the standards e^3. The rod e' permits of the longitudinal motion of the ink-roller when moved laterally by the type-wheels. The pressure of the ink-roller e on the type-wheels B and B′ may be adjusted in any suitable manner.

The type-wheel shaft b carries a cam f, which is adjusted thereon relatively to the releasing-space of the type-wheels. This cam f depresses once in each revolution the verti-

cal rod f', which vibrates the releasing device hereinafter described. The type-wheel shaft b also carries a unison spirally-threaded screw g, into the grooves of which the right-angular extremity g' of the unison-latch g^2 engages in a well-understood manner. The unison-latch g^2 is pivoted vertically and laterally at its other extremity to a trunnion g^3, and is solicited downward and laterally by the helical spring g^4. This latch g^2 arrests the type-wheel shaft b at the unison position when the right-angular extremity of the latch g' impinges against the termination of the unison-screw. The unison-latch g^2 is released from the screw g through the instrumentality of the extension h of the printing magnet-lever p^5 each time an impression is given or recorded, as will be hereinafter more fully described.

The sunflower-shaft c is pivotally supported in position concentrically with the table of contacts in the sunflower C, and carries the escape-wheel i, the local-circuit-interrupting wheel k, and an arm l, which once in each revolution at the unison position separates the insulating-springs l' and l^2, thereby interrupting at this position only the local circuit which is employed to energize the shifting-magnet D. The number of teeth in the escape-wheel i is equal to half the number of divisions on a type-wheel B or B', one division for either type-wheel being positioned radially by each vibratory movement of the escapement-armature lever and pallets i'. The armature i' may be a polarized armature vibrated between the poles of electro-magnets I by alternating line-currents or a neutral armature vibrated by the current of a local battery closed alternately through the respective electro-magnets by the contacts of a polarized relay M included in the line-circuit.

The ratchet-wheel k for interrupting the local circuit has as many beveled teeth as there are divisions on each of the type-wheels or some multiple thereof. The right-angular lever k', pivoted at k^2 and solicited by the helical spring k^3, has a beveled projection k^4, which rides over the beveled teeth of the ratchet-wheel k by the revolution of the shaft c, causing the insulated contact-point k^5 thereon to rapidly make and break contact with the fixed and insulated contact-point k^6, and when the shaft c is arrested by the pallets on i' the projection k^4 of the arm k' drops into one of the teeth on the interrupting-wheel k, permitting the insulated contact-points k^5 and k^6 to close the portion of the local circuit hereinafter described.

The sunflower C consists of insulated contact-segments c' equal in number to the divisions on each type-wheel. A hub c^2, insulated from the shaft c, carries an arm c^3, to which is secured a contact spring or brush c^4, divided at its extremity so as to overlap the insulating-strips c^5, separating any two segments and thereby preventing any interruption of the line-circuit as the contact-spring sweeps over the segments. The line is conducted to the hub c^2 by means of a hub c^6 and spring c^7, bearing thereon and supported at its other extremity on an insulated bearing. Each segment of the sunflower is connected by a conductor 10 to one of the springs n, which are attached to a bar of insulating material n', secured to the base n^2, preferably made of wood, vulcanite, or other suitable insulating material.

The keys and their contact-springs are preferably supported, as shown, by the removable key-board N; but we do not limit ourselves to this particular arrangement of the keys and contacts shown, since numerous modifications of construction and arrangement of the parts for effecting the same result may be substituted therefor. There are three transverse ranges of keys, each range consisting of two rows of keys N' and N², with ten keys in each row, making thirty keys for each type-wheel and corresponding in number with the divisions on said wheels. The first, third, and fifth transverse rows N' relate to the type-wheel B, normally in position for printing, and the second, fourth, and sixth rows N² relate to the type-wheel B', which must be shifted into position to deliver its impression on the same line with the impression given by the type-wheel B. Any two adjacent keys N' and N² in the respective odd and even numbered rows are so associated by their contacts and circuits as to arrest the type-wheels, by means hereinafter described, at the same radial position; but the circuits and devices are such that when the type-wheels are arrested by the depression of a key N' in the first, third, or fifth row an impression is given by the wheel B, and when arrested by the depression of a key N² in the second, fourth, or sixth row the type-wheel B' is shifted into the position to give an impression in the position previously occupied by the type-wheel B.

The characters on the type-wheel B are presented in regular order, starting from the unison position (indicated by the first key n^{11} on the left in the first row) as the keys are successively depressed in regular order from left to right in each range of double rows of keys—that is, the odd rows of keys passing successively from left to right in rows will give all the positions for the type-wheel B, and the even rows of keys will similarly give all the positions for the type-wheel B', two adjacent keys, as N' and N², in any range indicating the same segment c' of the sunflower and the same radial position of both type-wheels. With this explanation the circuits controlled by the keys, their functions, and the devices associated therewith will be readily understood when the circuits are described in detail by reference to the diagram Figs. 9 to 14, and the detail connections shown in Fig. 10.

The paper-carriage O, Figs. 1 and 6, consists of two side bars, between which are se-

cured the rack-bar o', strut o^2, which forms the guide-rail for the paper-carriage, a bar o^3 to guide the sheet of paper, and a split bar o^4 between the upper ends of the side bars o. There are also grooved guide-bars o^5 on the inner side of the side bars o to hold the edges of the sheet of paper o^6. The carriage runs on two wheels o^7, supported on a track o^8, secured to the rear end of the base A. Below the track are two safety-wheels o^9 to prevent the carriage from being derailed. The strut o^2, forming the upper guide-rail, bears on a single-grooved wheel o^{10}, which is pivoted to a bracket p, rising from the post p', which supports the impression-hammer p^2 and the lever p^3, that actuates the same. By employing only one wheel for the guide-rail o^2 the necessity of extending this rail beyond the side bars o of the paper-carriage is obviated. The paper-roller o^{11}, the feed-roller o^{12}, and the pressure-roller o^{13} are journaled in the side bars o. The end of the feed-roller journal carries a ratchet-wheel o^{14}, in which engages the pawl o^{15}, pivotally attached to the upper end of a sliding bar o^{16}, moving in a guide o^{17}, fastened to the side bar o. The lower end of the sliding bar o^{16} is hinged at o^{18} to one arm of a toggle-lever o^{19}, the other arm of which is hinged to the side bar at o^{20}. A spring o^{22} maintains the pawl o^{15} in contact with the ratchet-wheel o^{14}, and a helical spring o^{21} draws back the sliding bar o^{16}, and thereby deflects the toggle-lever o^{19}. When the paper-carriage is released, as hereinafter described, a cord o^{23}, solicited by a weight o^{24}, causes the carriage to run backward, and when it nears the end of its excursion the deflected toggle-levers o^{19} strike against a fixed arm o^{25}, causing the toggle-levers to assume a nearly vertical position, thereby forcing the sliding bar o^{16} upward, and by means of the pawl o^{15} revolving the ratchet-wheel o^{14} and the feed-roller o^{12}, so as to feed the paper the space between two lines of printing. The toggle-jointed levers possess many advantages over cams or inclined ways for effecting this result, since the power exerted by the toggle-jointed levers increases as the momentum of the paper-carriage diminishes.

The magnet P, by which the paper-carriage and the impression and releasing devices are controlled, is attached to the table A, Figs. 1, 3, 5, and 7. Its armature p^4 is attached to the lever p^5, turning on trunnions p^6, pivoted in the table A and the bracket p^7. The lever p^5 carries at its extremity a pawl p^8, with a spring p^9, which causes the pawl p^8 to engage with the teeth of the rack o'. When the magnet P is energized, the armature p^4 is attracted and the pawl p^8 engages a tooth of the rack o', and when the local circuit through the magnet is broken the retracting-spring p^{10} causes the lever p^5 to move the paper-carriage forward one notch to space between letters of the printing. The carriage is prevented from taking a retrograde movement by a detent p^{11}, when the electro-magnet p attracts its armature. To a post p', supported by the table A, is secured a horizontal pipe p^{12}, through which the rod p^{13}, carrying the printing-hammer p^2, is guided. The rod is surrounded by a helical spring p^{14}, which causes the return movement of the rod p^{13}. In a bracket p^{15}, attached to the post p', a lever p^3 is pivoted, forked at its upper end to engage the rod p^{13}, and having at its lower end a reciprocating pawl p^{16}, pivoted thereto and arranged so that the rear extremity p^{17} of the pawl plays between shoulders. Another similar reciprocating pawl p^{18} is arranged so as to be held rigidly by a spring p^{19} against a shoulder p^{20} during the downward motion of an arm p^{21}, attached to the rock-shaft p^{22}, turning in supports p^{23}. Another arm p^{24} on the same rock-shaft is connected by a link p^{25} to the lever p^5. When the electro-magnet P is energized, the lever p^5 rocks the shaft p^{22} and the pawl p^{18} strikes and passes the pawl p^{16}, causing a movement of the forked lever p^3, and thereby effecting a quick blow of the printing-hammer p^2, which instantly recoils by the action of the helical spring p^{14} on the rod p^{13}. When the local circuit through the electro-magnet P is interrupted, the lever p^5 recoils, rocking the shaft p^{22} in a reverse direction, whereupon the reciprocating pawls, being pivoted and free to revolve during the return movement, pass one another and are again in a position to engage by means of the spring p^{19}, attached to the pawl p^{18}, when the magnet P is energized.

The mechanism for releasing the paper-carriage at any point in its excursion will now be described. A cam f, (see Fig. 7,) secured to the type-wheel shaft b, once in each revolution of the shaft strikes and depresses a rod f', sliding freely and vertically in guides attached to the rear plate a^5 of the frame-work of the instrument. This rod f' abuts against the shorter arm of the lever f^2, pivoted by the trunnion f^3 to supports secured to the plate a^5. The longer arm of the lever f^2 carries at its extremity a link f^4, supporting a strut f^5, one end of which rises into the path of a projection f^6, fixed to the under side of the lever p^5, and falls clear of the same each time the cam f on the type-wheel shaft b passes over the rod f'. The other end of the strut f^5 is connected by a universal joint to the short arm of the bell-crank lever f^7, pivoted by a stud screw to a table a. The long arm of this bell-crank lever f^7 bears against the short arm f^8 of a bent lever f^9, also pivoted by a stud-screw to the table a, and the extremity of this lever terminates in a cross-arm in which are fixed two pins f^{10} and f^{11}, which engage the pawl p^8 and the detent p^{11}. These pins are held out of contact with the pawl and detent by the spring f^{12}. A key n^3, called the "releasing-key," is connected by a conductor to a division of the sunflower device indicating a blank division on both type-wheels, and the cam f is so adjusted on the type-wheel shaft b that when the type-wheels

are arrested by the depression of the key n^3 the cam f hangs vertically and stops directly over the sliding rod f', slightly depressing the same. This causes the lever f^2 to lift and firmly hold the strut f^9 in the path of the projection f^6, and since the electro-magnet P is now energized by the circuits to be described its armature q^4 is attracted, causing the projection f^6 on the lever p^5 to collide with the strut f^5, thereby actuating the bell-crank lever f^7 and curved lever f^9. The pins f^{10} and f^{11} consequently disengage the pawl p^8 and the detent p^{11} from the rack o' and retain them in this position while the key n^3 is depressed, permitting the paper-carriages of all the instruments looped in the line to return to their initial position by the weight o^{24} from any point in their excursion, thus enabling any operator on a long line in which numerous instruments may be included to simultaneously bring the paper-carriages of all the instruments to unison from any point in the excursion of the carriages O. This result cannot be effected by an automatic releasing-device, such as heretofore employed.

A description of the electric circuits and devices included therein will now be given. The line-battery Q, Fig. 9, may be any suitable source of electric energy located at a terminal station and with transmitting and receiving instruments looped in the line at intermediate points. All the apparatus for alternating the currents of the battery through the line and for arresting the alternator is preferably located at the station with the line-battery, and this station may be at any point in the line and connected to earth. From one electrode—say the positive—of the line-battery a conductor 1 is connected to the coils of a relay U, and from the same a conductor 2 is led to one contact-spring v of a pole-changer V. The other electrode is connected by a conductor 3 directly to the other contact-spring v' of the pole-changer V. From the two back contacts v^2 and v^3, electrically connected, a conductor 4 is led to the two contact-springs t and t' of the alternator T, and from the lever v^4 of the pole-changer V another conductor 5 is connected to the two contact-springs t^2 and t^3 of said alternator T. The line-spring t^5 and earth-spring t^4 bear upon hubs t^6 and t^7, electrically connected with disks comprising alternate contacts and insulations. The two inner springs t' and t^3 bear on alternate contacts and insulations on the disks t^9 and t^{10}, and these contacts and insulations alternate with those on the disks t^8 and t^{11} and are in electrical connection each with the adjacent outer disks t^6 and t^7, but insulated from one another by the disks t^{12}, of insulating material. It is evident, therefore, that as the disks revolve, presenting alternately two contacts on the outer disks and two contacts on the inner disks to their respective contact-springs, the direction of the current from the line-battery will be alternately to line and to earth. When the alternator in the line is at an intermediate station, the earth-spring t^4 is connected with a line running in an opposite direction to the line connected with the spring t^5, and the same effects are thereby produced as when the alternator T is located, as illustrated in Fig. 9, in the line at the terminal station. The current in the line passes by the conductor 6 to the coils of a polarized relay W, through the same, and then by the line 7. The relay U closes, through its front contact u and through the coils of the pole-changer magnet V, the circuit 20 of the local battery q, and through its back contact u' the coils of the unison-magnet S and the circuit 20 and 21 of the same local battery. The polarized relay W closes by one contact w the circuit 23 and 24 of a local battery q' through the coils of the escapement magnet R, and by its other contact w' the circuit 25 and 24 of the same local battery q' and through the coils of the escapement-magnet R'. As the currents in the line alternate, the armature r of the escapement-magnets R and R' vibrates, thereby actuating the pallets r' between the teeth r^2 of the escape-wheel r^3 on the shaft r^4 of the alternator T without arresting said shaft. The armature r will continue to vibrate automatically as long as alternating currents are maintained in the line, but as soon as the circuit of the pole-changer magnet V is broken at the front contact u of the relay U the pole-changer armature v^4 leaves the poles of said magnet and its lever falls away reversing the direction of the current to the alternator and to line. This arrests the vibration of the armature r of the escapement magnets R and R', and one or the other of the pallets r' contacts with a tooth in the escape-wheel r^3. When the alternator T is arrested, the levers of all the polarized relays at the respective instruments in line are also arrested, and all the type-wheels of such instruments are consequently arrested in unison at the letter indicated by the key depressed at the transmitter, and the relay-tongue u^2 breaks from its front contact, whether a key breaking the line or a key closing the line circuit through a resistance is depressed, or whether the latter key causes the line to be interrupted for a very short interval before closing the line through a resistance. The line-circuit passes from the polarized relay W by the conductor 7 through the coils of a neutral relay X with front and back contacts x^3 and x^4, then by a conductor 8 to a polarized relay M through the coils of its magnet by the conductor 9 to the sunflower-brush c^7, and from the insulated hub c^6 through the arm c^3 and brush c^4 to the contacts c' as the brush c^4 sweeps over the same. The polarized relay M closes the circuit of a local battery q^3 through the escapement-magnet I by its tongue m^2 and contact m', and through the escapement-magnet I' by its tongue m^2 and the contact m. Each contact c' of the sunflower is connected by a conductor 10 to the spring n in the base of the instrument. The

spring n connects with the insulated contact-piece n^4, with which the spring n^5 on a key N^2 in an even row of keys contacts. The spring n^6 on the opposite side of this key N^2, is electrically connected with the spring n^5, and the course of the current is through these springs n^5 and n^6 to the insulated contact n^7. The spring n^8 on an adjacent key N', in an odd-numbered row of keys, is in the same circuit, and the spring n^8 contacts with the insulated contact n^7, and the opposite end of the spring n^8 contacts with a bar-conductor n^9, which is connected by the conductor 11 to earth when one transmitter only is in line, but to line and the other transmitters when more that one is in line and then to earth. When a key N^2 is depressed, the springs n^5 and n^6 break contact and thereby interrupt the line when the sunflower-brush c^4 contacts with the segment c', connected electrically with the key depressed. The conductors 12 are connected to the contact-pieces n^4 and the springs n^{10}, which when depressed contact with a bar n^{12}, connected by the conductor 13 to a resistance R^2, and then by the conductor 14 to earth. It follows that when a key in an even-numbered row of keys is depressed it breaks the line to the odd-numbered row, and at the same time the circuit of the line is closed through the resistence R^2 when the sunflower-brush c^4 contacts with the segment c' connected electrically with this key. To prevent the current passing from the springs n^{10} back to line through other ranges of keys, said springs are insulated from one another and an insulation on the lower end of the key N^2 presses on the spring n^{10} until contact is made with the conductor-bar n^{12}. When a key is released, the uniform line-current acts to attract the armature of the relay U at the terminal station, and the instruments run with a full current until another key is depressed. In operating the keys N' and N^2 it is necessary for rapid work to press each succeeding key before the last one pressed is released, otherwise the type-wheels of all the instruments will run to unison and be arrested in that position.

The operation of printing is as follows: All the instruments being at unison with one another and with the alternator T, and held by the unison-latches g^2, the unison-key n^{11} is depressed by the operator at any instrument in line. This breaks the line-circuit through the coils of the relay U, whereupon its lever u^2 breaks at its front contact u the local circuit 20 through the pole-changer magnet V, and closes at its back contact u' the local circuit of the battery q through the unison-magnet S, which consequently attracts its armature s', and by the rod s^2 releases the unison-latch s of the alternator T, while at the same time the detent s^3 on the lever s^2 holds the alternator-shaft r^4 in this position as long as the unison-key n^{11} remains depressed. Instead of closing the local circuit of the battery q through the back contact u' of the relay U, the circuit of a battery q^4 may be employed and closed by the contact-lever u^8 and the contact u^9 through the coils of the unison-magnet S. At each instrument in line the neutral relay-lever x^5 contacts with its back-stop x^4, closing the local circuit of the battery q^2 from one electrode through the conductor 28 to the insulated contacts k^6 and k^5 of the interrupter now in contact, then by a conductor 29 to the lever x^5 of the relay X, then through its back-stop x^4, by the conductor 30, to the coils of the printing-magnet P, and the conductor 31 to the other electrode of the battery. On the extremity of the lever p^5 of the printing-magnet P an arm h is fixed, which extends into the instrument, Figs. 3 and 7, where it contacts with a bell-crank lever h', pivotally attached to the rear plate a^5 of the instrument. This bell-crank h' supports a vertical rod h^2, moving freely in guides attached to the rear plate a^5, and abuts against the under side of the unison-latch g^2. When the circuit last described is closed, the armature p^4 is attracted and the bar h on the end of the lever p^5 strikes one arm of the bell-crank lever h' and the rod h^2, and consequently releases the unison-latch g^2 simultaneously with the release of the latch s at the alternator T. The operator now depresses a key N'—say in the odd-numbered range relating to the type-wheel B—and releases the unison-key n^{11}, whereupon, the line-circuit 7 being closed, alternating pulsations cause the type-wheels B and B' to rotate rapidly until the sunflower-brush c^4 contacts with a broken-line segment c' electrically connected with the key depressed, the projection k^4 of the interrupter-arm k' again drops into a notch in its ratchet-wheel k, closing the insulated contacts k^5 and k^6, and the relay-tongue x^5 falls against the back-stop x^4, thereby closing the circuit last described. The armature p^4 being attracted, the lever p^5 of the printing-magnet P is drawn forward, causing the reciprocating pawls p^{16} and p^{18} to collide and pass one another, as previously described, thereby effecting a sudden blow of the printing-hammer p^2 against the paper o^6, which causes an impression of the character presented on the type-wheel by the key depressed. The pawl p^8 also engages with another tooth of the rack o'. When the local circuit is interrupted at the relay X, in consequence of the release of this key, the line is closed. The type-wheels consequently begin to revolve and the circuit of the battery q^2, through the printing-magnet P, is broken at the contacts k^5 and k^6 of the interrupter k'. The retracting-spring p^{10} moves the lever p^5, thus causing the carriage O to advance one step to space between letters of the printing, and at the same time by the intervention of the bar p^{25} and rock-shaft p^{22} the reciprocating pawls p^{16} and p^{18} pass one another in the manner hereinbefore described and are in a position to repeat the operation. If a key N^2 in an even-numbered row be depressed, the

relay U at the terminal or intermediate station again breaks the line-current at its front contact u, and also causes the unison-latch s to be lifted, (a result which must occur at the impression of every letter,) and the alternator T, and consequently the type-wheels B and B′, of all instruments in line are arrested at the indicated position. There is now a weak current in line, and the neutral relay-lever x^5 contacts with its front stop x^3, closing the circuit of the printing local battery q^2 from one electrode by the conductor 28 to the insulated contact k^6 and k^5 of the interrupter k', then by the conductor 29 to the lever x^5 of the relay X, then from its front contact x^3 by the conductor 32 to the insulated spring l^2 of the unison cut-out L, (normally closed except at the unison position,) then from the other spring l' of the cut-out L by the conductor 33 to the insulated arm d^6 on the trunnion d^4 of the lever d^2 of the shifting-magnet D. This magnet D is of much greater resistance than the printing-magnet P. The insulated arm d^6 is in electrical contact with an insulated spring d^7, which completes the circuit by the conductor 34 to a resistance R^3 and to the coils of the shifting-magnet D, and then by the conductors 35 and 31 to the other electrode of the battery q^2. Just before the shifting-lever d^2 has completed its full stroke the arm d^6 contacts also with the insulated spring d^8, which closes the circuit in parallel through the coils of the printing-magnet P by the conductors 36 and 31 to the last-named electrode of the battery. The printing-magnet P, being of lower resistance than the magnet D, takes the stronger portion of the divided current to effect the printing, as previously described, while the portion through the coils of the shifting-magnet D is still sufficient, when the armature d^3 is near the poles of the magnet D, to hold the type-wheel B′ in position to deliver the impression on the same line with the impression previously given by the type-wheel B. Two or three impressions can evidently be taken alternately at the same position of the type-wheels by alternately pressing and releasing two keys connected electrically to the same segment of the sunflower, the keys, respectively, causing a break or a weak current through the line. The alternator T cannot move until a full current sufficient to actuate the relay U at the terminal or intermediate station passes over the line, and this cannot occur with alternate breaks and resistance in line; but the neutral relay X, which controls the type-wheel shifting and printing devices, will respond to breaks and to weak currents in line.

The complete circuits of a system embracing a relay U, pole-changer V, alternator T, automatic escapements R and R′, and unison devices S and s, located at a terminal station, as shown in Fig. 9, and operating with equal efficiency at any intermediate station of a line with both terminals of the line to earth have been fully described.

In carrying our invention into effect we do not wish to limit ourselves, however, to the employment of all of the devices and apparatus illustrated in Figs. 9 and 10. The alternator T may be a mechanically or magnetically actuated pole-changer.

In Fig. 11 we have shown a pole-changer with its magnet V, the local circuit of which is closed and broken by a rheotome T′ on the shaft r^4. A relay U is employed, as in Fig. 9, which closes at its front contact u the circuit of a local battery q, through the coils of a detent-magnet Z^2. The relay U breaks the circuit at its front contact u, when the line is broken or when the resistance is introduced by the keys of a transmitter, and the circuit through the electro-magnet Z^2 is thereupon interrupted. The detent-lever z', solicited by its retracting-spring z^2, engages a tooth of the ratchet-wheel z on the regularly-speeded shaft r^4, driven by frictional contact with a pulley r^5, actuated by any suitable power, and the shaft r^4, rheotome T′, and pole-changer V are consequently arrested. The back contact u' of the relay U closes the local circuit of the battery q through the coils of the unison-magnet S, as hereinbefore described.

In Fig. 11 one electrode of the line-battery Q is connected through the coils of the relay-magnet U to a contact-spring v of the pole-changer V. The other electrode is connected to the contact v'. The contacts v^2 and v^3 are connected to earth, and the lever v^4 is connected with the line 7. When the line-circuit is closed, the armature of the lever u^2 is attracted, closing by the front contact u the local circuit of the battery q through the coils of the detent-magnet Z^2. The armature z^3 of the detent-magnet Z^2 is consequently attracted, thereby retaining the detent-lever z' out of contact with the ratchet-wheel z, and the shaft r^4 and rheotome T′ revolve continuously at uniform speeds. The circuit of a local battery q^5 is closed and broken successively by the rheotome T′ through the pole-changer magnet V, causing rapid vibrations of the lever v^4, and consequently rapid alternating currents from the battery Q are sent to line. When a key at any transmitter is depressed, the relay U breaks the circuit of the battery q through the detent-magnet Z^2 and the lever z', and consequently arrests the ratchet-wheel z and the rheotome T′. The rheotome T′ being arrested the vibration of the lever v^4 is also arrested when a current of one polarity is passing to line, and the printing is effected as previously described. In order to re-enforce the line-current after the alternating devices have been arrested by including a resistance in the line at any transmitter, as hereinbefore described, in Fig. 11 has been illustrated an auxiliary battery Q′, one electrode of which is connected to the contact-lever u^8 of the relay U, and through the contact u^9 to one of the springs v', and the other electrode is connected directly to

the spring v. When the pole-changer V is vibrating, this circuit is open at the contact-lever w^8 and contact w^9; but when the line-current through the relay U is greatly reduced by the introducing of a resistance at any transmitter the lever w^8 falls against its contact w^9, thereby closing the circuit of the battery Q′ to line in parallel with the circuit of the battery Q.

The circuits illustrated in Fig. 12 are similar to those shown in Fig. 10, with this exception, that the polarized relay M and the local circuit through its contacts and the escapement-magnets I and I′ have been omitted. The line-circuit is connected by the conductor 8 to the coils of the escapement-magnets I and I′, and then by the conductor 16 to the sunflower-brush c^7, and then to line through the sunflower and key o, as previously described. The armature i' is in this case a polarized armature and responds to alternating currents in the line.

A detent may be employed with the rotating alternator of Fig. 13 or the vibrating pole-changer of Fig. 11, and the relay U, Fig. 11, or relay U of Fig. 13 may be omitted, provided the coils of the detent-magnet Z^2 be included in the conductor of one polarity between one of the electrodes of the line-battery and the pole-changer. In this case a back contact must be provided for the lever of the detent z' to close the circuit of a local battery q through the coils of the unison-magnet S in a well-understood manner to those skilled in electrical science.

It is a well-known fact that a relay-armature will fall from the poles of a magnet and interrupt the circuit much quicker when there is a complete break of the line-circuit through the coils of the magnet than when a high resistance is introduced into the line. We take advantage of this in order to attain greater rapidity of operation by including the coils of a relay Y, Fig. 12, in the conductor 11 between the line-contact bar n^9 of the odd-numbered rows of keys N′ at each transmitter in the line or to earth. The conductor from the bar n^{12}, leading to the resistance R^2, is carried to the lever y of the relay Y, and through its back contact y' and by the conductor 13 to the resistance R^2, and then by the conductor 14 back to line. Since the instruments operate by closed circuits and this circuit to line is always broken when any key is depressed and the brush c^4 of Fig. 12 contacts with a segment c' of the sunflower electrically connected with the depressed key, there will be a break in the line of very short duration, followed by the introduction of a resistance R^2 into the line every time a key N^2 is depressed. During this very short interval the armature of the relay U, connected with the conductor near the electrode of the line-battery Q, will fall away and the line-current reduced by the interposed resistance R^2 will not be of sufficient strength to cause the magnets of the relay U to overcome the retracting-spring u^4. By these devices we attain rapidity and absolute certainty of action in arresting the alternator T.

In Fig. 13 is shown a revolving alternator T with a detent similar to that previously described in connection with Fig. 11. In Fig. 13 the electrodes of the line-battery Q are connected to the four interior springs of the alternator, as hereinbefore described. One outside spring connects with the line 7 and the other outside spring is connected to earth in a similar manner, as is illustrated in Fig. 9. The relay U is included in the conductor between one of the electrodes of the battery Q and the alternator T and is consequently traversed by currents of one polarity only. When the line-current is interrupted or greatly reduced by interposing a resistance at any transmitter, the relay U breaks at its front contact u the circuit of the local battery q through the detent-magnet Z^2 and the alternator T is arrested, as hereinbefore described.

In order to re-enforce the current on long lines when the resistance R^2, Fig. 14, is thrown into line, a relay Y is inserted in the circuit of the line from the contact-bar n^9 by the conductor 11 to the coils of the relay Y and then by the line 14 to earth or to line. When a key N^2 is depressed, the circuit to the contact-bar n^9 is broken and the circuit of a shunt-line is closed by the spring n^{13}, contact-bar n^{15}, spring n^{10}, and bar n^{12}, through the resistance R^2 to earth or to line. The break of circuit through the relay-magnet Y causes the lever y to contact with its back contact y', thereby closing a branch circuit 17 and 18 through the lever y and the contact y'. This circuit cuts out part of the resistance R^2, thereby increasing the current in the line and thereby insuring greater certainty of action of the neutral relay X.

We are aware that a magnetic detent has been employed at a central station to arrest a shaft controlled by power frictionally connected and carrying an alternator when the coils of the magnets controlling the detent were included in the circuit of a local battery. The circuit of this battery was closed by a sunflower device when a segment of the sunflower was connected by a conductor to a key of a transmitter by which, when the key was depressed, another break in the local circuit was closed, causing the detent magnet to attract its armature and the detent-lever to engage a ratchet-wheel on said shaft. Such devices were employed to transmit stock quotations from a central station and were operated by means of a local battery-circuit. Such is not our invention, and we do not lay claim thereto.

The apparatus for arresting the alternating devices hereinbefore described is controlled by distant transmitters operating through a single-line circuit.

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

1. A printing-telegraph system comprising a source of electric energy and electrical and mechanical devices located at a station for alternating the polarity of the current in a single line, transmitting and receiving instruments looped in the line, and each instrument provided with type-wheels, means at said station for arresting the alternating devices responding to different conditions of current, keys in any transmitter, type-wheel shifting and impression devices, and mechanical and electrical devices responding at each instrument to a break or weak current in the line caused by the depression of any key of said transmitter to effect the arrest of the type-wheels at a position to present the character as indicated by the depressed key to the impression device.

2. A printing-telegraph system comprising a source of electric energy, a single line, electrical and mechanical devices located at a station operating to alternate the polarity of the current in said line, transmitting and receiving instruments looped therein and each having two type-wheels, a relay at said station in a portion of one of the conductors between one of the electrodes and the alternator, arresting devices located at said station in a local battery-circuit and controlled by said relay in consequence of the varying conditions of current effected either by the interposition of a resistance or by breaking the line by the depression of a key of a transmitter and having such relation to said keys of the transmitter that the alternating devices at said station and the type-wheels of all the instruments connected in line move in unison, and mechanical and electrical devices controlled by a double-contact neutral relay at the transmitting and receiving instruments responding to varying conditions in the line to cause a type-wheel of each instrument to assume a position to permit of an impression being effected.

3. In a printing-telegraph system, a source of electric energy at a station, a single line, a current-alternator driven by suitable power and controlled by a polar-escapement device, the electrodes connected to contact-springs of said alternator, a relay interposed between the source of electric energy and said alternator, a pole-changer with its contacts connected to said electrodes and to the contact-springs of the alternator, a magnet controlling the pole-changer included in the circuit of a local battery closed through one of the stops of said relay, transmitting and receiving instruments connected in said line-circuit, polarized relays in said line-circuit located at the instruments and controlling escapement devices and type-wheels by a local battery-circuit, the transmitters having keys to interpose resistance in said lines, keys to break said lines when a key is depressed and operating to cause the relay at said station to break the local circuit of the pole-changer magnet, thereby reversing the direction of current in the line and simultaneously arresting the alternator at said station and the type-wheels of all the instruments included in said line.

4. A single-line printing-telegraph system comprising a source of electric energy, electrical and mechanical devices located at a station for alternating the direction of the current in line, transmitting and receiving instruments looped in said line and each instrument provided with type-wheels, means at said station for arresting the alternating devices responding to different conditions of current in the line battery-circuit effected by interposing resistance through keys and by breaking the line by the depression of keys in any transmitter, an auxiliary battery at said station, and means for including the same in line for strengthening the current thereof.

5. A single-line printing-telegraph system comprising a source of electric energy, electrical and mechanical devices located at a station for alternating the polarity of the current in line, transmitting and receiving instruments looped in said line and each instrument provided with type-wheels, means at said station for arresting the alternating devices and responding to different conditions of current in said line effected by interposing resistance through keys and by breaking the line by the depression of keys in any transmitter, an auxiliary battery at said station in connection with said source of electric energy, and a relay at said alternating station for introducing said auxiliary battery into said line for strengthening the current thereof.

6. A single-line printing-telegraph system comprising a source of electric energy and electrical and mechanical devices located at a station for alternating the direction of the current in said line, an auxiliary battery connected with said alternating devices for strengthening the current in said line, transmitting and receiving instruments looped therein and each provided with type-wheels, means for arresting the alternating devices responding to different conditions of current in the line, keys for interposing resistance and breaking the line, type-wheel-arresting devices adapted to permit of the type-wheels being simultaneously arrested at the character indicated by the depression of a key, and mechanical and electrical devices responding at each instrument to a break in the line or to a weak current in the line produced by the depression of any of said keys to cause a character on said type-wheels to be impressed therefrom simultaneously on all instruments included in said line.

7. A printing-telegraph system comprising a source of electric energy, electrical and mechanical devices, a single-line circuit, alternating devices at a station for alternating the direction of currents of said line, transmitting

and receiving instruments looped therein and provided with two type-wheels, means for arresting the alternating devices and responding to different conditions of currents in the line, resistance-keys and keys for breaking said line, arresting devices adapted to permit of the type-wheels of said instruments being simultaneously arrested at a character indicated through the depression of a key, and mechanical and electrical devices to cause a character on said type-wheels to be impressed therefrom simultaneously on all instruments in said line.

8. A printing-telegraph system comprising a source of electric energy, a single line, electrical and mechanical devices located at an alternating station, transmitting and receiving instruments provided with two or more type-wheels looped in said line, means at said alternating station for arresting the devices located thereat and responding to different conditions of current in the line effected by interposing resistance therein, keys at the transmitter for breaking the line, and mechanical and electrical devices responding at each instrument to a break in the line or a weak current in the line to cause a character on the type-wheels to be simultaneously recorded on sheets of paper on all the instruments looped in said line.

9. A printing-telegraph system comprising a source of electric energy and electrical and mechanical devices located at a station for alternating the direction of current in a single line, transmitting and receiving instruments looped in said line and each instrument provided with type-wheels, means at said station for arresting the alternating devices, keys for interposing resistance and for breaking said line, and a relay located at any transmitting-instrument for cutting out a portion of said resistance.

10. A printing-telegraph system comprising a source of electric energy, a single-line circuit, electrical and mechanical devices, an alternating station, transmitting and receiving instruments provided with two type-wheels and looped in said circuit, keys for interposing resistance and for breaking said line, and neutral relays included in said circuit at the transmitting and receiving instruments.

11. A single-line printing-telegraph system comprising a source of electric energy, electrical and mechanical devices, an alternating station, transmitting and receiving instruments looped in said circuits and provided with two type-wheels, keys for interposing resistance and for breaking said line, and neutral and polar relays included in said circuit at the transmitting and receiving instruments and controlling, respectively, the printing mechanism and type-wheels of the instruments.

12. A printing-telegraph system comprising a source of electric energy, a single-line conductor, electrical and mechanical devices, alternating devices at a station for alternating the direction of the current in said line, a relay included in said line for arresting said alternating devices, transmitting and receiving instruments looped in said line, keys for interposing resistance and for breaking said line, and magnetic devices in said line at the transmitting and receiving instruments for closing local battery-circuits through the printing-magnets of said instruments.

13. A printing-telegraph system comprising a source of electric energy, a single-line conductor, electrical and mechanical devices, alternating devices at a station for alternating the direction of the current in said conductor, a relay included in said circuit to cause the arrest of said alternating devices, transmitting and receiving instruments looped in said circuit, keys for interposing resistance and for breaking said conductor, and a magnetic device included in said line conductor at the transmitting and receiving instruments for closing local circuits in parallel through the shifting and printing magnets of said instruments.

14. A printing-telegraph system comprising a source of electric energy, a single-line circuit, electrical and mechanical devices at a station in said line for alternating the currents therein, arresting devices at said station, magnetic devices in said instruments operating by uniform alternating currents, resistances at said instruments, and keys therein operating to interpose said resistances in and to break said line.

15. A single-line printing-telegraph system comprising a source of electric energy, a circuit, electrical and mechanical devices, an alternator at a station, transmitting and receiving instruments looped in said circuit and each provided with two type-wheels operating by uniform alternating currents, keys for interposing resistance and breaking said circuit, and a relay at any transmitting-instrument for cutting out a portion of said resistance.

16. A printing-telegraph system comprising a source of electric energy, a circuit, electrical and mechanical devices located at a terminal station for alternating the direction of the current in a single line, transmitting and receiving instruments looped in said line, detent and unison magnets at the terminal station included in said line for arresting the alternating devices, a relay responding to different conditions of current in said line, resistances at the transmitting-instruments, a relay located in said line at each transmitting-instrument for short-circuiting a portion of the resistance, and two series of keys for controlling said line-circuit.

17. A printing-telegraph system comprising a source of electric energy, a circuit, electrical and mechanical devices, an alternating station, transmitting and receiving instruments looped in said circuit, a detent-magnet at said alternating station, a relay respond-

ing to different conditions of current in said circuit, resistances at all of said instruments, and keys for controlling said line-circuit.

18. A printing-telegraph system comprising a source of electric energy and line-circuit, electrical and mechanical devices located at a station in said circuit for alternating the current in said line, a local battery-circuit at said station, a unison magnet included in said local circuit, transmitting and receiving instruments looped in said line circuit, a relay-magnet responding to varying conditions of current in said line, and a resistance adapted to be interposed at any transmitting-instrument by one of two series of keys in each transmitting-instrument.

19. A printing-telegraph system comprising a source of electric energy and line-circuit, electrical and mechanical devices located at a station in said line-circuit for alternating the direction of current in said circuit, means for arresting the alternating devices at said station, transmitting and receiving instruments looped in said line-circuit, a relay-magnet responding to different conditions of current in said line-circuit, a resistance at each transmitting-instrument, and keys for including said resistance in and for breaking said line.

20. A printing-telegraph system comprising a source of electric energy, a circuit, electrical and mechanical devices, a station for alternating the direction of current in said circuit, transmitting and receiving instruments, means for arresting the devices at said station, keys for interposing resistance and breaking said circuit, a neutral relay responding to different conditions of current in said circuit at said instruments, and a relay for cutting out a portion of said resistance.

21. A printing-telegraph system comprising a source of electric energy, a single line, electrical and mechanical devices located at a station for alternating the direction of current in said line, a relay at said station responding to breaks and changes of intensity of the current, a relay at the transmitting-instrument for producing short instantaneous breaks, followed by the introduction of resistances in said line, and a row of keys for controlling said relay and line.

22. A printing-telegraph system comprising a source of electric energy and line-circuit, electrical and mechanical devices located at a station for alternating the current in said line-circuit, polarized escapement and unison devices at said station for said alternating devices, transmitting and receiving instruments looped in said line-circuit, a relay at said transmitters for causing short breaks of circuit and for introducing resistance in said circuit, and keys in said transmitters for controlling said relay and circuit.

23. A printing-telegraph system comprising a source of electrical energy, a single line, electrical and mechanical devices located at a station for alternating the current in said line, transmitting and receiving instruments looped in said line, a relay located in said line at said station, local battery-circuits controlled by said relay, arresting devices included in one of said local circuits, and keys in said transmitting-instruments for controlling said line.

24. A printing-telegraph system comprising a source of electric energy, a single line, electrical and mechanical devices located at a station for alternating the current in said line, transmitting and receiving instruments looped in said line, detent and unison devices at said station for arresting the alternating devices thereat, a relay at said station responding to different conditions of current in said line, resistances at a transmitting-instrument, means for including said resistance in said line, a neutral relay and local battery, and circuits controlled by said relay.

25. A printing-telegraph system comprising a source of electric energy, a single line, electrical and mechanical devices at a station for alternating the current in said line, transmitting and receiving instruments looped in said line, detent and unison devices controlled by a relay at said station and responding to different conditions of current in said line, and two series of keys at a transmitting-instrument for controlling said line.

26. A printing-telegraph system comprising a source of electric energy, a single line, electrical and mechanical devices located at a station for alternating the direction of current in said line, a relay located in line at said station, local batteries and circuits at said station controlled by said relay, arresting devices included in one of said local circuits, alternating devices controlled by a magnet included in the other of said local circuits, and receiving and transmitting instruments looped in said line.

27. A single-line printing-telegraph system comprising a line battery-circuit, a pole-changer and magnet, a current-alternating device located at a station, a relay-magnet included in said circuit, a local battery-circuit closed through the coils of said pole-changer magnet and the front contact of said relay by the breaking of said line battery-circuit or by the weakening of the current through resistances interposed in said circuit to cause said relay to interrupt said local circuit through said pole-changer, thereby arresting said alternator by reversing the direction of the current to line and to earth.

28. A single-line printing-telegraph system comprising a line battery-circuit, a pole-changer and magnet, a current-alternating device in said circuit at a station, a relay included in said battery-circuit, transmitting and receiving instruments looped in said line, a local battery-circuit closed through the coils of the pole-changer magnet and through one of the contacts of said relay by the breaking of the line or by the weakening of the current through resistances included in said cir-

cuit to cause said relay to interrupt said local circuit through said pole-changer magnet to arrest said alternating device by the reversal of the direction of the current to line and to earth, and two series of keys in each transmitting-instrument for controlling said line-circuit.

29. A single-line printing-telegraph system comprising a line battery-circuit, a pole-changer and magnet, a current-alternating device in said circuit at a terminal station, a relay-magnet included in said battery-circuit, a local battery-circuit closed through the coils of said pole-changer magnet and front contact of said relay by the breaking of the line or by the weakening of the current through the interposition of resistance in said circuit to cause said relay to interrupt the local circuit through said pole-changer, thereby arresting said alternator by reversing the polarity of the current to line and to earth, a unison magnet included in said local battery-circuit closed through the back contact of said relay and adapted to release the unison latch and to maintain the alternating device in a fixed position.

30. A single-line printing-telegraph system comprising a line battery-circuit, a pole-changer and magnet, a current-alternating device, a relay-magnet included in said circuit at said station, a local battery-circuit closed through the coils of said pole-changer magnet and front contact of said relay, transmitting and receiving instruments, and a unison magnet included in said local battery-circuit, and keys for breaking and controlling said line battery-circuit.

31. A single-line printing-telegraph system comprising an alternating station, a battery-circuit, electrical and mechanical devices, substantially as described, located at said station, a pole-changer and magnet, a relay included in said circuit and controlling said pole-changer, a local battery-circuit closed through the coils of said pole-changer magnet, transmitting and receiving instruments, detent and unison magnets included in said local battery-circuit at said station, and keys for controlling said line battery-circuit.

32. A single-line printing-telegraph system comprising an alternating station, a battery-circuit, electrical and mechanical devices located at said station, a pole-changer and magnet, a relay included in said circuit and controlling said pole-changer, a local battery closed through the coils of said pole-changer magnet, transmitting and receiving instruments looped in said line-circuit, detent and unison magnets included in a local battery-circuit at said station, neutral relays included in said line battery-circuit at said instruments, and keys for controlling said line-circuit.

33. A single line printing-telegraph system comprising a battery and circuit, a pole-changer and magnet, a current-alternating device and a relay-magnet included in said circuit, a local battery-circuit closed through the coils of said pole-changer magnet and the one contact of said relay, resistances to reduce the current of said line-battery through said circuit, a pole-changer to reverse the direction of current in said circuit, and a magnetic escapement device included in said line battery-circuit for arresting and releasing said alternating device.

34. A single-line printing-telegraph system comprising a current-alternating device located at a station, a line battery-circuit, a relay-magnet included in said battery-circuit, a local battery-circuit and means included therein adapted to arrest said alternating devices, transmitting and receiving instruments looped in said line battery-circuit, resistance devices connected with said instruments and adapted to include the same in said circuit, a magnetic escapement device for arresting the type-wheels of said transmitting and receiving instruments, and keys for controlling the line battery-current through said instruments and said current-alternating devices.

35. A single-line printing-telegraph system comprising a line battery-circuit, a pole-changer magnet, a rheotome, and a relay-magnet included in said battery-circuit at a station for alternating the current in said circuit, a local battery-circuit at said station closed through the coils of said pole-changer magnet and said rheotome, a detent-magnet included in a local circuit at said station, resistances included in said line battery-circuit to control said relay and detent magnet through said local circuit and to arrest said pole-changer, a unison electro-magnet included in said local circuit, transmitting and receiving instruments included in said line battery-circuit, and keys at the transmitting-instruments to control the current of said line battery-circuit.

36. A single-line printing-telegraph system comprising a line battery-circuit, a pole-changer and a relay included in said battery-circuit, a rheotome and a pole-changer magnet, a local battery-circuit closed through said magnet by said rheotome, a double-contact relay in said line battery-circuit, a detent-magnet and a unison magnet included in a second local circuit closed through the stops of said relay, transmitting and receiving instruments looped in said line battery-circuit, resistances to control the current in said line battery-circuit and arrest the vibrations of said pole-changer, and keys at said transmitting-instruments for including said resistances in or interrupting said line-circuit.

37. A single-line printing-telegraph system comprising a line battery-circuit, a pole-changer and magnet, a rheotome, a local battattery-circuit closed through the coils of said pole-changer and through said rheotome, a relay-magnet in said line and adapted to close a second local battery-circuit through the front stop of said relay and a detent-magnet, a unison magnet included in said local battery-cir-

cuit and closed through the back-stop of said relay, transmitting and receiving instruments looped in said line battery-circuit, and keys and devices for controlling said line battery-circuit.

38. A single-line printing-telegraph system comprising a line battery-circuit, a pole-changer and magnet, a current-alternating device and a relay-magnet included in said battery-circuit, a local battery closed through the coils of said pole-changer magnet and the front contact of said relay operating when the line is broken or the current weakened by the interposition of resistance to cause said relay to break the local circuit through the pole-changer magnet, reversing the direction of the current to line and to earth, a unison magnet included in a local battery-circuit closed through the back contact of said relay and adapted to release the unison latch and to maintain the alternating device in a fixed position while a transmitter-key is depressed, and a magnetic escapement controlling the alternating device by a polarized relay in the line, closing through its respective stops the circuit of a local battery through the coils of said magnetic escapement.

39. A single-line printing-telegraph system comprising a battery-circuit, a pole-changer and magnet, a current-alternating device and a relay-magnet included in said battery-circuit, a local battery-circuit closed through the coils of said pole-changer magnet and the front contact of said relay, resistances and interrupters interposed in said circuit to cause said relay to break the local circuit through said pole-changer, thereby arresting said alternator by reversing the polarity of current to line and to earth, a unison magnet included in said local battery-circuit closed through the back contact of said relay and adapted to release the unison latch and to maintain the alternating device in a fixed position while a key is depressed, and a polar escapement-magnet included in said line battery-circuit for arresting and releasing said alternating device.

40. A single-line printing-telegraph system comprising an alternating station, a line battery-circuit having the electrodes thereof connected with the alternating device at said station employed to reverse the polarity of the line battery-current, a relay-magnet interposed in a conductor between an electrode of said battery and said alternating device, a ratchet-wheel mounted on the altenator-shaft, a magnetic detent provided with a retracting-spring for arresting said alternator and included in a local battery-circuit closed through a contact of said relay, transmitting and receiving instruments provided with a sunflower device and brushes included in said line battery-circuit, and keys connected with said transmitting-instruments and adapted to interpose resistance in said circuit and to break said line-circuit, and thereby cause said relay to control said local battery-circuit.

41. A single-line printing-telegraph system comprising an alternating station, a line battery circuit having the electrodes thereof connected with the alternating device of said station, a relay-magnet interposed in a conductor between one electrode of said battery and said alternating device, a ratchet-wheel mounted on the alternator-shaft, a magnetic detent included in a local battery-circuit and provided with a retracting-spring for arresting said alternator by the interruption of said local battery-circuit at a contact of said relay, a magnetic unison device connected with said shaft, transmitting and receiving instruments provided with sunflower devices and brushes included in said line battery-circuit, keys in the transmitting-instruments adapted to interpose resistances in said line battery-circuit and to break said circuit to cause said relay to control the local circuits of the detent, and unison devices arresting said alternator at a position corresponding with that of the type-wheels of all the instruments looped in said line battery-circuit.

42. A single-line printing-telegraph system comprising a current-alternator, a line battery-circuit having the electrodes thereof connected with said alternator, a relay-magnet interposed in a conductor between one electrode of said battery and said alternator, ratchet and friction wheels mounted on said alternator-shaft, a magnetic detent included in a local battery-circuit and provided with a retracting-spring for arresting said alternator by the interruption of said local battery-circuit at a contact of said relay, a unison device the magnets of which are included in a local battery-circuit and closed by a contact of said relay, transmitting and receiving instruments provided with sunflower devices and brushes included in said line battery-circuit, keys in the transmitting-instruments adapted to interpose resistances in said line battery-circuit and to break said circuit to cause said relay to control the local circuits of the detent, and unison devices for arresting the alternator at a position corresponding with that of the type-wheels of all the instruments looped in said line battery-circuit.

43. A single-line printing-telegraph system comprising an alternator, a line battery-circuit having the electrodes thereof connected with said alternator, a relay-magnet interposed in a conductor between said battery and alternator, a ratchet-wheel mounted on said alternator-shaft, power frictionally applied to a pulley or wheel mounted on said shaft, a magnetic detent included in a local battery-circuit and provided with a lever and retracting-spring for arresting said alternator through the breaking of said local battery-circuit at a contact of said relay, a magnetic unison device connected with said shaft, transmitting and receiving instruments provided with sunflower devices and brushes

included in said line battery-circuit, keys in the transmitting-instruments adapted to interpose resistances and to break said circuit to cause said relay to control the local battery-circuits of the detent, and unison devices for arresting the alternator at a position corresponding with that of the type-wheels of all the instruments looped in said line battery-circuit.

44. A single line printing-telegraph system comprising a current-alternating device at a station, a line battery-circuit having the electrodes connected to said alternating device to permit of a reversal of the polarity of the current in said circuit, a magnetic device included in a conductor between one of said battery-electrodes and said alternating device, a local battery-circuit and a unison magnet included therein through the back contact of said magnetic device, a ratchet-wheel mounted on said alternator-shaft, means for driving said shaft, a magnetic detent with its lever and retracting-spring for arresting said alternating device and included in the circuit of said local battery closed through the front contact of said magnetic device, transmitting and receiving instruments provided with sunflower devices and brushes included in said line battery-circuit and two series of keys, two type-wheels in each transmitting-instrument and said keys of the transmitting-instruments arranged so as to break the line-circuit and interpose resistances therein to cause said relay to break the circuit of said detent-magnets to arrest the alternating device at a position corresponding with that of the type-wheels of each transmitter looped in said circuit.

45. In an alternating station for a single-line printing-telegraph system, the combination of a single-line battery-circuit, an alternator frictionally driven by suitable means, and a polarized escapement magnetic device included in said line battery-circuit and automatically controlling the speed of said alternator, substantially as and for the purposes described.

46. In an alternating station for a printing-telegraph system comprising a single-line battery-circuit, an alternator included therein at an alternating station and driven by suitable power, transmitting and receiving instruments provided with two type-wheels and looped in said line battery-circuit, and electrical and mechanical devices at said instruments for controlling said alternator, substantially as and for the purposes described.

47. In an alternating station for a printing-telegraph system, the combination of a single-line circuit, an alternator and a relay-magnet included therein, escapement-magnets operating a polarized armature and included in said line, and a unison magnet included in a local battery-circuit controlled by said relay, substantially as and for the purposes described.

48. In a terminal station for a printing-telegraph system, the combination of a single line, an alternator frictionally driven, a relay-magnet included in said line, and detent and unison magnets included in local battery-circuits controlled by said relay, substantially as and for the purposes described.

49. In an alternating station for a line printing-telegraph system, the combination of a single-line battery-circuit, an alternator frictionally driven, a polar escapement magnetic device and relay-magnet included in said line battery-circuit, a local battery-circuit, and a magnetic device for arresting said alternator at the unison position, substantially as and for the purposes described.

50. In a printing-telegraph system, the combination of a source of electric energy, a single line, an alternator frictionally driven by suitable power, a polarized escapement magnetic device and a relay-magnet included in said line, a local battery, a unison magnetic device included therein, transmitting and receiving instruments looped in said line battery-circuit and each provided with double type-wheels and keys for controlling the actuating parts of said instruments and said line battery-circuit, substantially as and for the purposes described.

51. An alternating station for a single-line printing-telegraph system comprising a battery-circuit having the electrodes thereof connected with the alternator employed to reverse the polarity of the line-current, a relay-magnet interposed between one electrode of said battery and the alternator, a ratchet-wheel mounted on a revolving shaft, a magnetic detent provided with a retracting-spring for arresting said alternator and included in a local battery-circuit closed through a contact of said relay, transmitters and receivers each provided with two type-wheels, and a sunflower and brushes interposed in said line battery-circuit, a series of keys connected with said circuit, another series of keys adapted to be connected through resistances with said circuit to permit said relay to break said local circuit through said detent-magnet, substantially as and for the purposes described.

52. In a station for a printing-telegraph system adapted to record impressions from two type-wheels, the combination of a line battery-circuit, current-alternating devices, arresting devices, a relay traversed by the current of said line battery-circuit and controlling the circuits of local batteries operating said alternating and arresting devices, transmitting and receiving instruments provided with sunflower devices included in said line battery-circuit, and keys adapted to permit said relay to respond to breaks and changes of intensity in the current of said line battery-circuit, substantially as and for the purposes set forth.

53. In a station-alternating device for a printing-telegraph system, the combination of a source of electric energy, a line battery-

circuit, a frictionally-driven shaft, two hubs and four disks mounted thereon and said disks provided with alternating contacts and insulations, two of said disks electrically connected with one of said hubs and the other two electrically connected with the other of said hubs, six springs insulated from one another, two of said springs electrically connected with one electrode of said line battery-circuit and another two of said springs electrically connected with the other electrode of said line battery-circuit, and the remaining springs bearing on hubs connected to earth through the said line battery-circuit, substantially as and for the purposes set forth.

54. In a station-alternating device for a printing-telegraph system, the combination of a frictionally-driven shaft, two hubs and four disks mounted thereon and said disks provided with contacts and insulations, two of said disks electrically connected with one of said hubs and the other two with the other of said hubs, six springs insulated from one another, four of said springs electrically connected alternately with the electrodes of a line battery-circuit and the remaining two bearing on hubs and connected with said line battery-circuit and to earth, and a magnetic detent, substantially as and for the purposes set forth.

55. In a station-alternating device for a printing-telegraph system, the combination of a frictionally-driven shaft, a current-alternating device mounted thereon, insulated springs bearing on said device and included in a line battery-circuit, and an automatic magnetic escapement device for controlling said shaft, substantially as and for the purposes set forth.

56. In a station-alternating device for a printing-telegraph system, the combination of a frictionally-driven shaft, a current-alternating device mounted thereon, insulated springs bearing on said device and included in a line battery-circuit, an automatic magnetic escapement device, and a unison device for controlling said shaft, substantially as and for the purposes set forth.

57. In a station-alternating device for a printing-telegraph system, the combination of a frictionally-driven shaft, a current-alternating device mounted thereon, means included in a line battery-circuit contacting with said alternating device, an automatic escapement magnetic device, a unison magnetic device, and a relay included in said line battery-circuit between said alternating device and one electrode of said line-battery and adjusted to control said alternator, substantially as and for the purposes set forth.

58. The combination, in a vibrating alternator for a printing-telegraph system, of a shaft, means, substantially as shown and described, for driving said shaft, a rheotome mounted thereon, devices included in a local battery-circuit connected with said rheotome, a pole-changer vibrated by said devices, a relay in a line battery-circuit, and an automatic escapemnet magnetic device included in said line battery-circuit and adapted to control said shaft, substantially as set forth.

59. In an alternator for a printing-telegraph system, the combination of a shaft driven by suitable power, an alternating device mounted thereon, insulated springs bearing on said device and included in a line battery-circuit, an escapement magnetic device, a magnetic unison device, and means included in said line battery-circuit between said alternating device and one electrode of said line-battery and adapted to close local battery-circuits to release the arresting device of said alternator, substantially as and for the purposes set forth.

60. In an alternator for a printing-telegraph system, the combination of a shaft frictionally driven, a pulsating device, a ratchet-wheel mounted thereon, a pole-changer and magnet in a local circuit through said pulsating device, and a detent-magnet in a local circuit controlled by a relay included in a main-line battery-circuit, substantially as and for the purposes set forth.

61. In an alternator for a printing-telegraph system, the combination of a shaft frictionally driven, a pulsating device and a ratchet-wheel mounted thereon, a pole-changer, its magnet in a local circuit through said pulsating device, a detent-magnet, and a unison device in a local circuit controlled by a relay included in a main-line battery-circuit, substantially as and for the purposes set forth.

62. In a printing-telegraph system, the combination of a frictionally-driven shaft, a pulsating device mounted thereon, insulated springs bearing on said device and included in a local battery-circuit, a pole-changer controlled through said local circuit by said pulsating device, and a unison magnetic device in a second local circuit, substantially as and for the purposes set forth.

63. In a printing-telegraph system, the combination of a frictionally-driven shaft, a pulsating device mounted thereon, insulated springs bearing on said device and included in a local battery-circuit, a pole-changer controlled through said local circuit by said pulsating device, and a unison device in a second local battery-circuit controlled by a relay in a line battery-circuit, substantially as and for the purposes set forth.

64. In a printing-telegraph system, the combination of a frictionally-driven shaft, a pulsating device mounted thereon, insulated springs bearing on said device and included in a local battery-circuit, a pole-changer controlled through the local circuit by said pulsating device, and detent and unison magnetic devices included in local battery-circuits controlled by a relay in a line battery-circuit, substantially as and for the purposes set forth.

65. In a printing-telegraph system, the combination of a frictionally-driven shaft, a pul-

sating device mounted thereon, insulated springs bearing on said device and included in a local battery-circuit, a pole-changer controlled through the local circuit by said pulsating device, detent and unison magnetic devices included in local battery-circuits controlled by a relay in a line battery-circuit, and transmitting and receiving instruments each provided with two type-wheels, a sunflower, brushes, and keys included in said line battery-circuit, and said keys controlling the same, substantially as and for the purposes set forth.

66. In a printing-telegraph system, the combination of a rotating pulsator driven by power frictionally applied thereto and controlled by escapement-magnets vibrating a neutral armature, and a lever and said magnets responding to currents in a local battery-circuit controlled by a polar-relay included in said line battery-circuit, magnetic devices provided with a neutral armature vibrating a lever and arrested by a break or weak current in said circuit caused by an interruption in said line battery-circuit by interposing resistances therein, substantially as and for the purposes set forth.

67. In a printing-telegraph system, the combination of a rotary pulsator driven by power frictionally applied thereto and automatically controlled by escapement-magnets vibrating a polarized armature, and a lever and said magnets responding to alternating currents in a line battery-circuit, magnetic devices provided with a neutral armature vibrating a lever in response to currents of a local battery-circuit, and said devices closing the circuits of said local battery through a unison magnetic device, substantially as and for the purposes set forth.

68. In a printing-telegraph system, the combination of a positively-driven shaft controlled by mechanical and electrical devices actuated by alternating single-line currents, two type-wheels attached to a sleeve mounted on said shaft and having characters in the same radial line, a sunflower provided with insulated contacts equal in number to the number of characters on each of said type-wheels, sunflower contact-brushes in said line, two series of keys normally in closed circuit through said sunflower, one series of keys connected to each sunflower contact and operating to break the line battery-circuit to its corresponding key in the other series and to close the line-circuit through a resistance, the keys of the other series adapted to break the line through the contacts of said sunflower with which said keys are electrically connected, substantially as described.

69. In a printing-telegraph system, the combination of a station alternating and arresting device, a shaft positively driven by suitable power, a unison device, its latch, magnet, armature, and releasing-lever, a detent and retracting-spring, a rheotome mounted on said shaft, springs in a local battery-circuit contacting with said rheotome, a magnet adapted to vibrate a pole-changer, a line-battery located at said station and having the electrodes connected with said pole-changer and to line and to earth, a relay included in a conductor between said pole-changer and electrode of said line-battery, a detent-magnet, and a ratchet-wheel mounted on said shaft, substantially as and for the purposes set forth.

70. In a printing-telegraph system, the combination of an alternating and arresting device, a shaft driven by power applied thereto, a unison device, its latch, magnet, armature, and releasing-lever, a detent and retracting-spring, a rheotome mounted on said shaft, springs in a local battery-circuit contacting with said rheotome, a magnet adapted to vibrate a pole-changer, a line battery-circuit having the electrodes connected to said pole-changer and to line and to earth, a relay included in a conductor between said pole-changer and an electrode of said line battery-circuit, a detent-magnet, and a ratchet-wheel mounted on said shaft, substantially as and for the purposes set forth.

71. In a printing-telegraph system, the combination of an alternating and arresting device, a shaft suitably driven, a unison device, its latch, magnet, armature, and releasing-lever, a detent and a retracting-spring, a rheotome mounted on said shaft, springs in a local battery-circuit contacting with said rheotome, a magnet adapted to vibrate a pole-changer, a line-battery located at said station and having the electrodes connected to said pole-changer and to line and to earth, a relay included in the line conductor between said pole-changer and an electrode of said line-battery, a detent-magnet, a ratchet-wheel mounted on said shaft, transmitting and receiving instruments provided with type-wheels, a sunflower device included in said line battery-circuit, and two series of keys to break and to interpose resistance in said line battery-circuit, substantially as and for the purposes set forth.

72. In a single-line printing-telegraph system, the combination of a line battery-circuit, an alternator, an arresting device thereat, a relay in said line battery-circuit, a unison device on said alternator-shaft, a unison latch, mechanical means and a local battery-circuit for controlling the same, transmitting and receiving instruments provided with type-wheels and included in said line battery-circuit and said type-wheels controlled by alternating currents, unison devices on shafts of said transmitters and receivers and moving synchronously with said type-wheels, means for releasing the same, a neutral double-contact relay included in said line battery-circuit at each transmitting and receiving instrument and closing through one contact the circuit of a local printing-battery, a unison cut-out at each instrument in said line battery-circuit for interrupting said local battery-

circuit, the other contact of said relay adapted to close said local battery-circuit through a printing-magnet controlling the unison releasing devices of each instrument and said line battery-circuit adapted to arrest said alternating devices and the type-wheels of all the instruments in said line battery-circuit at unison position, a unison key at a transmitter to cause said relay in said line battery-circuit at the alternating station to close said local battery-circuit and to energize the unison magnet at said alternating station and to cause the relays at said instruments to close said local printing-circuits, to energize the printing-magnets of each instrument, and to release simultaneously said alternating device and type-wheels of all the instruments at the unison position, substantially as described.

73. In a single-line printing-telegraph system, the combination of a line battery-circuit, a rheotome, arresting devices for said rheotome, a relay in said line battery-circuit, a unison device mounted on the rheotome-shaft, a unison latch and means for controlling the same located at an alternating station, transmitting and receiving instruments provided with type-wheels and included in said line battery-circuit controlled by alternating currents, unison devices on a shaft of said transmitters and receivers and moving synchronously with said type-wheels, means for releasing the same, a double-contact neutral relay included in said line battery-circuit at each transmitting and receiving instrument and closing through one contact the circuit of a local printing-battery, a unison cut-out at each instrument for interrupting said local printing battery-circuit, the other contact of said relay adapted to close said local printing battery-circuit through a printing-magnet controlling the releasing devices of each instrument, said line battery-circuit adapted to arrest the alternating devices and the type-wheels of all instruments in said line battery-circuit at the unison position, and a key at a transmitter to cause said relays in said line battery-circuit to close the local circuits and to energize the unison-magnet at the alternating station and the printing-magnets of each instrument and to release the alternating devices and type-wheels of the instruments at the unison position, substantially as described.

74. In a single-line printing-telegraph system, the combination of a line battery-circuit, a current-alternator, arresting devices therefor, a relay, unison devices located at an alternating station, transmitting and receiving instruments included in and controlled by said line battery-circuit and provided with type-wheels and unison devices, and a double-contact neutral relay included in the said line battery-circuit at each transmitting and receiving instrument and adapted to close through one contact a local battery-circuit through a printing-magnet and through its other contact a local circuit in parallel through a type-wheel-shifting magnet and said printing-magnet, substantially as and for the purposes set forth.

75. In a single-line printing-telegraph system, the combination of a line battery-circuit, a current-alternator, arresting devices, a relay and unison devices located at said alternator, transmitting and receiving instruments included in said line battery-circuit and provided with type-wheels and unison devices, a neutral relay included in said line battery-circuit at each transmitter and receiver, and an interrupter on the type-wheel shaft and operated thereby to make and break a local battery-circuit through the printing and type-wheel-shifting magnets controlled by said neutral relay, substantially as described.

76. In a printing-telegraph system, the combination of a positively-driven shaft, mechanical and electrical devices actuated by alternating single-line currents for controlling the same, two type-wheels mounted on a sleeve on said shaft and having characters in the same radial line, a sunflower provided with insulated contacts equal in number to the number of characters on each of said wheels, sunflower devices and contact-brushes two series of keys normally in closed circuit through said sunflower devices, the keys of one series connected to each sunflower contact and adapted to break the line-circuit to its corresponding key in the other series and to close said line battery-circuit through a resistance, and the keys of the other series adapted to break said line battery-circuit through said sunflower contact and keys, substantially as described.

77. A printing-telegraph system comprising a line battery-circuit, an alternating device therein, means for actuating and arresting the same, a polarized relay actuated by alternating currents in said line battery-circuit, transmitting-instruments looped in said circuit and comprising a shaft driven by suitable power, two type-wheels adjustably mounted thereon and having characters in the same radial line, a sunflower provided with insulated contacts equal in number to the number of characters on each of said wheels, sunflower devices and contact-brushes, keys and electrical devices in said transmitters, a local battery-circuit, and a magnetic device included in said local circuit and controlling said shaft, substantially as and for the purposes set forth.

78. A printing-telegraph system comprising a line battery-circuit, an alternating device therein, means for actuating and arresting the same, a polarized relay actuated by alternating currents in said line battery-circuit, transmitting-instruments looped in said circuit, comprising a shaft driven by suitable power, two type-wheels adjustably mounted thereon and having characters in the same radial line, a sunflower provided with insulated contacts equal in number to the number of characters

on each of said wheels, sunflower devices and contact-brushes, keys and electrical devices in said transmitters, a local battery-circuit, and a magnetic escapement device included in said local circuit closed through said polarized relay and controlling said shaft, substantially as and for the purposes set forth.

79. A printing-telegraph system comprising a line battery-circuit, an alternating device therein at a station, means for actuating the same, a shaft frictionally driven by suitable power, two type-wheels adjustably mounted thereon and having characters in the same radial line, a sunflower provided with insulated contacts equal in number to the number of characters on each of said wheels, sunflower devices and contact-brushes, keys in said transmitters, a magnetic escapement device included in said line battery-circuit responding to alternating currents to control said shaft, and means for arresting the alternating device at said station, controlled through keys in each transmitting-instrument looped in said line-circuit, substantially as and for the purposes set forth.

80. A printing-telegraph system comprising a line battery-circuit, an alternating device therein, means for actuating and arresting the same, a polarized relay actuated by alternating currents in said line battery-circuit, transmitting-instruments looped in said circuit and consisting of a shaft driven by suitable power, two type-wheels mounted thereon, a sunflower provided with insulated contacts equal in number to the number of characters on each of said wheels, sunflower devices and contact-brushes, a local battery-circuit, a magnetic device included in said local circuit and controlling said shaft, and keys for controlling said line battery-circuit, substantially as and for the purposes set forth.

81. A printing-telegraph system comprising a line battery-circuit, an alternating device therein at a station, means for actuating said alternating device, transmitting and receiving instruments, each provided with type-wheels, sunflower devices and insulated contacts, a shaft driven by suitable power, a magnetic device included in said line battery-circuit responding to alternating currents to control said shaft, keys controlling said line battery-circuit, and means for arresting the alternating device at said station controlled by keys in each transmitting-instrument looped in said circuit, substantially as and for the purposes set forth.

82. A printing-telegraph system comprising a line battery-circuit, an alternating device, means for actuating and arresting the same, a polarized relay actuated by alternating currents in said line, a battery-circuit, a shaft driven by suitable power, type-wheels adjustably mounted thereon and having characters arranged in the same radial line, a sunflower provided with insulated contacts equal in number to the number of characters on each of said wheels and adapted to move synchronously therewith, brushes included in said line battery-circuit, a local battery-circuit, a magnetic escapement device included therein and controlling said shaft, and two series of keys normally in closed circuit through the sunflower, the keys of one series connected to each sunflower contact and adapted to break the line-circuit to its corresponding key in the other series and close the line-circuit through a resistance, and the keys of the other series adapted to break the line through the sunflower contact with which said keys are electrically connected, substantially as described.

83. A printing-telegraph system comprising a line battery-circuit, an alternating device, means for actuating and arresting the same, a shaft driven by suitable power, two type-wheels adjustably mounted thereon and having characters arranged in the same radial line, a magnetic escapement device included in said line battery-circuit and responding to alternating currents to control said shaft, a sunflower adapted to move synchronously with said type-wheels and having insulated contacts equal in number to those on each of said type-wheels, sunflower brushes included in said line battery-circuit, two series of keys normally in closed circuit through said sunflower, the keys of one series connected to each sunflower contact and adapted to break said line battery-circuit to its corresponding key in the other series and to close said line battery-circuit through a resistance, and the keys of the other series adapted to break said line battery-circuit through the sunflower contact electrically connected with said keys, substantially as and for the purposes set forth.

84. A printing-telegraph system comprising a line battery-circuit, an alternating device, means for actuating and arresting the same, transmitting-instruments looped in said battery-circuit and consisting of a shaft driven by suitable power, two type-wheels adjustably mounted thereon and having characters arranged in the same radial line, a magnetic escapement device included in said line battery-circuit and responding to alternating currents to control said shaft, a sunflower adapted to move synchronously with said type-wheels and having insulated contacts equal in number to those on each of said type-wheels, sunflower brushes included in said line battery-circuit, two series of keys normally in closed circuit through said sunflower, the keys of one series connected to each contact of said sunflower and adapted to break said line battery-circuit to its corresponding key in the other series and to close said line battery-circuit through a resistance, the keys of the other series adapted to break said line battery-circuit through the contact of said sunflower electrically connected with said

keys, a unison device on the type-wheel shaft, and means for releasing the same, substantially as and for the purposes set forth.

85. A printing-telegraph system comprising a line battery-circuit, an alternating device, means for actuating and arresting the same, a polarized relay actuated by alternating currents in said line battery-circuit, transmitting-instruments looped in said circuit, consisting of a shaft driven by suitable power, type-wheels mounted on said shaft, a unison device and means for releasing the same, an arm on a shaft revolving synchronously with the type-wheel shaft and adapted to operate a unison cut-out in a local printing-circuit, a sunflower adapted to move synchronously with said type-wheels and having insulated contacts equal in number to the characters on each of said type-wheels, sunflower brushes included in said line battery-circuit, a local battery-circuit, a magnetic device included therein and controlling said shaft, and two series of keys normally in closed circuit through said sunflower, the keys of one series connected to each contact of said sunflower and adapted to break said line battery-circuit to its corresponding key in the other series and to close said line battery-circuit through a resistance, the keys of the other series adapted to break said line battery-circuit through the contact of said sunflower electrically connected with said keys, substantially as and for the purposes set forth.

86. A printing-telegraph system comprising a line-battery circuit, an alternating device, means for actuating and arresting the same, a polarized relay actuated by different conditions in current of said battery-circuit, transmitting-instruments looped in said circuit and comprising a shaft driven by suitable power, two type-wheels adjustably mounted on said shaft and having characters in the same radial line, an arm on said shaft, contact-springs insulated from each other in a local circuit and adapted to break said local circuit at the unison position, a sunflower provided with insulated contacts equal in number to the characters on each of said type-wheels, sunflower contact brushes included in said circuit, a local battery-circuit closed by the contacts of said polarized relay, a magnetic escapement device included therein and controlling said shaft, and two series of keys normally in closed circuit through said sunflower, the keys of one series connected to each sunflower contact and adapted to break the line-circuit to its corresponding key in the other series and to close said circuit through a resistance, the keys of the other series adapted to break said circuit through a sunflower contact electrically connected with said keys, substantially as and for the purposes set forth.

87. A printing-telegraph system comprising a source of energy, a circuit, an alternating device, means for actuating and arresting the same, a polarized relay actuated by alternating currents, transmitting and receiving instruments looped in said circuit and comprising a shaft driven by suitable means, type-wheels adjustably mounted on said shaft and having characters arranged in the same radial line, a unison device and releasing mechanism therefor, a unison cut-out arm, a sunflower provided with insulated contacts equal in number to the characters on each of said type-wheels, sunflower brushes included in said line-circuit, a local battery-circuit, a magnetic escapement device included therein and controlling said shaft, and two series of keys normally in closed circuit through said sunflower, the keys of one series connected to each of said sunflower contacts and adapted to break said line-circuit to its corresponding key in the other series and to close said line-circuit through a resistance, the keys of the other series adapted to break said line through a sunflower contact electrically connected with said keys, substantially as and for the purposes set forth.

88. A printing-telegraph system comprising a source of electric energy, a circuit, an alternating device, means for actuating and arresting the same, a polarized relay actuated by alternating currents, combined transmitting and receiving instruments looped in said circuit and comprising a shaft driven by suitable power, type-wheels mounted thereon, a unison device and releasing mechanism therefor, a unison cut-out arm, a circuit-interrupter, and means mounted on a shaft for actuating said interrupter and revolving synchronously with said type-wheel shaft, a sunflower provided with insulated contacts equal in number to the characters on each of said type-wheels, brushes included in said line-circuit, a local battery-circuit, a magnetic escapement device included therein and controlling said shaft, and two series of keys normally in closed circuit through said sunflower, the keys of one series connected to each of said sunflower contacts and adapted to break said line-circuit to its corresponding key in the other series and to close said line-circuit through a resistance, the keys of the other series adapted to break said line through a sunflower-contact electrically connected with said keys, substantially as and for the purposes set forth.

89. A printing-telegraph system comprising a source of electric energy, a circuit, an alternating device, means for actuating and arresting the same, combined transmitting and receiving instruments looped in said circuit and comprising a shaft driven by suitable power, type-wheels mounted thereon, a unison device and releasing mechanism therefor, a unison cut-out arm, a sunflower device provided with insulated contacts, equal in number to the characters on each of said type-wheels, brushes included in said line-circuit, a magnetic escapement device included in said line-circuit and responding to alternating currents to control said shaft, and two series

of keys normally in closed circuit through said sunflower device, substantially as and for the purposes set forth.

90. A printing-telegraph system comprising a source of electric energy, a circuit, an alternating device, means for actuating and arresting the same, combined transmitting and receiving instruments looped in said circuit and comprising a shaft driven by suitable power, type wheels mounted thereon, a unison device and releasing mechanism, a unison cut-out arm, a circuit-interrupter, a ratchet device mounted on a shaft moving synchronously with said type-wheel shaft and adapted to actuate said interrupter, a sunflower device provided with insulated contacts equal in number to the characters of each of said type-wheels, brushes included in said line-circuit and responding to alternating currents and controlling said shaft, and two series of keys in connection with said sunflower device, substantially as and for the purposes set forth.

91. A printing-telegraph system comprising a line battery-circuit, an alternating device, means for actuating and arresting the same, transmitting and receiving instruments looped in said circuit and comprising a shaft driven by suitable power, type-wheels mounted thereon, a unison latch and spiral, releasing devices therefor, a circuit-interrupter actuated by a ratchet-wheel on said shaft for rapidly making and breaking a local circuit through a printing-magnet, a sunflower device with insulated contacts equal in number to the characters of each of said type-wheels, sunflower brushes included in said circuit, a magnetic escapement device included in a circuit and responding to alternating currents, and two series of keys for controlling said line circuit, substantially as and for the purposes set forth.

92. A printing-telegraph system comprising a line battery-circuit, an alternating device, means for actuating and arresting the same, a polarized relay actuated by alternating currents, transmitting and receiving instruments looped in said circuit and comprising a shaft driven by suitable power, type-wheels adjustably mounted on said shaft and having characters in the same radial line, a local battery-circuit, escapement magnets included therein and controlling said type-wheels, a unison latch and spiral, releasing device therefor, a circuit-interrupter and a ratchet-wheel on said shaft for rapidly making and breaking a local battery-circuit through a printing-magnet, a sunflower provided with insulated contacts equal in number to the number of characters of each of said type-wheels, a sunflower device, brushes included in said line battery-circuit, and two series of keys normally in closed circuit through said sunflower device, the keys of one series connected to each sunflower contact and adapted to break said line battery-circuit to its corresponding key in the other series and to close said line-circuit through a resistance, the keys of the other series adapted to break said line battery-circuit through a sunflower contact electrically connected with said keys, substantially as and for the purposes set forth.

93. A printing-telegraph system comprising a line battery-circuit, an alternating device, means for actuating and arresting the same, transmitting and receiving instruments looped in said line battery-circuit and comprising a shaft positively driven, type-wheels mounted thereon, a magnetic escapement device, a unison latch and spiral, releasing mechanism therefor, a circuit-interrupter, a ratchet-wheel mounted on said shaft, a local battery-circuit, a printing-magnet and said interrupter actuated by said ratchet-wheel for making and breaking said local circuit through said magnet, a double-contact neutral relay adapted to close the local battery-circuits through the type-wheel-shifting and printing magnets, a sunflower device provided with insulated contacts equal in number to the characters of each type-wheel, brushes included in said line battery-circuit, and two series of keys normally in closed circuit through said sunflower device, the keys of one series connected to each sunflower contact and adapted to break said line battery-circuit to its corresponding key in the other series and to close said line battery-circuit through a resistance, the keys of the other series adapted to break said line battery-circuit through the sunflower contact electrically connected with said keys, substantially as and for the purposes set forth.

94. A printing-telegraph system comprising a line-battery circuit, an alternating device, means for actuating and arresting the same, a polarized relay responding to alternating currents, transmitting and receiving instruments looped in said line battery-circuit and comprising a shaft positively driven, type-wheels adjustably mounted on said shaft and having characters arranged in the same radial line, an escapement magnetic device included in a local circuit and controlling said type-wheels, a unison latch and spiral, releasing mechanism therefor, a circuit-interrupter, a ratchet-wheel mounted on said shaft, a local battery-circuit, a printing-magnet and said interrupter actuated by said ratchet-wheel for rapidly making and breaking said local circuit through said magnet, a double-contact neutral relay included in said line battery-circuit and through the front contact and electrical devices closing said local battery-circuit through said interrupter and in multiple arc through the type-wheel-shifting and printing magnets, a sunflower device provided with insulated contacts equal in number to the characters on each of said type-wheels, brushes included in said line battery-circuit, and two series of keys normally in closed circuit through said sunflower device, the keys of one series connected to each sunflower contact and adapted to break said line battery-circuit to its corresponding key in the other series and

to close said line battery-circuit through a resistance, the keys of the other series adapted to break said line battery-circuit through the sunflower contact electrically connected with said keys, substantially as and for the purposes set forth.

95. A printing-telegraph system comprising a source of electric energy, a single line, an alternating device, means for actuating and arresting the same, mechanical and electrical devices actuated by alternating single-line currents, combined transmitting and receiving instruments looped in said circuit, a shaft driven by suitable power, type-wheels adjustably mounted on said shaft and having the characters arranged in the same radial line, a unison latch and spiral, releasing devices therefor, a circuit-interrupter, a magnetic escapement device, a ratchet-wheel on said shaft, a local battery-circuit, a printing-magnet included therein, a double-contact neutral relay included in said line battery-circuit and adapted to close said local circuit through the type-wheel-shifting and printing magnets, a sunflower device with contacts equal in number to the characters of each of said type-wheels, sunflower contact brushes included in said line battery-circuit, and two series of keys normally in a closed circuit connected with said sunflower device, substantially as and for the purposes set forth.

96. A printing-telegraph system comprising a single-line battery-circuit, an alternating device, means for actuating and arresting the same, mechanical and electrical devices at said alternator and operated by alternating single-line currents, a shaft suitably driven, type-wheels adjustably mounted on said shaft and having the characters arranged in the same radial line, a unison latch and spiral, releasing devices therefor, a circuit-interrupter, a ratchet-wheel on said shaft, a local battery-circuit, a printing-magnet, a type-wheel-shifting magnet, a double-contact neutral relay included in said line battery-circuit and closing by means of its front contact and electrical devices said local battery-circuit through said interrupter and in multiple arc through said type-wheel-shifting and printing magnets, a sunflower with insulated contacts equal in number to the characters of each of said type-wheels, sunflower contact brushes included in said line battery-circuit, and two series of keys normally in closed circuit through said sunflower, the keys of one series connected to each sunflower contact and adapted to break said line battery-circuit to its corresponding key in the other series and to close said line battery-circuit through a resistance, the keys of the other series adapted to break said line battery-circuit through said sunflower-contact electrically connected with said keys, substantially as and for the purposes set forth.

97. In a printing-telegraph system, an alternating device at a station in a line battery-circuit, arresting devices at said station, the electrodes of said battery connected to said alternating device, a relay-magnet included in said circuit, and an auxiliary battery, the electrodes of which, similar in polarity to those of said line-battery, adapted to be connected through a contact of said relay to said alternating device, substantially as shown, and for the purposes set forth.

98. In a printing-telegraph system, a line battery-circuit, alternating devices included in said circuit, and means, substantially such as described, for controlling and arresting said devices, transmitting and receiving instruments with sunflower devices and keys, a relay-magnet included in said line battery-circuit at said instruments, and a resistance adapted to be connected directly with said keys and said circuit through a contact of said relay, substantially as and for the purposes set forth.

99. In a printing-telegraph, the combination of a line battery-circuit, a double-contact neutral relay included therein, a local battery-circuit, a printing-magnet and devices, a circuit-interrupter, and means for actuating the same, the line battery-circuit being closed through said interrupter and printing-magnet by the back contact of said relay, substantially as and for the purposes set forth.

100. In a printing-telegraph system, the combination of a line battery-circuit, a double-contact neutral relay included therein, a local battery-circuit, a circuit-interrupter, means for actuating the same, a printing-magnet and devices, a shifting-magnet, and mechanical and electrical devices, substantially as described, said relay adapted to close said local circuit in parallel through said shifting and printing magnets, substantially as and for the purposes set forth.

101. In a printing-telegraph system, the combination of a line battery-circuit, a double-contact neutral relay included therein, a local battery-circuit, a printing-magnet, a shifting-magnet, a circuit-interrupter, a unison cut-out, and mechanical and electrical devices, the said magnets and the contacts of said cut-out and interrupter included in a local battery-circuit through the front contact of said relay and said electrical devices, substantially as and for the purposes set forth.

102. In a printing-telegraph system, the combination of a shifting-magnet, its armature, lever, and retracting-spring, an insulated arm connected with said lever, two insulated contact-springs adapted to contact with said arm, a relay and its contacts, a printing-magnet and devices therefor, and a local circuit closed through said relay-contact, one of said springs, the shifting-magnet, and through said relay-contact, and both of said springs and the shifting and printing magnets in parallel circuit, substantially as and for the purposes set forth.

103. A printing-telegraph system comprising a source of electric energy, a single line, an alternating device, means for actuating

and arresting the same, transmitting and receiving instruments and a polarized relay looped in said line, a positively driven shaft, type-wheels adjustably mounted on said shaft and having characters arranged in the same radial line, a local battery-circuit, a magnetic escapement device included in said local circuit and controlling said type-wheels through the contacts of said polarized relay, a unison latch and spiral, releasing devices therefor, an interrupter, a neutral double-contact relay included in said line battery-circuit and closing by means of the front contact and electrical devices, a local battery-circuit through said interrupter and in multiple arc through the shifting and printing magnets, a sunflower provided with insulated contacts equal in number to the characters on each of said type-wheels, sunflower brushes included in said line battery-circuit, and two series of keys normally in closed circuit through said sunflower, the keys of one series connected to each sunflower contact and adapted to break said line-circuit to its corresponding key in the other series and to close said line-circuit through a resistance, the keys of the other series adapted to break said line through the sunflower contact electrically connected with said keys, substantially as and for the purposes set forth.

104. A printing-telegraph system comprising a line battery-circuit, an alternating device, means for actuating and arresting the same, transmitting and receiving instruments included in said line battery-circuit, a positively driven shaft, type-wheels mounted on said shaft, a local battery-circuit, a magnetic escapement included in said line battery-circuit and controlling said type-wheels, a unison latch and spiral, releasing devices therefor, a circuit-interrupter, a ratchet-wheel on said shaft for rapidly making and breaking a local circuit through the printing-magnet, a double-contact neutral relay included in said line battery-circuit and closing by means of the back contact and devices, a local battery-circuit through the printing-magnet, a sunflower provided with insulated contacts equal in number to the characters on each of said type-wheels, sunflower contact brushes included in said line battery-circuit, and two series of keys normally in closed circuit through said sunflower, the keys of one series connected to each sunflower contact and adapted to break said line battery-circuit to its corresponding key in the other series and to close said line-circuit through a resistance, the keys of the other series adapted to break said line battery-circuit through the sunflower contact electrically connected with said keys, substantially as and for the purposes set forth.

105. A printing-telegraph system comprising a source of electric energy, a single line, mechanical and electrical devices actuated by alternating currents, transmitting and receiving instruments, and a polarized relay included in said line, a shaft positively driven, type-wheels adjustably mounted on said shaft and having characters arranged in the same radial line, a unison latch and spiral, releasing devices, a local circuit, means connected with a shaft, a circuit-interrupter for rapidly making and breaking a local circuit through the printing-magnet, a double-contact neutral relay included in said line and closing by means of the back contact and devices said local battery-circuit through the printing-magnet, a sunflower provided with insulated contacts equal in number to the characters on each of said wheels, sunflower contact brushes included in said line, and two series of keys normally in closed circuit through said sunflower, the keys of one series connected to each sunflower contact and adapted to break said line to its corresponding key in the other series and to close said line through a resistance and the keys of the other series adapted to break said line through the sunflower contact electrically connected with said keys, substantially as and for the purposes set forth.

106. The combination, with a paper-carriage for a printing-telegraph system, of side bars, wheels connected thereto and mounted on a track, safety-wheels engaging below said track, a rack, and a strut forming a guideway bearing on a centrally-located single wheel, substantially as shown, and for the purposes set forth.

107. The combination, with a paper-carriage for a printing-telegraph system, of side bars provided with traction and safety wheels, a rack, a strut between said side bars and engaging with a roller centrally mounted on the frame of the instrument, guiding devices, paper-rollers, and feed-rollers and their actuating devices, substantially as shown, and for the purposes set forth.

108. In a paper-carriage for a printing-telegraph, the combination, with the side bars O, of the strut o^2, the guide-wheel o^{10}, journaled on a fixed support located centrally with reference to the excursion of said carriage, the bearing-wheels o^7, the track o^8, and the safety-wheels o^9, substantially as and for the purposes set forth.

109. In a printing-telegraph, the combination of a suitably-driven type-wheel shaft, mechanical and electrical devices actuated by alternating currents in a battery-circuit, type-wheels adjustably mounted on said shaft, a unison device, a unison cut-out arm mounted on a shaft revolving synchronously with said type-wheel shaft for breaking a local circuit at the unison position of the type-wheel shaft, a sunflower provided with insulated contacts equal in number to the characters on each of said wheels and sunflower brushes included in said circuit, and two series of keys normally in closed circuit through said sunflower, the keys of one series connected to each sunflower contact and adapted to break said line-circuit to its corresponding

key in the other series and to close the line-circuit through a resistance, and the keys of the other series adapted to break said line through a sunflower contact electrically connected with said keys, substantially as set forth.

110. In a printing-telegraph system, the combination of a type-wheel shaft driven by suitable power, a line battery-circuit, mechanical and electrical devices actuated by alternating currents in said circuit, type-wheels adjustably mounted on said shaft, a double-contact neutral relay included in said circuit, a local battery-circuit closed through the front contact of said relay and through an interrupter and in parallel circuit through shifting and printing magnets, a unison cut-out adapted to break said local battery-circuit at the unison position, a sunflower, two brushes, and two series of normally-closed circuit-keys in said line battery-circuit, substantially as and for the purposes set forth.

111. In a printing-telegraph system employing two type-wheels, a line battery-circuit, a unison-key, sunflower devices, a double-contact neutral relay connected in said line battery-circuit and unison devices, in combination with a local battery-circuit, type-wheel shifting and printing magnets, and a unison cut-out included in said local battery-circuit adapted to be closed by the front contact of said relay through said cut-out, and shifting and printing magnets by closing said line-circuit, and through the back contact of said relay and through said printing-magnet by interrupting said line-circuit, substantially as set forth.

112. In a paper-carriage for printing-telegraphs, the combination of a lower track, two bearing-wheels traversing the same and safety-wheels engaging below said track, a single guide-wheel centrally located in relation to the excursion of said carriage and traversed by a strut embraced between the side frames of the carriage, substantially as and for the purposes set forth.

113. In a printing-telegraph system, a double-contact neutral relay included in a line battery-circuit traversed by alternating currents, in combination with a printing-magnet operated by a local battery the circuit of which is closed through a circuit-interrupter and one contact of said relay, and a shifting-magnet in said local circuit closed through said interrupter and the other contact of said relay, substantially as and for the purposes set forth.

114. In a printing-telegraph system, a double-contact neutral relay included in a line battery-circuit traversed by alternating currents, in combination with a printing-magnet operated by a local battery the circuit of which is closed through an interrupter and one contact of said relay, and a shifting-magnet operated by a local battery the circuit of which is closed through a unison cut-out, said interrupter, and the other contact of said relay, substantially as and for the purposes set forth.

115. In a printing-telegraph system, a double-contact neutral relay included in a line battery-circuit traversed by alternating currents, in combination with a printing-magnet operated by a local battery the circuit of which is closed through an interrupter and one contact of said relay, a shifting-magnet operated by a local battery the circuit of which is closed through a unison cut-out, said interrupter, and the other contact of said relay, and electrical devices operated by the lever of said shifting-magnet to close in parallel the local battery-circuit through said printing and shifting magnets, substantially as and for the purposes set forth.

116. In a hammer for printing-telegraphs, the combination of a rod moving freely through a tube supported by a standard, a printing-hammer attached to said rod, a retracting-spring attached to said rod, a lever carrying a reciprocating pawl to actuate said rod, a printing-magnet, its armature, lever, and retracting-spring, a link connected with said lever and actuating a rock-shaft, and a lever secured to said shaft and having a reciprocating pawl operating when said magnet is energized to cause the hammer to strike a blow and recoil and when demagnetized to cause the pawls to pass one another, substantially as and for the purposes set forth.

117. In a printing-telegraph system, the combination, in a combined transmitting and receiving instrument, of a sunflower device in a single-line battery-circuit traversed by alternating currents, a brush or trailer maintaining closed circuit in passing insulations between segments of said sunflower device, two series of keys, the adjacent keys in each series connected to the same segments of said sunflower device and normally closing said battery-circuit, a resistance, means for including the same in said circuit when a key of one series is depressed, and electrical devices for interrupting said circuit in the other series by the depression of a key, substantially as and for the purposes set forth

118. In a printing-telegraph system, a sunflower device in a single-line battery-circuit traversed by alternating currents, a split brush maintaining closed circuit while passing insulations between segments of said sunflower device, two series of keys, the adjacent keys in each series connected to the same segment of said sunflower device and normally closing said battery-circuit, a resistance and means for including the same in said circuit when a key of one series is depressed, and electrical devices for interrupting said circuit by the depression of a key in the other series, substantially as and for the purposes set forth.

119. In a printing-telegraph system having combined transmitting and receiving instruments, a sunflower device in a single-line battery-circuit, a brush or trailer maintaining a closed circuit while traversing insulations

between segments of said sunflower device, two series of keys, a resistance in electrical connection with circuit-closing devices of said keys, and a relay included in a branch circuit, the said relay adapted to momentarily break said circuit and then suddenly close said circuit by the depression of a key adapted to interpose said resistance therein, substantially as and for the purposes set forth.

120. In a printing-telegraph system, a source of electric energy and circuit, combined transmitting and receiving instruments looped in said circuit and each provided with a sunflower device, a brush or trailer adapted to maintain closed circuit while traversing insulations between the sunflower segments, two series of keys electrically connected with said sunflower device adapted to interpose resistance and to break said circuit, a relay located at said instruments and included in said circuits, electrical and mechanical devices at a station for alternating the polarity of the current and arresting devices controlled by a relay included in said line-circuit and responding to keys in each transmitting-instrument, substantially as and for the purposes set forth.

121. In a printing-telegraph system, an auxiliary battery at a station in a line battery-circuit, alternating devices, a relay operating to break at its front contact a local-battery circuit to arrest said alternating devices and to close at its rear contact the circuit of said auxiliary battery to said alternator in parallel circuit with said line battery-circuit, whereby the current in line is re-enforced after the alternating devices have been arrested by the interposition of resistances in said line battery-circuit, substantially as and for the purposes set forth.

122. The combination, in a printing-telegraph system, of a source of electric energy, an auxiliary battery at a station in a single line, alternating devices included therein, a local battery-circuit, a relay adapted to break at one of its contacts said local circuit to arrest said alternating devices and to close at the opposite contact of said relay said auxiliary battery-circuit to said alternating device at said station in parallel with said line, whereby the current in said line is re-enforced after the alternating devices have been arrested by interposing resistances in said circuit, substantially as and for the purposes set forth.

123. The combination, in a printing-telegraph system, of a source of electric energy and circuit, an auxiliary battery located at a terminal station, electrical and mechanical alternating devices thereat, a local battery-circuit controlled by a relay included in said line-circuit, and detent and unison electromagnets for arresting said alternating devices thereat, substantially as and for the purposes set forth.

124. The combination, in a printing-telegraph system, of a source of electric energy and circuit, an auxiliary battery located at a terminal station, a polarized escapement electro-magnetic unison and arresting devices, a local battery-circuit for controlling said devices, and a relay included in said line battery-circuit, substantially as and for the purposes set forth.

125. The combination, in a printing-telegraph system, of a source of electric energy and line-circuit, an auxiliary battery located at an alternating station, a polarized escapement and devices automatically controlling said alternating devices, electro-magnetic unison and arresting devices at said station, a local battery-circuit for controlling said devices, and a relay included in said line-circuit, substantially as and for the purposes set forth.

126. The combination, in a printing-telegraph system, of a source of electric energy, a single line, an auxiliary battery located at an alternating station, a polarized relay in said line, magnetic devices, and a local battery closed through said magnetic devices by said relay and automatically controlling the alternating device, substantially as and for the purposes set forth.

127. In a single-line printing-telegraph system, a station provided with a source of electric energy, electrical and mechanical devices for alternating the polarity of the current in a single line, arresting mechanism for controlling the alternating devices, a relay included in said line and responding to varying conditions therein, transmitting and receiving instruments looped in said line, local battery-circuits, polarized relays at said instruments in said line and closing said local batteries through escapement-magnets, a neutral relay at each instrument included in said line and adapted to close at its front contact in consequence of a weak current in said line said local battery-circuits in parallel through the shifting and printing magnets, and to close at its back contact when said line is broken the local circuits through only the printing-magnets, substantially as and for the purposes set forth.

128. In a single-line printing-telegraph system operating by alternating currents, the combination of a line-battery, alternating and arresting devices in said line, telegraph-instruments looped in said line and each having two type-wheels, a sunflower and keys in closed circuit therewith through the sunflower brushes and arranged when depressed to break the line-circuit or to introduce resistance therein, electrical devices, substantially such as described, for rotating the type-wheels for shifting the same and for causing impressions to be effected therefrom, a key to arrest the alternator and all instruments in line to effect impressions on one type-wheel, and a resistance interposed in said line to arrest said alternator and all the instruments in line and to shift the second type-wheel to

the plane occupied by the first and effect impressions therefrom in the same line of printing, substantially as described.

129. In a single-line printing-telegraph system, a station provided with a source of electric energy and circuit, electrical and mechanical devices for alternating the direction of current in said single main line, arresting devices controlling alternating devices at said station and a relay thereat responding to varying conditions in the line, transmitting and receiving instruments looped in said line, local battery-circuits, polar relays at each instrument controlling said local battery-circuits through escapement-magnets, local printing-batteries, a neutral relay included in said line at each instrument and to control said local printing-battery circuits through shifting and printing magnets, a sunflower device, and two series of keys included in a closed line, substantially as and for the purposes set forth.

130. In a single-line printing-telegraph system, the combination, with a station provided with mechanical and electrical devices to alternate the direction of a current, of a source of electric energy, arresting devices for controlling said alternating device and a relay included in the line at said alternator, transmitting and receiving instruments looped in said line and each provided with a local printing-battery and a neutral relay, the relay adapted to close the local circuit at the front contact thereof and an interrupter in parallel through shifting-magnets, electrical devices, a shifting-lever, and printing-magnets to cause an impression to be made from type-wheels normally held in an inoperative position in said transmitting and receiving instruments, substantially as and for the purposes set forth.

131. In a single-line printing-telegraph system, the combination, with a station provided with electrical and mechanical devices to alternate the direction of the current, of a source of electric energy and a circuit, arresting devices controlled by a relay responding to different conditions in said line-circuit, transmitting and receiving instruments looped in said line-circuit and each provided with a sunflower device, two series of keys in said closed line-circuit, neutral relays thereat to close local circuits through an interrupter, a unison cut-out and in parallel through shifting-magnets, and electrical devices on shifting-lever and printing-magnets to cause a type-wheel to be presented to impression devices and a character to be recorded, substantially as and for the purposes set forth.

132. In a printing-telegraph, the combination, in receiving and transmitting instruments, of a unison latch, a printing-magnet and armature, its lever provided with an extension, a bell-crank lever, and a rod connected therewith and adapted to release said unison-latch, substantially as set forth.

133. In a printing-telegraph receiving and transmitting instrument, the combination of a unison device, a printing-magnet, its armature and lever, and a bell-crank lever, a vertical rod sliding in bearings and resting on said bell-crank lever and adapted to release said unison device at each impression, substantially as set forth.

134. In a printing-telegraph receiving and transmitting instrument, the combination of a shaft, a unison device mounted thereon, and a latch and spring therefor, a printing-magnet energized by a local battery-circuit controlled by a neutral relay included in a line battery-circuit, its armature and lever, and means adapted to release the latch of said unison device at each impression, substantially as set forth.

135. In a printing-telegraph receiving and transmitting instrument, the combination of printing and shifting magnets, local battery-circuits, a neutral relay, a line battery-circuit, a unison device, a type-wheel shaft, and the armature-lever of said printing-magnet adapted to release said unison device, substantially as and for the purposes set forth.

136. In a printing-telegraph transmitting and receiving instrument, the combination of a local battery-circuit, a printing-magnet, impression devices, a printing-hammer operated by the armature-lever of said printing-magnet through the intervention of reciprocating pawls mounted on levers actuated by a rock-shaft from said armature-lever, a recoil-spring around the stem of said hammer, and a double-contact neutral relay interposed in a line battery-circuit and adapted to control said local circuit, whereby said hammer is caused to deliver a quick blow by the attraction of the armature of said printing-magnet when energized by said local battery-circuit and to recoil by the force of said spring to its normal position through the breaking of said local battery-circuit, substantially as set forth.

137. In a printing-telegraph receiving and transmitting instrument, the combination of a printing-magnet, a hammer operated by the armature-lever of said magnet by the intervention of reciprocating pawls mounted on levers actuated by a rock-shaft from said armature-lever, and a recoil-spring around the stem of said hammer, substantially as shown and set forth.

138. In a printing-telegraph transmitting and receiving instrument, the combination of a printing-magnet P and an impression device consisting of a printing-hammer p^2, mounted on a stem p^{13}, lever p^3, pawls p^{16} and p^{18}, spring p^{19}, arm p^{21}, rock-shaft p^{22}, arm p^{24}, and link p^{25}, operated by the armature-lever p^5 of said printing-magnet P, substantially as and for the purposes set forth.

139. In a printing-telegraph transmitting and receiving instrument, the combination of a printing-magnet, a paper-carriage, devices, substantially as described, for advancing the paper-carriage, means for releasing the same at any point in its excursion and consisting of a cam mounted on the type-wheel shaft and

adapted to actuate a lever, and a pivoted strut to cause said strut to be interposed in the path of a pin on the printing armature-lever, and said strut pivoted to a bell-crank lever impinging against a bent lever having projections adapted to engage with the pawl and detent of said advancing device, and means to return said carriage to its initial position, substantially as and for the purposes set forth.

140. In a printing-telegraph system, transmitting and receiving instruments and each provided with a paper-carriage, advancing, releasing, and returning devices, magnetic devices, and type-wheels, the type-wheels having a blank space at the releasing position corresponding with a cam on a shaft moving synchronously with the type-wheels and operating by means such as described to release the pawl and detent of said advancing device by the attraction of the armature of said magnetic device, substantially as and for the purposes set forth.

141. In a printing-telegraph system, transmitting and receiving instruments provided with local battery circuits, printing and shifting magnets included therein, a neutral relay interposed in a single-line battery-circuit, a paper-carriage at each instrument, advancing, releasing, and returning devices for said paper-carriage, the releasing devices comprising an arm mounted on a shaft moving synchronously with the type-wheels of the instruments, and a lever adapted to engage with pawls of said advancing device to release the same, a blank space on each of the type-wheels corresponding with the position of said arm, a sunflower device comprising a number of segments, one of which corresponds to the blank spaces on said type-wheels, and electrical and mechanical devices adapted to arrest the type-wheels at said space and to energize the printing-magnet, substantially as and for the purposes set forth.

142. In a printing-telegraph system, transmitting and receiving instruments comprising a paper-carriage, advancing, releasing, and returning devices, magnetic impression devices, type-wheels, a sunflower device, and keys, the releasing devices comprising a cam mounted on a shaft moving synchronously with the type-wheels and adapted to actuate a lever to disengage said advancing device at any point in the excursion of the paper-carriage, a blank space on the type-wheels corresponding with the position of said cam and a contact-segment of said sunflower device, and a key to interpose resistance or to break a line battery-circuit through said sunflower contact segment to operate means controlling the magnetic impression devices, substantially as and for the purposes set forth.

143. In a printing-telegraph, transmitting and receiving instruments, the combination of a paper-carriage, advancing and releasing mechanism therefor, the releasing mechanism consisting of the cam f, rod f', lever f^2, trunnion f^3, a link connection f^4, a pivoted strut f^5, bell-crank lever f^7, bent lever f^9, provided with pins f^{10} and f^{11} and adapted to release the pawl p^8 and detent p^{11} by the attraction of the armature p^4 of the lever p^5, substantially as and for the purposes set forth.

144. In a printing-telegraph instrument, the combination of the vertical side plates a' and a^2, the beveled and recessed bar a^4, forming a strut between said plates and recessed for the type-wheels B B′, the rear plate a^5, the removable glass top and front a^6, the cover-plate a^3, the drum a^8, and its shaft mounted in bearings secured to the top plate a, substantially as and for the purposes set forth.

145. In a printing-telegraph instrument, the combination of a positively-driven shaft, type-wheels mounted on a sleeve moving loosely on said shaft, a cross-arm with pins projecting from same attached to said shaft, said pins adapted to pass through apertures in said wheels to prevent said sleeve from turning on said shaft, and a spring connected with said cross-arm and said wheels, substantially as and for the purposes set forth.

146. In a printing telegraph instrument, the combination of a shaft, means, substantially such as described, for actuating the same, a sleeve mounted thereon, type-wheels attached thereto, a cross-arm rigidly attached to said shaft and provided with pins passing through said type-wheels, and a spiral spring attached to said cross-arm and type-wheels to take up lost motion between said pins and the openings in said type-wheels, substantially as and for the purposes set forth.

147. In a printing-telegraph instrument, the combination of a shaft driven by suitable power, a sleeve loosely mounted on said shaft, type-wheels attached thereto, a forked lever engaging in a groove in said sleeve, a rod connected with said forked lever and adapted to slide in fixed guides, a cross-arm rigidly attached to said shaft and provided with pins passing through said type-wheels, and a spring attached to said cross-arm and type-wheels, substantially as shown and set forth.

148. In a printing-telegraph instrument, the combination of a shaft driven by suitable power, a sleeve loosely mounted in said shaft, type-wheels attached thereto, a forked lever engaging in a groove in said sleeve, a rod connected with said forked lever and adapted to slide in fixed guides, a cross-arm rigidly attached to said shaft and provided with pins passing through said type-wheels, a spring attached to said cross-arm and type-wheels, a shifting-magnet, its lever, armature, and retracting-spring, and said armature-lever pivotally connected with said sliding rod, substantially as and for the purposes set forth.

149. In a printing-telegraph instrument, the combination of a shaft driven by power, a sleeve loosely mounted on said shaft, type-wheels attached thereto, a forked lever engaging in a groove in said sleeve, a rod connected with said forked lever and adapted to

slide in fixed guides, a cross-arm rigidly attached to said shaft and provided with pins passing through said type-wheels, a spring attached to said cross-arm and type-wheels, a shifting-magnet and its actuating devices, a line battery-circuit, a sunflower device, and keys adapted to interpose resistance and interrupt said line battery-circuit, substantially as and for the purposes set forth.

150. In a printing-telegraph instrument, the combination of a shaft driven by power, a sleeve loosely mounted on said shaft, type-wheels attached thereto, a forked lever engaging in a groove in said sleeve, a rod connected with said forked lever and adapted to slide in fixed guides, a cross-arm rigidly attached to said shaft and provided with pins passing through said type-wheels, a spring attached to said cross-arm and type-wheels, a shifting-magnet and its actuating devices, a line battery-circuit, a sunflower device, keys adapted to interpose resistance and to interrupt said line battery-circuit, a local battery-circuit, and a relay in said line battery-circuit, a printing-magnet included therein and its actuating devices, and said relay closing in multiple arc or parallel the circuit of said local battery through said printing and shifting magnets, substantially as and for the purposes set forth.

151. In a printing-telegraph instrument, the combination of a positively-driven type-wheel shaft provided with a sleeve carrying two type-wheels, a cross-arm attached to said shaft and provided with pins, and a spiral spring attached to said cross-arm and one of the type-wheels to force the latter in one direction, substantially as and for the purposes set forth.

152. In a printing-telegraph instrument, the combination, with a type-wheel shaft provided with a sleeve carrying two type-wheels, a cross-arm attached to said shaft and provided with pins, a spiral spring attached to said cross-arm and one of said type-wheels, of an inking-roller, frame, and spindle, substantially as and for the purposes set forth.

153. In a printing-telegraph system, a key-board provided with two series of keys adapted to maintain a closed line-circuit, adjacent keys of both series electrically connected with each other, and one series constructed so as to break said line and the other adapted to interpose resistance in said line, substantially as and for the purposes set forth.

154. In a printing-telegraph instrument, a key-board provided with two series of keys adapted to maintain a closed line battery-circuit, adjacent keys of both series electrically connected with each other and with a sunflower device, one series adapted to close said line battery-circuit and the other adapted to interpose resistance in said closed line battery-circuit, substantially as and for the purposes set forth.

155. In a printing-telegraph system provided with combined transmitting and receiving instruments operated by alternating currents in a single line through polar relays and a closed line-circuit at each instrument, in combination with escapement-magnets having neutral armatures controlling type-wheels by the currents of a local battery-circuit at each instrument closed by said polar relay, and a double-contact neutral relay interposed in said single-line battery-circuit traversed by weak currents to close local battery-circuits by one of its contacts in parallel through shifting and printing magnets, substantially as and for the purposes set forth.

156. In a printing-telegraph system provided with combined transmitting and receiving instruments operated by alternating currents in a single line through polar relays and a closed line sunflower circuit at each instrument, in combination with escapement-magnets having neutral armatures controlling the type-wheels by currents of a local battery at each instrument closed by said polar relay and a double-contact neutral relay interposed in said single-line battery-circuit, and said relay responding to breaks in the line to close a local battery-circuit through printing-magnets, substantially as and for the purposes set forth.

157. In a printing-telegraph system provided with combined transmitting and receiving instruments operated by alternating currents in a single line through escapement-magnets with polarized armatures controlling type-wheels by said line-currents, a double-contact neutral relay interposed in said single line to close local battery-circuits by one of its contacts in parallel through shifting and printing magnets, substantially as and for the purposes set forth.

158. In a printing-telegraph system, combined transmitting and receiving instruments operated by alternating currents in a single line through escapement-magnets with polar armatures controlling type-wheels by line-currents, a double-contact neutral relay interposed in said single line traversed by weak currents to close local battery-circuits by one of its contacts in parallel through an interrupter, and shifting and printing magnets, substantially as and for the purposes set forth.

159. A printing-telegraph system provided with combined transmitting and receiving instruments operated by alternating currents in a single line through escapement-magnets with polarized armatures controlling type-wheels by line-currents, a double-contact relay interposed in said single line traversed by weak currents to close local battery-circuits by one of its contacts, an interrupter, and a unison cut-out in parallel through shifting and printing magnets, substantially as and for the purposes set forth.

160. In a printing-telegraph system provided with combined transmitting and receiving instruments operated by alternating currents in a single line through escapement-magnets with polarized armatures controlling

type-wheels by line-currents, a double-contact neutral relay interposed in said single line and responding to breaks in said line to close local battery-circuits through one of its contacts, an interrupter, and a printing-magnet, substantially as and for the purposes set forth.

161. In a printing-telegraph system provided with combined transmitting and receiving instruments operated by alternating currents in a single line through polarized relays and a sunflower device, escapement-magnets with neutral armatures for controlling the type-wheels energized by local battery-currents closed by said polarized relay, a double-contact neutral relay interposed in said single line and responding to breaks therein to close a local battery-circuit through an interrupter, and a printing-magnet, substantially as and for the purposes described.

162. In a printing-telegraph system provided with combined transmitting and receiving instruments operated by alternating currents in a single line through escapement-magnets with polarized armatures and controlling type-wheels by line-currents, a double-contact neutral relay interposed in said single line traversed by weak currents to close local battery-circuits by one of its contacts, an interrupter, and in parallel through a shifting-magnet by an arm of the shifting armature-lever through a printing-magnet, substantially as and for the purposes set forth.

163. In a printing-telegraph system provided with combined transmitting and receiving instruments operated by alternating currents in a single line through polarized relays and escapement magnetic devices having neutral armatures for controlling type-wheels energized by local battery-currents closed by said polarized relay, a double-contact neutral relay interposed in said single line and responding to weak currents therein to close local battery-circuits through one of its contacts, an interrupter, and a unison cut-out in parallel through a shifting-magnet and by an arm of the shifting armature-lever through a printing-magnet, substantially as and for the purposes set forth.

In witness whereof we have hereunto set our signatures in the presence of two subscribing witnesses.

SAMUEL R. LINVILLE.
LOUIS F. HETTMANSPERGER.

Witnesses:
GEO. W. REED,
THOMAS M. SMITH.