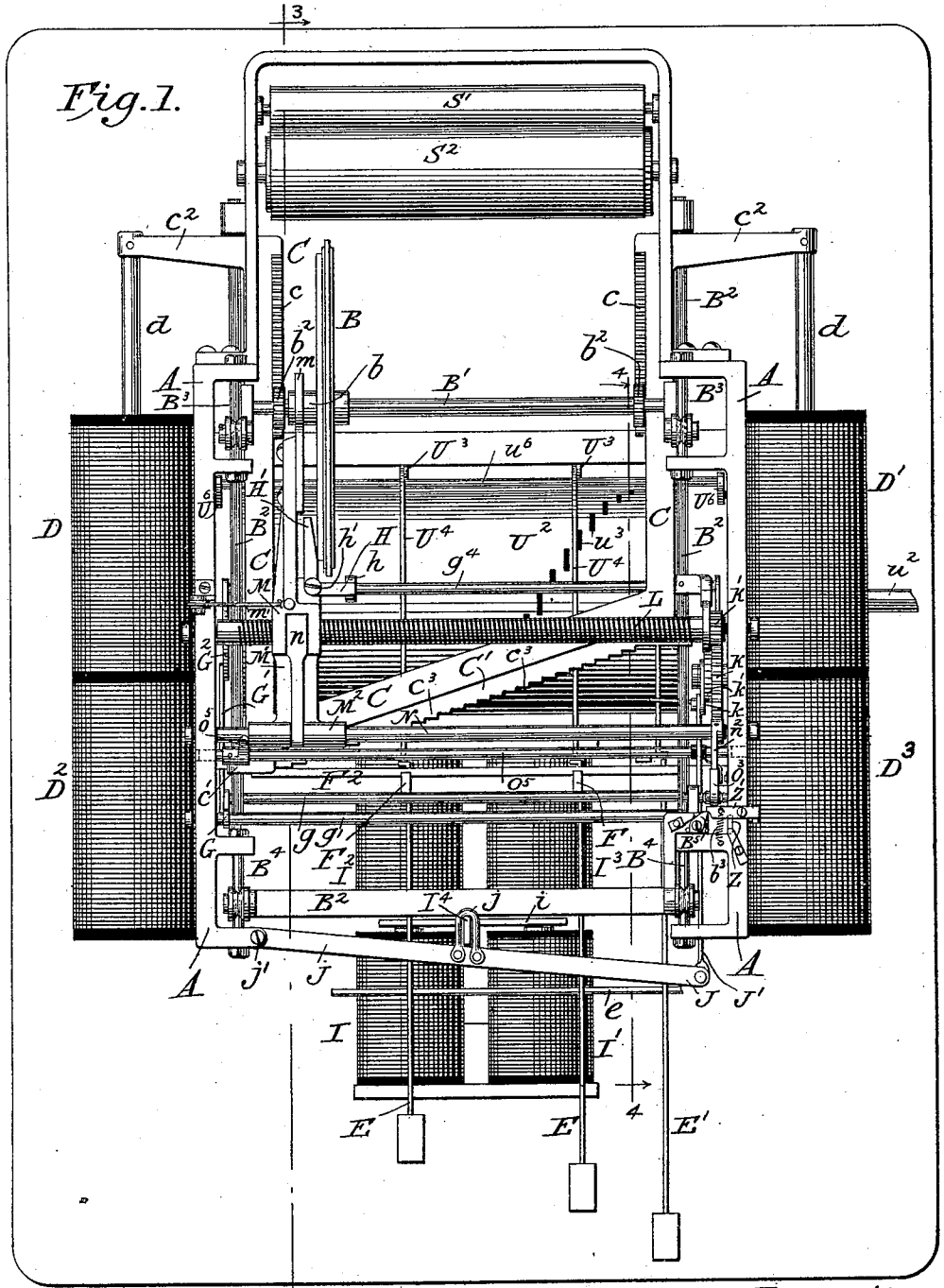
(No Model.) 7 Sheets—Sheet 1.

E. J. SILKMAN.

PRINTING TELEGRAPH.

No. 470,768. Patented Mar. 15, 1892.

Fig. 1.



Witnesses

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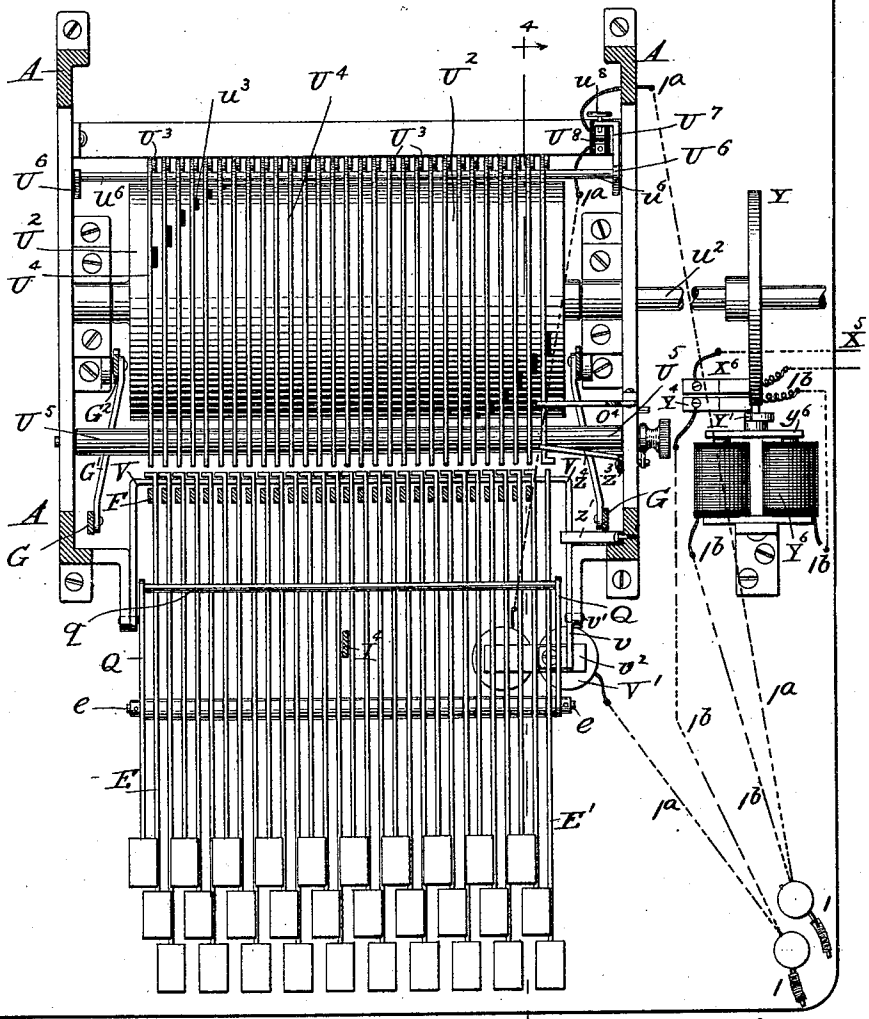
Fig. 2
ON LINE 2-2



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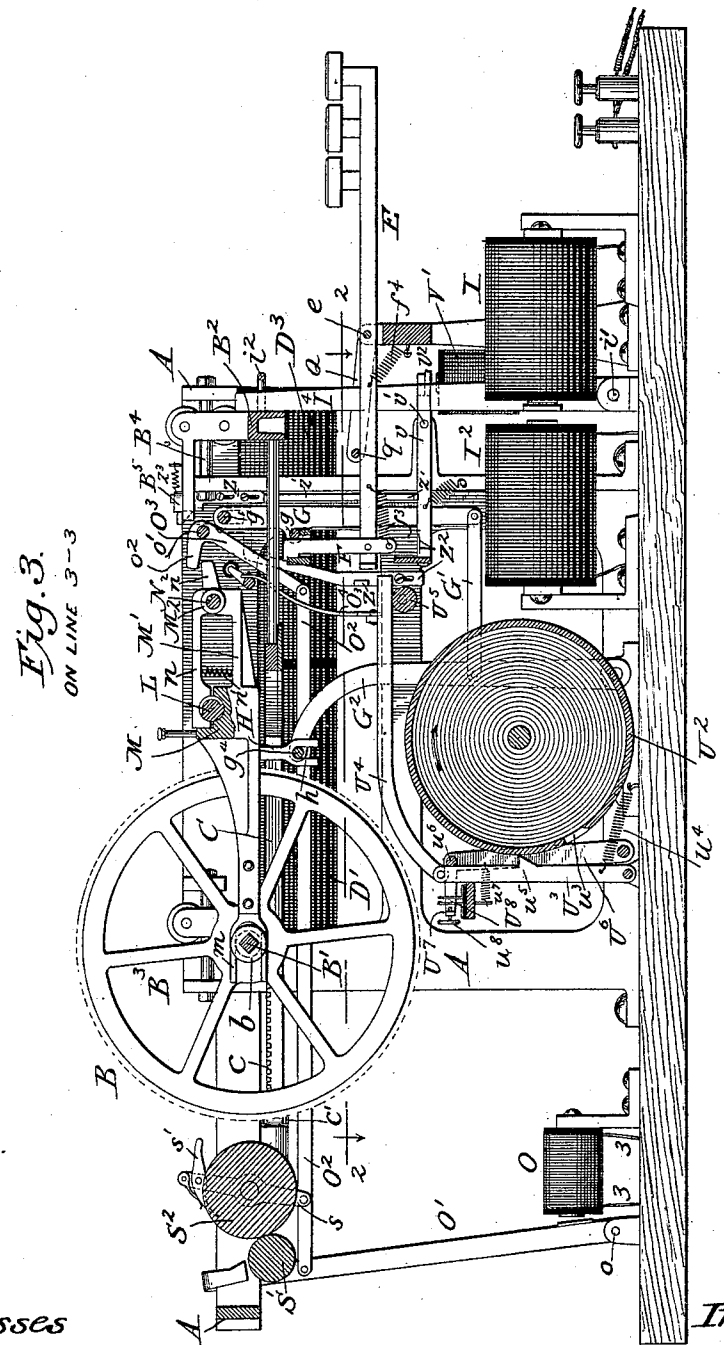

Fig. 3.
ON LINE 3-3

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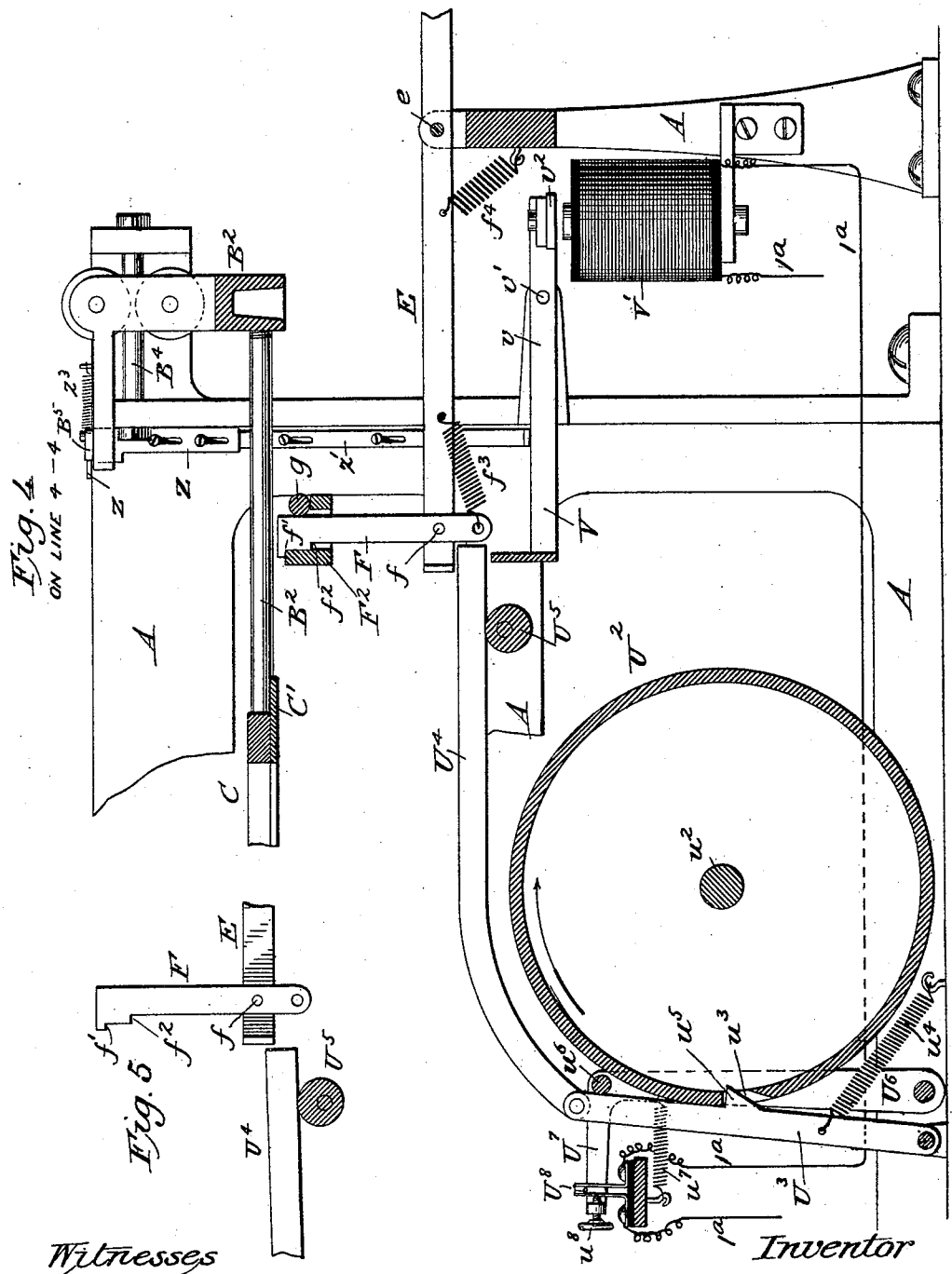

Fig. 4.
ON LINE 4—4

Fig. 5

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Fig. 7

ON LINE 7-7

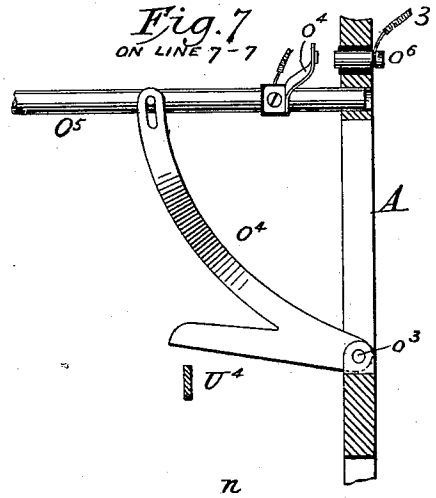
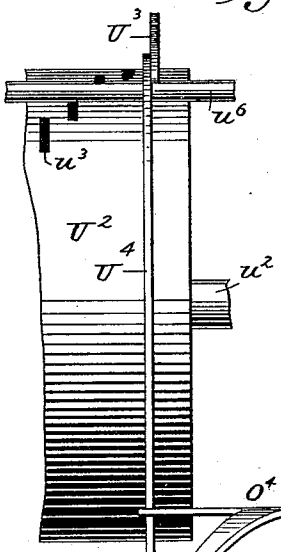


Fig. 6



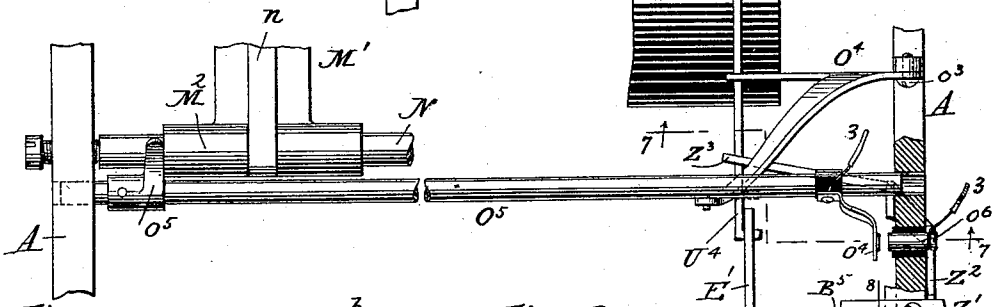


Fig. 8.

ON LINE 8-8

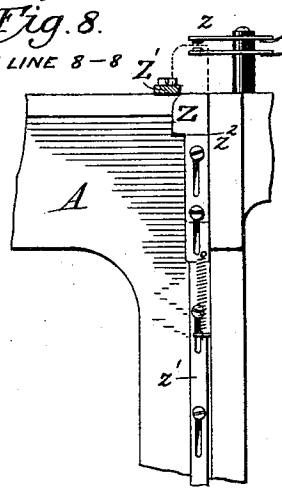


Fig. 9.

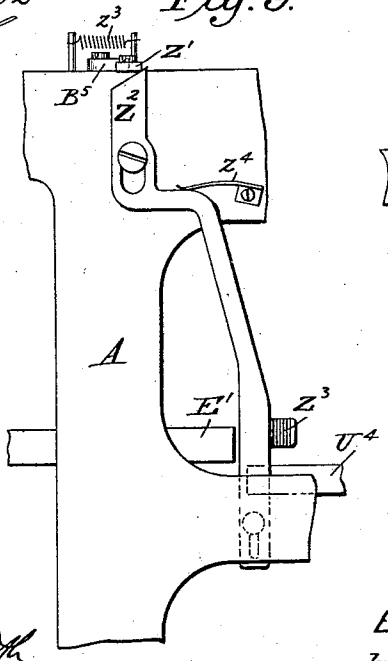


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Fig. 10.

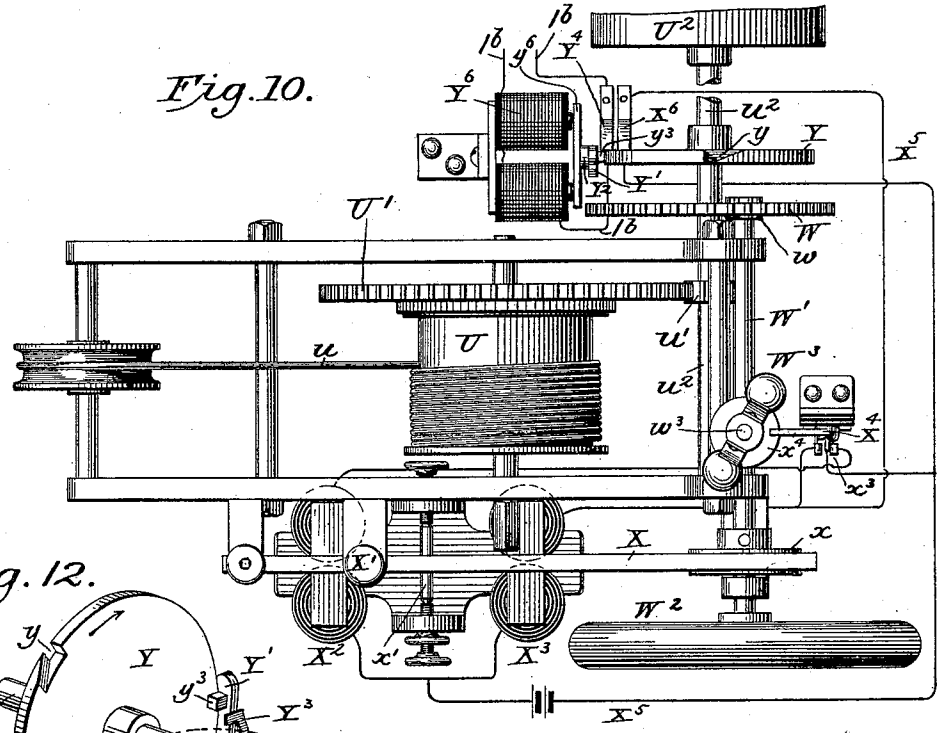


Fig. 12.

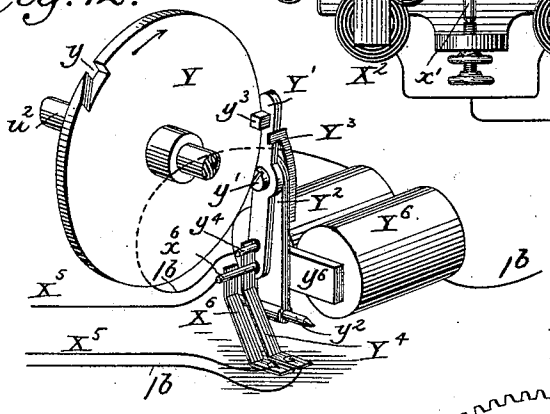
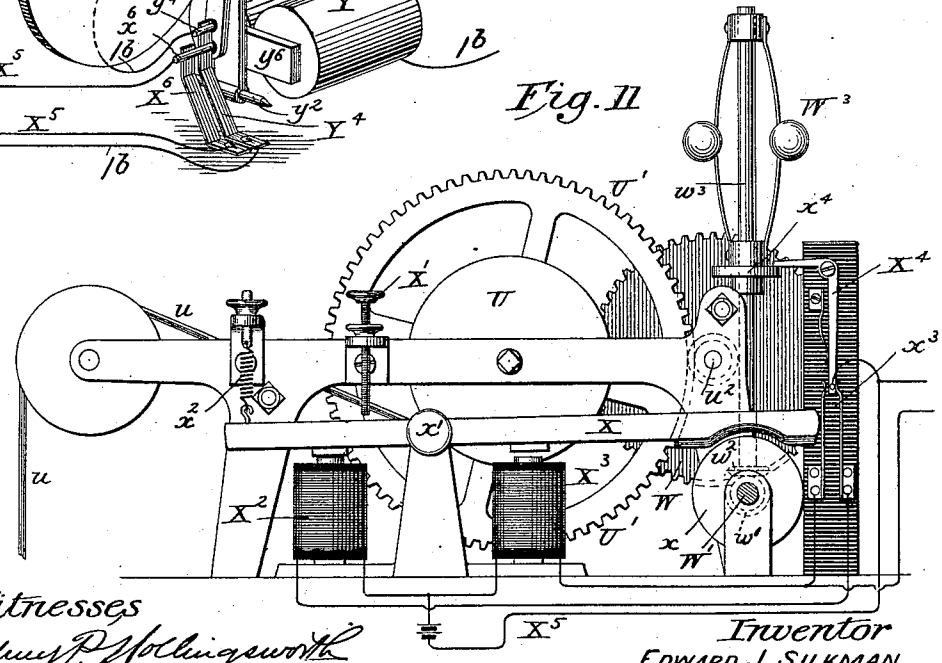


Fig. 11



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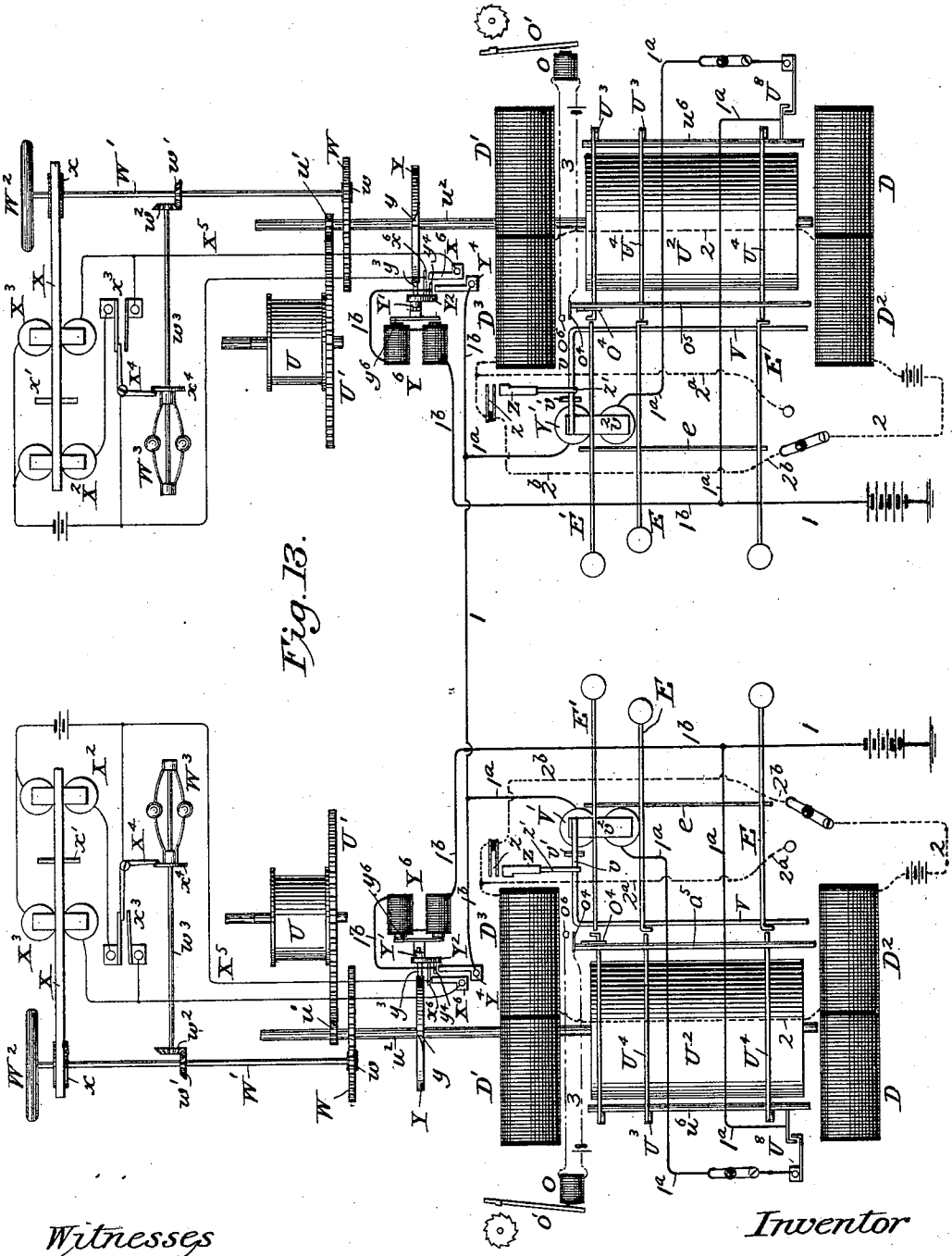

Fig. 13.

Witnesses
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UNITED STATES PATENT OFFICE.

EDWARD J. SILKMAN, OF BALTIMORE, MARYLAND, ASSIGNOR OF TWO-THIRDS TO GEORGE D. PENNIMAN AND THOMAS K. WORTHINGTON, OF SAME PLACE.

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 470,768, dated March 15, 1892.

Application filed April 16, 1891. Serial No. 389,184. (No model.)

To all whom it may concern:

Be it known that I, EDWARD J. SILKMAN, a citizen of the United States, residing at Baltimore city, in the State of Maryland, have invented certain new and useful Improvements in Printing-Telegraphs, of which the following is a specification.

My invention more especially relates to page-printing telegraphs in which two duplicate electrically-actuated type-writing machines are so organized that the transmitting-operator can simultaneously duplicate the message at his own and at the receiving station by means of a single connecting line-wire.

The principal object of my invention is to provide a simple and effective apparatus which insures the duplication on the receiver of the character transmitted without the possibility of error. This end I attain by certain novel organizations of instrumentalities, hereinafter designated in the claims, relating more especially to the motors which actuate the transmitting and reproducing mechanism, their synchronizing and circuit-controlling apparatus, the printer-actuating mechanism, and the type-wheel-controlling mechanism.

To carry out the objects of my invention, I preferably arrange the characters to be printed upon the perimeter of a type-wheel adapted to rotate and to traverse both laterally and longitudinally relatively to its platen or printing-cylinder. A series of finger-keys or key-levers carry stops which when properly actuated intersect the path of the type-wheel carrier and start automatic mechanism, which brings the proper type into position, locks it, prints the character, unlocks the type-wheel, and returns it to its normal position to repeat this process for printing each character in succession. The type-wheel is automatically fed step by step laterally as each character is printed and automatically retracted at the completion of each line to a proper position for beginning the next line by striking a key. It may also be returned to this starting-point at any period of its traverse by automatic mechanism actuated by a key-lever.

The apparatus thus far described constitutes an electrically-operated type-writing machine. In order to duplicate the message thus printed upon the transmitting type-writer upon one or more receiving type-writers, each of them is provided with a motor, a governor, and synchronizing apparatus which drives synchronously and uniformly mechanism which automatically interposes between the stop and its actuating devices an instrument which simultaneously throws the printing mechanism into action, as well as the actuating mechanism, regulates the synchronizing mechanism, both of the transmitting and receiving machines, and prints the character transmitted on the receiver. The organization is such that the receiver and the transmitter are duplicates of each other, and the machine may be used in either capacity at will simply by shifting the position of the interposing actuating device. The entire series of movements is inaugurated and completed by simply actuating a finger-key or key-lever, the parts being simultaneously or successively thrown into action as required by the automatic opening and closing of the various circuits.

The accompanying drawings represent all my improvements as adapted for use in connection with an electric type-writing machine substantially similar to that shown in United States Letters Patent No. 448,271, granted to me March 17, 1891, which describes and shows the details of the construction and operation of the type-writing part of the apparatus.

Figure 1 is a plan view of so much of such an electric type-writing machine embodying my improvements as is necessary to illustrate the subject-matter; Fig. 2, a horizontal section therethrough just above the key-levers, on the line 2 2 of Fig. 3, looking downward; and Fig. 3, a vertical longitudinal section on the line 3 3 of Fig. 1, looking inward. Fig. 4 is a similar section on the line 4 4 of Figs. 1 and 3, showing, on an enlarged scale, the details of the automatic circuit-controlling mechanism of the apparatus in the position it occupies when acting as a receiver. Fig. 5 is a similar view of a slide-bar, key-lever, and stop in the position occupied when transmitting. Fig. 6 is an enlarged sectional plan view of the mechanism controlling the solenoid-circuits and for automatically returning the type-wheel to its normal position for begin-

ning a new line. Fig. 7 is a sectional elevation through a portion of the same mechanism, on the line 7 7 of Fig. 6, looking forward, illustrating the way in which the key-lever closes the circuit to actuate the type-wheel-releasing mechanism. Fig. 8 is a sectional elevation through the solenoid-circuit-controlling apparatus on the line 8 8 of Fig. 6, looking outward. Fig. 9 is an elevation of the same apparatus as seen from the outer side of the main frame, illustrating particularly the operation of the slide-plate which releases the slide-holding finger. Fig. 10 is a plan, and Fig. 11 a side elevation, with the balance-wheel removed, of the motor, its governor, and automatic brake mechanism; Fig. 12, a detail perspective of the synchronizing mechanism controlling the brake above mentioned. Fig. 13 is a diagrammatic plan view of the apparatus, illustrating the several circuits, in which the heavy full line shows the main circuit through the key-lever-actuating magnets and the synchronizing magnets, the light full lines the brake-circuits controlled by these magnets, the heavy dotted lines the solenoid-circuit, and the light dotted line that for releasing the type-wheel. Fig. 2 shows the main and brake circuits in dotted lines because concealed by other parts of the mechanism.

The keyboard end of the machine I call the "front;" the printing end the "back." That portion of the machine on the right of a person facing the keyboard—the usual operative position—I call the "right;" the opposite side the "left."

Short unfeathered darts indicate the direction of view of the sections.

Unless otherwise indicated, the apparatus is of usual approved construction and operation.

All the mechanism is shown as mounted in or upon a main frame A, having suitable bearings, brackets, and guides therefor.

The characters, figures, letters, or symbols are arranged on the periphery of a type-wheel B. This type-wheel is carried by a collar or sleeve b, turning with and capable of sliding freely endwise on a shaft B′, rotating in bearings in a carriage or frame B^2, reciprocating longitudinally in guides B^3 B^4 on the main frame. Gears or pinions b^2 on the type-wheel shaft engage with racks c on a type-wheel-actuating frame C, having a range of reciprocation somewhat greater than that of the type-wheel carriage in which it traverses on suitable guides c'. Laterally-projecting arms c^2 on the rear end of this actuating-frame C carry rods d, on which the armature-cores of the type-wheel-actuating magnets or solenoids D D′ D^2 D^3 are mounted. These solenoids are shown as arranged parallel to each other and with the line of reciprocation of the type-wheel carriage on opposite sides of the machine near its upper part, so as to secure direct connection between their magnets or cores and the type-wheel-actuating frame reciprocated by them. They are also shown as arranged in pairs end to end, so that one armature-core serves for each pair of solenoids, and the cores or magnets are attracted by the solenoids, so as to move the frame C, with which they are connected, in alternately-opposite directions as the current is shifted from one set of solenoids to the other. In the normal position shown in the drawings the circuit is through the rear solenoids D D′. When it is shifted through the front solenoids D^2 D^3, the type-wheel-actuating frame C moves forward, while the type-wheel carriage B^2 remains stationary. The racks c consequently rotate the gears b^2 on the type-wheel shaft and turn the type-wheel, so as to bring the proper letter into position for printing. In order, however, to adapt the machine to print any character desired, a stop-plate C′ is mounted on the front end of the type-wheel actuating-frame C obliquely to its line of movement and is provided with notches c^3, one for each character on the type-wheel.

The usual finger-keys are arranged in any desired order in front of the machine. Their key-levers E are shown as rocking on a common axis e. Each key-lever E carries a stop F, capable of rocking vertically on its pivot f in a plane parallel with its key-lever, and also movable endwise vertically in a transverse guideway F^2 on the main frame, wide enough to permit of the necessary rocking or yielding movement of the stop-arm on its pivot. Steps f' f^2 are provided on the head or upper end of each stop, the lower one f^2 of which when elevated normally resting on the rear edge of the guideway, while the upper one f' at the proper time engages its appropriate notch on the stop-plate C′. Springs f^3 f^4 tend to hold the stops and key-levers in their normal backward and downward or inactive position.

A shifter-bar g, extending across the machine in front of the line of stops F, unites two levers G, swinging on another cross-bar g' and respectively connected by a pivoted link G′ with an arm G^2, rocking on a pivot g^2 and normally held in a backward position by a spring. (Not shown.) A cross-bar g^4 connects the tops of the arms G^2. This cross-bar is embraced by the forks h of an elbow-lever H, rocking on a pivot h'. The rearwardly-projecting arm H′ of this lever at proper times interlocks with the type-wheel B to hold it while printing. This printing is done by means of printing-magnets I I′ I^2 I^3, whose armature i is carried by a lever I^4, rocking on a pivot i' and connected by a loop i^2 with the type-wheel carriage B^2. This lever is also embraced by a loop j on a radius-bar J, rocking on a pivot j' and connected by a link-rod J′ with the pawl k of a ratchet k' on a spur-wheel K, meshing with a spur-gear K′ on a screw-shaft L, which controls the lateral feed of the type-wheel. A block M slides freely endwise on this screw-shaft. A forked arm m on this block embraces a groove in the type-wheel

collar b, thus causing the block and type-wheel simultaneously to traverse their respective shafts. A plate M′ connects the block M with a slide M^2, movable freely endwise on a rock-shaft N. An arm n, capable of sliding freely endwise on the rock-shaft and movable around its bearings in the slide M^2, is provided with a tail-piece traversing a longitudinal groove in the rock-shaft, so that the arm n can both turn with and move laterally on the rock-shaft correspondingly with the type-wheel and traversing block M. That portion of the arm which overlaps the screw-shaft is correspondingly screw-threaded and normally held in contact therewith by a spring n', so as to cause the type-wheel and block M to traverse step by step to space the printing. In thus traversing the block winds up a coiled spring or lifts a weight connected with it by a cord or chain m'. When this reaches the end of its traverse, or before, the arm n is released from the screw-shaft by striking a key, and the spring or weight retracts the block and type-wheel to begin a new line. The type-wheel may automatically be reset to begin a new line at any stage of its progress by actuating a key-lever E′, so as to close an electric circuit through a magnet O, actuating an armature-lever O′, rocking on a pivot o. A link-rod O^2 is pivoted to this lever and to an elbow-lever O^3, rocking on a pivot o'. The short arm o^2 of this elbow-lever constitutes a dog which acts on a crank-arm n^2 on the rock-shaft N, and rocks it so as to release the screw-arm n from the screw-shaft L. A suitable spring-pawl holds this arm up until the block reaches its place of beginning, when it is automatically released, and the arm re-engages the screw-shaft, and the forward feed is resumed. The paper is passed upward in front of the impression-roller or printing-cylinder S^2 between it and the ribbon and type-wheel and then down between this cylinder and a roller S′. This printing-cylinder also acts as a feed-roll, being advanced step by step at the proper time to print a new line by means of a ratchet thereon actuated by a spring feed-pawl s', pivoted on an arm s, rocking on an axis concentric with that of the printing-cylinder and pivoted to the link-rod O^2, which is actuated at the proper time by the magnet O to cause the dog o^2, connected with this link-rod, to release the type-wheel block M from its actuating screw-shaft N just as the type-wheel begins to retract to begin a new line.

My patent, No. 448,271, above mentioned, shows a convenient arrangement of the inking-ribbon. This patent also clearly shows and describes the electrical apparatus and circuit connections by which the solenoids which control the position of the type-wheel, the magnets which actuate the frame to print the character, and the magnet which releases the block to retract the type-wheel to its normal position after printing a line, and the means by which these are thrown into action by the key-levers, and therefore are not shown herein, as their details constitute no part of the subject-matter claimed, as other well-known equivalent ways of actuating these parts might be used.

The apparatus above described operates as follows, starting from the normal position shown in the drawings—that is, with the type-wheel-actuating frame C in its extreme rearward position, the type-wheel being in its forward position clear of the printing-roller, unlocked, free to turn, and with its actuating-gears b^2 engaged with the forward portion of the actuating-racks c. The rear set of solenoids and the front set of printing-magnets are in circuit. In this position the actuating of a key-lever closes the circuit through the front solenoids and draws forward the type-wheel-actuating frame C, while the type-wheel carriage B^2 is held stationary by abutting against suitable stops. Meanwhile the key-lever E has moved its appropriate stop F through its guideway F^2, so that its lower step f^2 rests on the upper rear edge thereof directly in the path of the stop-plate C′, the corresponding notch c^3 of which engages with the stop and shoves it forward against the front side of the guideway. At this moment the relation of the parts is such that the character corresponding with the key pressed is presented by the wheel to the impression-cylinder. A contact-bar q rests on the key-levers and is connected with their pivot-bar or axis e by radius-bars Q, so as to be free to move with the key-levers. Consequently the elevation of the key-lever, as above described, breaks the circuit through the rear solenoids and simultaneously closes that through the front solenoids. As the stop is shoved forward, as above described, by the stop-plate it carries with it the shifter-bar g, which in turn, through its levers G, link G′, and arms G^2, actuates the cross-bar g^4, which locks the dog H and type-wheel after the latter, however, has been revolved by its actuating-gear to bring the letter corresponding with the key-lever actuated into proper position for printing, as above mentioned. This locking movement simultaneously opens both solenoid-circuits and that of the front set of printing-magnets and closes the circuit through the rear set of printing-magnets, which retracts the type-wheel carriage B^2 and frame C and prints a character. As the printing is done the circuit through the rear set of printing-magnets is broken and that through the front set closed. The carriage B and frame C are again drawn forward, the dog released from the type-wheel, and the latter moved laterally a space for the next letter. This series of operations is automatically repeated as long as any stop remains in the path of the stop-plate; but when that path is unobstructed the parts resume their normal inactive position and maintain it until a key-lever is actuated.

The organization and operation of the apparatus above described are substantially similar to those shown in my patent, No.

448,271, above mentioned, which also shows and describes the details of the various circuit connections. That apparatus, however, was only adapted to print its own sheet. My present invention goes much farther than this and contemplates such an organization and connection of two such machines by a single wire that either may be used at pleasure as a transmitter or as a receiver and that by printing a message on one machine it will automatically be duplicated on the other. I will now proceed to describe the modification in the apparatus by which this can be done, premising that, unless otherwise indicated, the organization and operation of the apparatus may be similar to that hereinbefore set forth. Motors and synchronizing apparatus at both the receiving and transmitting stations are essential to the proper operation of the apparatus. These may be of various approved constructions. The drawings show such apparatus as consisting of a train of gearing driven by a weight and regulated by a governor controlling an electric brake. The weight (not shown) is suspended by a cord or chain u, wound around a barrel U, carrying a large spur-wheel U′, meshing with a spur-pinion u' on the shaft u^2 of an actuating-cylinder U^2. A coupling may connect the pinion and cylinder-shaft, if desired. This cylinder turns in bearings in the main frame across which it extends. A series of notches u^3—one for each key-lever—runs spirally around the cylinder, but does not quite encircle it, a short space being left between them to aid synchronizing, as hereinafter explained. A series of radius-bars U^3, pivoted at bottom to the frame, is held against the cylinder by springs u^4. Endwise-moving slide-bars U^4, pivoted in rear to the upper ends of these radius-bars, extend forward toward the key-levers, their front ends resting on a cam-roller U^5, by turning which these bars may be raised or lowered a slight distance. A wedge-shaped spur or tappet u^5 on each radius-bar ordinarily bears on the surface of the cylinder and keeps its slide-bar retracted; but when the tappet enters its appropriate notch in the cylinder its spring throws the slide-bar forward under its appropriate key-lever. This only occurs, however, when the slide-bars are lowered by the cam-roller, for when this forward movement takes place with the slide-bars lifted their front ends abut against the rear ends of the key-levers, which are made broad for this purpose, (see Fig. 5,) and their action is neutralized. The notches are so spaced that one slide-bar retracts before the succeeding one advances, thus preventing interference or misprinting. A U-shaped frame or lifter-bar V has its forward ends pivoted to brackets on the main frame in advance of the rear ends of the key-levers E, while the bar itself extends across the machine underneath and between their rear ends and the bottoms of the stops F, pivoted thereon, and beneath the front ends of the slide-bars U^4 when in their forward position. One of the arms v of this bar projects in advance of its pivot v' and carries the armature v^2 of a magnet V′, which when energized attracts the armature and raises the lifter-bar V, carrying with it any one of the slide-bars U^4 which has intruded between it and its corresponding key-lever, which in turn lifts that key-lever and its stop, which consequently intersects the path of the stop-plate C′, for the purposes hereinbefore explained. The range of movement of the lifter-bar is less than the depth of the sliding bars. Consequently no key-lever is actuated by it without the interposition of its slide-bar. The slide-bars of the transmitting-machine are raised (see Fig. 5) and normally remain inactive, as above explained, while those of the receiving-machine are lowered, as shown in other figures, so as to adapt them to the automatic duplication of the message transmitted, as hereinafter described. A bar or rod u^6, mounted on arms U^6, rocking on pivots in the base of the frame, is pressed against the front sides of the radius-bars U^3 by a spring u^7. Consequently when one of these bars advances when its tappet enters a notch in the cylinder this circuit-closing bar u^6 is carried with it to close the main circuit, as hereinafter explained. When the radius-bar retracts, the spring u^7 retracts the bar u^6 and opens the circuit again, which is its normal condition. An arm U^7 on the circuit-closing bar or on one of its arms carries a set-screw u^8, which acts upon contact-springs U^8 in the main line to close it when the bar u^6 advances.

The motors are regulated as follows: A spur-wheel W on the cylinder-shaft u^2 gears with a corresponding pinion w on a counter-shaft W′, carrying a balance-wheel W^2, and a bevel-pinion w', gearing with a corresponding pinion w^2 on a governor-shaft w^3, carrying a governor W^3. The counter-shaft also carries a brake-wheel x. One end of a brake-lever X, rocking on a central pivot x', is provided with a properly shaped and constructed rubbing-surface adapted to bear on the brake-wheel at the proper time, while the other end is provided with a tension-spring x^2 and a regulating-stop X′. Magnets X^2 X^3 on opposite sides of the pivot act upon corresponding armatures carried by the brake-lever to actuate it when desired. The circuit of these magnets is regulated by an elbow-lever X^4, controlled by a ring or collar x^4 on the governor, and acting on contact-springs x^3, Fig. 11, so that when the speed increases the magnet X^3 is energized to apply the brake-lever, which is retracted by the other magnet X^2 when the speed becomes too slow. The running of the motor can thus nicely be regulated. These magnets are shown as in a local circuit X^5, controlled by synchronizing mechanism now to be described. A disk Y, also on the cylinder-shaft u^2, is provided with a notch or recess y on its edge or periphery, which notch has a later-

ally-inclined rear edge, Fig. 12. A contact-arm Y′ rocks across the edges of this disk or parallel with the shaft thereof on an intermediate pivot y' on the upper end of an armature-bar Y^2, rocking on a pivot y^2, so as to allow it and the contact-arm Y′, carried by it, to move toward or from the edge of the disk, as desired. A spring Y^3 on this armature-bar presses a lug y^3 on the inner side of the upper end of the contact-arm Y′ against the side of the disk and into its notch y at the proper time. Normally, however, this lug rides on the edge or periphery of the disk and not on its side, as shown in Fig. 12, and drops into the notch at the proper time, as hereinafter explained. Insulated pins x^6 y^4 on the lower end of the contact-arm Y′ are respectively connected with one of the terminals of the brake-circuits and the main circuit. The opposite terminals of these circuits consist of springs X^6 Y^4, in contact with which the pins above mentioned come in the proper time to close their respective circuits; but normally they are held out of contact therewith as the lug y^3 is riding on the edge of the disk and its spring Y^3 forces or holds the pins x^6 y^4 out of contact with the circuit-closing springs X^6 Y^4. Fig. 12 shows the circuits as closed through these pins. Magnets Y^6 in the main circuit actuate an armature y^6 on the armature-bar Y^2 when the circuit is closed therethrough, so as to draw the contact-arm away from the disk far enough to allow the lug y^3 to ride on its edge, as above explained. This is the normal position in which the circuits are open; but when the lug y^3 drops from the edge of the disk into the notch y and is forced to one side of its incline the parts assume the position shown in Fig. 12, and both the main and brake circuits are closed until the magnets Y^6 draw the armature-bar and contact-arm away from the edge of the disk, at which moment the lug y^3 is again moved laterally by its spring, so as to ride on the edge or periphery of the disk, where it remains until the notch y comes around again, when the circuit is again closed and broken as before. It will be noted that the main-circuit branch 1^b runs through the magnets Y^6, pin y^4, and spring Y^4, while the brake-circuit X^5 includes the pins x^6 and spring X^6. Consequently both of these circuits are simultaneously opened and closed by the same movement of the contact-arm Y.

The type-wheel-resetting apparatus has already been set forth. I will now describe my present way of operating it electrically. Whenever the operator desires to retract the type-wheel to its point for beginning a new line, he operates a key-lever E′ on the right side of the key-board, Figs. 6 and 7. This key-lever has no stop F, like the ordinary ones, but co-operates, like them, with its appropriate radius-bar U^3, slide-bar U^4, and notch u^3 in the cylinder U^2. When the key-lever is actuated with its sliding bar in position, the slide-bar is elevated by the lifter-bar V and strikes one arm of a bell-crank O^4, rocking on a pivot o^3 on the main frame, the other arm of which is connected by a slot and pin to a rod O^5, adapted to slide endwise across the frame, carrying an insulated spring-contact o^4 at one end and a rigid stud o^5 at the other. The lifting of the key-lever consequently forces this spring-contact against an insulated pin o^6 on the main frame, thus closing the circuit through the magnet O to rotate the printing-cylinder one step and release the type-wheel block M from the feed-screw L, as hereinbefore described, to allow the type-wheel to retract. As the type-wheel ends its backward movement, its slide M^2 strikes the rigid stud o^5, which moves the slide-rod O^5 and opens the circuit by separating the spring-contact o^4 and pin o^6.

The circuit through the front solenoids is controlled in the following manner: Spring-contacts z, which normally stand open, are mounted on an insulated support on the main frame and overhang a circuit-making slide Z, movable vertically in guides on the inner side of the main frame and normally held with its upper end flush with the top of the frame. This slide is raised at proper times by means of a bent rod z', Fig. 3, connecting it with the lifter-bar V. The upper rear corner of this slide is beveled, and it is also provided with a shoulder z^2, Fig. 8, for purposes hereinafter described. A finger Z′, rocking horizontally on an intermediate pivot on the main frame, normally overlies the upper inclined end of the slide, a spring z^3 holding its inner end against a yielding spring stop or pawl B^5 on the type-wheel carriage. The pawl yields to slide past the finger as the type-wheel carriage moves forward, but bears against it when moving backward. A stop b^5 prevents it from going too far. A slide-plate Z^2, movable vertically in guides on the outer side of the main frame, Figs. 6 and 9, is provided with a lifting-arm Z^3, bent inward, so as to be actuated by the slide-bar U^4 of the key-lever E′. A spring z^4 normally holds the plate with its upper edge flush with the top of the main frame. This edge is inclined backward and upward on the rear side of the outer end of the spring-finger Z′, so that when it rises it forces the inner end of this finger backward. When the slide Z is raised by the lifter-bar V to close the contacts z, the spring-finger Z′ engages its shoulder and holds it up, consequently keeping the circuit closed until the type-wheel frame moves backward, when its pawl B^5 releases the spring-finger from the slide and breaks the circuit. When, however, the key-lever E′ is lifted by its slide-bar and lifter-bar, the slide-plate also rises and its inclined end releases the spring-finger from the slide and permits it to descend with the lifter-bar without waiting for the pawl B^5 to act. It in fact prevents the engagement of the slide and finger, as it holds them out of contact.

The circuits and their contact-controlling

devices pertaining to the type-writer proper—that is those controlling the printing, feeding, and resetting mechanisms—are fully shown in my patent above mentioned, and are consequently not shown in detail here, except where necessary to illustrate the working of my present improved apparatus. The drawings, Figs. 2 and 13, show the main circuit 1 connecting the transmitting and receiving instruments as proceeding from a suitable generator and as divided into shunts or branches, one 1^a of which runs through the transmitter-contacts U^8 and the lifter-bar magnets V′ to the main line and thence in reverse order through the corresponding lifter-bar magnets V′ and circuit-controlling contacts U^8 of the receiver to the generator or ground. The other branch 1^b of the main circuit runs from the generator through the transmitting synchronizing-magnets Y^6 and contacts y^4 and Y^4 to the main line and thence through the corresponding receiving synchronizing-magnets Y^4 y^4 in reverse order to the generator or ground at the receiving-station.

Fig. 13 shows the apparatus at the transmitting and receiving stations exactly duplicated, except that the position is reversed, so that the front or keyboard ends of the machine are nearest each other.

The running of the brake-circuits X^5 heretofore has been explained.

The circuit through the rear solenoids may be similar to that shown in my patent above mentioned. The front solenoid-circuit 2 is divided into two alternative branches, one 2^a of which is used when the machine is operating simply as a local type-writer, and is shown in Fig. 13 as running directly from the generator through the solenoids and their circuit-controlling apparatus, as in my patent above mentioned. When used as a transmitter, the circuit runs through the branch 2^b, which includes the circuit-controller or spring-contacts z. The type-wheel-releasing magnet-circuit 3 runs from the generator through its magnet O and contacts o^4 o^6 back to the generator or ground, as shown.

Fig. 13 shows the switches of all the circuits as set for the transmission and reproduction of a message.

Figs. 3 and 4 show the relations of the parts, both of the transmitter and receiver at this moment, except that the slide-bars U^5 of the transmitter are raised, as in Fig. 5.

The operation is as follows: Both motors are started, rotating the actuating-cylinders, say, thirty times a minute and the governor and brake mechanism at an appropriate speed. As before stated, the spiral series of notches u^3 do not entirely encircle the actuating-cylinder, but leave a blank space between their beginning and end. The object of this is to aid in synchronizing the motors by adjusting the speed once in each revolution, and this is done by so organizing the apparatus that just after the notch y is engaged with the lug y^3 on the armature-lever Y′ of the synchronizing mechanism, and the brake-circuit is consequently closed, the spurs u^5 of the radius-bars U^3 are traversing the blank space on the actuating-cylinder U^2, in which position the contacts U^8 of the main-line branch 1^a are open and the actuating or lifter magnets V′ and printing-magnets are inactive. Consequently the synchronizing is effected during the momentary pause thus occasioned in the printing mechanism and without interference with the operation of the latter mechanism. The depression of a transmitting-key raises the rear end of its corresponding key-lever E and its stop F, the appropriate solenoid-circuit is closed, and when the lifter-bar V raises circuit-making slide Z and makes contact at z and through the front solenoids the proper letter is printed by the transmitter, as described in my patent aforesaid. This elevation of the key-lever lifts it above the path of its corresponding slide-bar U^4. Consequently when the spur u^5 of the radius-bar U^3 of that slide-bar enters its appropriate notch in the actuating-cylinder the slide-bar is interposed between the key-lever and lifter-bar V, as shown in Fig. 4. This movement closes the main-circuit branch 1^a through the contacts U^8 and lifter-magnets V′ of both the transmitter and receiver as they are revolving synchronously, and the slide-bars U^4 of both instruments are consequently simultaneously inserted between their lifter-bars and key-levers. This energizing of the receiving-lifter-magnet causes its lifter-bar to raise its appropriate stop, which causes the printing of the proper letter on the receiving-machine, as was done on the transmitter. These operations are repeated as each letter is printed. The transmitting slide-bars all advance in turn, but all abut against the rear ends of their respective key-levers, and thus remain inoperative until the key-levers are lifted out of the way, when they are interposed between the key-lever and lifter-bar, as above described. The receiving slide-bars, on the contrary, are always so interposed in turn at each advance, being all dropped out of the way of key-levers by the cam-roller U^5; but they produce no effect until struck up against the key-levers by the lifter-bar when actuated by its magnets. Consequently the printing of any but the letter transmitted is impossible. This energizing of the lifter-bar magnets is necessarily momentary only, as the circuit is broken as soon as the spurs, which remain only a moment in the notches of the actuating-cylinder, escape therefrom, and both the contacts U^8 and the armatures of the lifter-bar magnets are quickly retracted by their springs. The synchronizing-contacts are opened and closed once for every revolution of the disk Y, as above explained. Every impulse sent through the synchronizing-magnets Y^6 breaks both the main-line and brake circuits. Should, however, the motors not be in synchronism, the lug y^3 of one instrument would enter its notch y, and thus close its

brake-circuit, putting on the brake and retarding the motor. By the time the notch of the lagging disk opposes its lug the closing of the main circuit has opened its brake-circuit. Consequently its motor is unretarded and gains on the other until they synchronize. This synchronizing of the instruments is important in promoting rapid work, as when the instruments are out of synchronism the lagging one remains inactive until its proper actuating-notch in the cylinder U^2 comes into action. Suppose, for instance, the receiving-instrument to be the lagging one. When a key is depressed, the circuit is simultaneously closed through the branch 1^a, including the lifter-magnets V′ and the contacts U^8, which are closed by the forward movement of the cross-bar w^6 as the lug w^5 of the slide-bar U^4 drops into its notch w^3 in the cylinder U^2, thus completing the circuit to the corresponding parts of the receiving-instruments to actuate them, as above described, to print the letter. Simultaneously with this operation the branch 1^b of the main line energizes the synchronizing-magnets Y^6 of the transmitter, which attracts the armature y^6 and causes the lug y^3 to ride on the edge of the disk Y, as above explained, in which position the spring Y^3 breaks the main-line circuit and holds it broken until the lug y^3 again drops into the notch y. This correspondingly breaks the circuit through the receiving synchronizing-magnets, and consequently leaves its brake-circuit open, thus allowing the receiving-cylinder to gain upon the transmitting one until synchronism is restored. The front solenoid-circuit is closed by the lifter-bar raising the slide Z, as above described, and broken automatically by the pawl B^5 on the backward stroke of the type-wheel carriage or by the lifting of the slide-plate Z^2 by the slide-bar of the key-lever E. The circuit of the type-wheel-releaser magnet is opened and closed by the key-lever E′, its slide-bar, and lifter-bar, as above described. My improvements enable me to employ two comparatively simple and effective type-writing machines capable of being worked by any ordinary operators either as simple separate machines or reciprocally as transmitters and receivers by simply moving a few cams and switches, to duplicate accurately the work of the transmitter on one or more receivers by means of a single line-wire, and to prevent the possibility of error or mistake in printing any but the character or letter transmitted, and to duplicate the messages as in an ordinary type-writing machine.

The brake-magnets and their circuit-controlling switches are shown in Fig. 13 as arranged in shunt or local circuits X^5, controlled by the synchronizing-magnets Y^6, so as to actuate the brake-magnets intermittently irrespective of the switch controlled by the governor.

The following is a description of the operation of the apparatus, which is duplicated at the transmitting and receiving stations, as illustrated in Fig. 13, and connected by a single line-wire. Fig. 1 represents the normal position of the type-writers, the operation of which as a type-writer has already been described. Figs. 3 and 4 represent the apparatus in position for acting as a receiver, Fig. 3 showing the normal position of the parts with the main-line circuit open, and Fig. 4 the position of the parts with the circuit closed, but without current on the main line. Fig. 12 shows the condition of the synchronizing-disk at the same moment and under the same conditions. The motors at both stations are supposed to be running in synchronism with their parts in the same relative attitudes. The transmitting-instrument, however, has its slide-bars U^4 elevated by means of the cam-shaft U^5, as shown in Fig. 5, so that each normally abuts on its forward stroke against the rear end of its appropriate key-lever unless the latter be elevated. If now with the parts in this position the operator depresses a key, he throws up its corresponding stop F, causing the stop to intersect the path of the slide-plate C′. This movement also lifts the contact-bar q, which simultaneously breaks the circuit through the rear solenoids and closes that through the front ones, thus drawing forward the type-wheel-actuating frame C and its stop-plate C′. This movement causes the shifter-bar g and its connecting-lever to interlock the dog H with the type-wheel after it has revolved sufficiently to present its appropriate letter. The stop mechanism also simultaneously opens the circuits both of the front and rear solenoids and that of the front set of printing-magnets and closes the circuits through the rear set, which retracts both the type-wheel carriage and its actuating-frame and prints the character by the striking of the type-wheel against the printing-cylinder, or rather against the ribbon interposed between it and the paper on the cylinder. As the character is printed the circuit through the rear set of printing-magnets is broken, and that through the front one, closed simultaneously, releasing the dog locking the type-wheel and drawing forward the type-wheel carriage for a new stroke, the operation above described being repeated. This is the operation of the transmitting type-writer. The same lifting of the stop that caused the above movements leaves the corresponding slide-bar U^4 free to move forward under the stop of the key-lever and allows the lug w^5 of the slide-bar to enter the corresponding recess w^3 in the actuating-cylinder U^2 whenever it comes around. As soon as this happens the spring w^4 throws the lug into the recess, thus closing the contact U^8 in the main-line branch 1^a and energizing lifter-magnet V′ of the transmitter; but this produces no particular effect there, as the corresponding stop has already been lifted by the key-lever. The circuit, however, passes over the main line and through the lifter-magnets and contact U^8 of the receiver and thence to ground.

This energizes the lifter-magnet and elevates the lifter-bar V, so that it lifts the corresponding slide-bar U^4, which in the meantime has been thrust forward by its lug entering its notch in the actuating-cylinder, which must be done before the circuit can be closed through the contact U^8, and lifts the corresponding stop, together with the key-lever of the receiver, which movement causes in the receiver an automatic repetition of all the movements above described as having taken place in the transmitter. This is done each time a character or letter is printed, and the work is consequently done by a series of impulses corresponding with such letters or characters. One branch 1^b of the main line, it will be observed, runs direct from the generator through the synchronizing-magnets and through the contact-pins x^6 y^4, above mentioned, and thence through the contact-pin Y^4 and branch 1^b again back to the main branch 1^a, where it joins the main line, the two branches 1^a and 1^b being thus connected in the branch or multiple arc to the main line connecting the two instruments, the circuit connections being the same at each instrument, as before explained, except that they run in reverse order. This arrangement of the circuits will be readily understood by reference to Figs. 2 and 13.

Having thus fully described the organization and operation of my improved printing-telegraph apparatus, what I claim therein as new and as of my own invention is—

1. The combination, substantially as hereinbefore set forth, of a motor, its governor, gearing connecting them, a brake-wheel, a friction-brake rocking on a central pivot, its actuating-magnets on opposite sides of the pivot, and a circuit-controlling switch actuated by the governor to regulate the speed of the motor.

2. The combination, substantially as hereinbefore set forth, of a motor, its governor, its friction-brake, its actuating-magnets and generator in an independent circuit, a circuit-controlling switch actuated by the governor to regulate the speed of the motor, and a second or separate circuit-controlling device automatically controlled from the main line and in a local shunt-circuit with the governor-circuit shifter, but directly and independently controlling the brake.

3. The combination, substantially as hereinbefore set forth, of a motor, a counter-shaft driven by gearing therefrom, a governor driven from this shaft, a brake-wheel thereon, a brake-lever rocking on a central pivot and acting on the brake-wheel, a local circuit, magnets controlling the brake-lever therein on opposite sides of the pivot, and a circuit-controlling switch actuated by the governor to regulate the speed of the motor.

4. The combination, substantially as hereinbefore set forth, of a motor, its governor, its brake mechanism, a local circuit, a generator of electricity, brake-controlling magnets, and a circuit-controlling switch actuated by the governor, all in a shunt-circuit, and automatic synchronizing mechanism in a branch of this circuit, which intermittently and independently actuates the brake mechanism.

5. The combination, substantially as hereinbefore set forth, of a motor, its governor, its brake mechanism, a local circuit, brake-controlling magnets, and a circuit-controlling switch actuated by the governor, a main line, mechanism automatically controlling this circuit actuated by the motor, synchronizing mechanism also actuated by this motor, and automatic switch mechanism in the main line controlling this synchronizing mechanism.

6. The combination, substantially as hereinbefore set forth, of two motors, their governors, an electrically-actuated brake for each motor in a separate local circuit, circuit-controlling mechanism actuated by each governor, synchronizing mechanism actuated by the motors intermittently to open and close their circuits, a main-line circuit, its automatic circuit-controlling mechanism operated by the motors, and electrically-actuated circuit-controlling mechanism which simultaneously opens both the main and local circuits to aid the synchronizing.

7. The combination, substantially as hereinbefore set forth, of a traversing type-wheel carriage, a stop intersecting its path, mechanism for actuating the stop, and an intermittently-interposed device which connects the actuating mechanism and stop.

8. The combination, substantially as hereinbefore set forth, of a traversing type-wheel carriage, finger-keys or key-levers, stops carried thereby, electrically-controlled mechanism for actuating these stops and the type-wheel carriage, and devices intermittently interposed between the actuating mechanism and stops to operate the latter.

9. The combination, substantially as hereinbefore set forth, of finger-keys or key-levers, stops carried thereby, mechanism for actuating these stops, a motor, devices actuated thereby, intermittently interposed between the motor and stops, and circuit-controlling mechanism actuated by these devices to energize the stop-actuating mechanism.

10. The combination, substantially as hereinbefore set forth, of a finger-key or key-lever, electrically-controlled mechanism for operating it, a motor, mechanism actuated thereby for energizing the lever-actuating mechanism and for interposing a device between this mechanism and lever to render them operative, the orgaization being such that the action is prevented until the key-lever is moved out of the path traversed by the interposing device.

11. The combination, substantially as hereinbefore set forth, of a series of key-levers, electrically-operated mechanism for operating them, a motor, a series of devices automatically interposed by the motor between the key-levers and actuating mechanism when

operating as a receiver, and a device causing them to intersect the path of the key-levers when acting as a transmitter, the removal of the key from such path throwing the mechanism into operation.

12. The combination, substantially as hereinbefore set forth, of a series of key-levers, an electrically-operated lifter-bar, a motor, a series of automatically-actuated slide-bars adapted to be interposed between the key-lever and lifter-bar, and a cam-roller which changes the path traversed by the bars, so as to cause them to abut against the key-lever, thus rendering the mechanism inoperative until the key-lever is removed.

13. The combination, substantially as hereinbefore set forth, of a finger-key or key-lever, a lifter-bar, its actuating-magnet, a rotating cylinder, a slide-bar actuated thereby and adapted to be interposed between the key-lever and lifter-bar, and a circuit-controlling switch also actuated by this slide-bar to control the circuit of the lifter-bar magnet.

14. The combination, substantially as hereinbefore set forth, of a series of key-levers, a lifter-bar, its actuating-magnet, a rotating cylinder, a series of notches therein, a series of spring-actuated radius-bars, lugs thereon adapted to be thrown into and out of their respective notches, slide-bars carried by these radius-bars, one for each key-lever, and circuit-controlling devices actuated thereby, so that the forward movement of any slide-bar to interpose between the key-lever and lifter-bar energizes the magnet of the latter to operate the key-lever.

15. The combination, substantially as hereinbefore set forth, in two similar type-writing machines, of a series of key-levers, their electric actuating mechanism, a motor for each machine, devices actuated thereby intermittently interposed between the key-levers and their actuating mechanism, a main-line circuit passing through both the key-lever actuating mechanisms, and circuit-controlling mechanism actuated by the interposition of these devices to energize the lever-actuating mechanism of each machine.

16. The combination, substantially as hereinbefore set forth, in two similar type-writing machines, of a series of key-levers, their lifter-bars, their actuating-magnets, rotating cylinders, slide-bars actuated thereby and adapted to be intermittently interposed between the key-levers and lifter-bars, a main-line circuit including the actuating-magnets, and circuit-controlling switches actuated by the slide-bars, so that the interposition of any one bar closes the circuit through both magnets.

17. The combination, substantially as hereinbefore set forth, in two similar type-writing machines, of series of key-levers, electrically-controlled mechanism for operating them, motors, devices actuated thereby adapted to be interposed between the key-levers and their actuating mechanism, synchronizing mechanism for each motor, a main circuit in shunts or branches of which the magnets of both the lever-actuating and synchronizing mechanisms are included, and circuit-controlling devices actuated by the interposition of any one of these devices between the key-levers and their actuating mechanism, so as simultaneously to energize these magnets.

18. The combination, substantially as hereinbefore set forth, of a traversing type-wheel carriage, a stop intersecting its path, a key-lever actuating the stop, an electrically-operated traversing lifter-bar, and a slide-bar intermittently interposed between the lifter-bar and finger-key to actuate the stop.

19. The combination, substantially as hereinbefore set forth, of a traversing type-wheel carriage, its actuating-frame, a stop-plate carried thereby, a key-lever, a stop carried thereby to intersect the stop-plate, a lifter-bar, its actuating-magnet, and a slide-bar intermittently interposed between the lifter-bar and key-lever to energize the magnet and actuate the lifter-bar.

20. The combination, substantially as hereinbefore set forth, of a type-wheel, its carriage, its actuating-frame, electro-magnetic apparatus for actuating it, a stop-plate on this frame, a key-lever, a stop actuated thereby to engage the stop-plate, a lifter-bar, electro-magnetic apparatus actuating it, and an automatically-actuated slide-bar adapted to be interposed between the lifter-bar and key-lever to enable the lifter-bar to actuate the stop.

21. The combination, substantially as hereinbefore set forth, of a type-wheel, its carriage, its actuating-frame, a stop-plate thereon, type-wheel-locking mechanism, means for actuating the locking mechanism, a key-lever, a stop actuated thereby to engage the stop-plate, electro-magnetic apparatus actuating it, and an automatically-actuated slide-bar adapted to be interposed between the lifter-bar and key-lever to actuate the stop.

22. The combination, substantially as hereinbefore set forth, of a type-wheel, a feed-screw shaft, mechanism connecting the two to feed the type-wheel laterally, a key-lever, an electrically-actuated lifter-bar, an automatically-actuated slide-bar adapted to be thrust over the lifter-bar to be lifted by it, and automatic mechanism actuated by this slide-bar to open and close the circuit of the type-wheel-releasing mechanism to permit its retraction to begin a new line.

23. The combination, substantially as hereinbefore set forth, of laterally-movable type-wheel-feeding mechanism, an endwise moving shaft, a circuit-making contact thereon, a key-lever, an electrically-actuated lifter-bar, an elbow-lever actuating the contact-shaft to close it, and a slide-bar automatically interposed between the lifter-bar and elbow-lever to enable the former to actuate the latter.

24. The combination, substantially as hereinbefore set forth, of laterally-movable type-wheel-feeding mechanism, an endwise-moving contact-making shaft, a key-lever, an elec-

trically-actuated lifter-bar, mechanism for moving the shaft in one direction to close its contacts, a slide-bar automatically interposed between the lifter-bar and contact-making mechanism, and a stop on the contact-shaft against which the type-wheel-feeding mechanism abuts as it begins a new line, so as to separate the contacts.

25. The combination, substantially as hereinbefore set forth, of a main frame, solenoids thereon, a type-wheel carriage actuated thereby, a key-lever, an electrically-actuated lifter-bar, circuit-controlling devices for the solenoid-circuits, and a slide-bar automatically interposed between the lifter-bar and circuit-controlling devices to actuate them.

26. The combination, substantially as hereinbefore set forth, with two similar type-writing machines, of continuously-rotating actuating-cylinders, notches arranged spirally around a portion of their perimeters, spring-actuated radius-bars carrying lugs or tappets corresponding with these notches, circuit-closing devices actuated by the radius-bars, synchronizing devices connected with each machine in a local circuit, a main line connecting them, and circuit-controlling contacts or switches therein actuated by the circuit-closing devices, so as to actuate the synchronizing mechanism while the tappets are traversing the solid face of the cylinders.

27. The combination, substantially as hereinbefore set forth, with two similar type-writing machines, of continuously-rotating cylinders, notches arranged on a portion of their perimeters, spring-actuated radius-bars carrying lugs or tappets corresponding with these notches, slide-bars carried by the radius-bars, key-levers, stops thereon, lifter-bars, their actuating-magnets, synchronizing mechanism, branch circuits of the main line, including these actuating-magnets and synchronizing devices, and circuit-controlling switches actuated by the radius-bars, the organization being such that the slide-bars are interposed between the lifter-bars and key-levers simultaneously with the energizing of the magnets which actuate the lifter-bar and break the synchronizing-circuit.

28. The hereinbefore-described printing-telegraph, consisting of the combination, with two similar type-writing machines, of motors, governors, synchronizing mechanism, continuously-rotating cylinders provided with series of spiral notches on their perimeters, spring-actuated radius-bars carrying tappets corresponding with the notches, slide-bars connected with the radius-bars, circuit-closing bars actuated thereby controlling contacts in the connecting main line, lifter-bars acting on the slide-bars, magnets in the main line actuating the lifter-bars, and magnets in shunts of the main line controlling the synchronizing mechanism, the organization being such that the actuation of a key-lever causes the successive automatic operation of the other mechanisms.

In testimony whereof I have hereunto subscribed my name.

EDWARD J. SILKMAN.

Witnesses:
WILLIAM H. BERRY,
THOS. M. DOBBIN.