

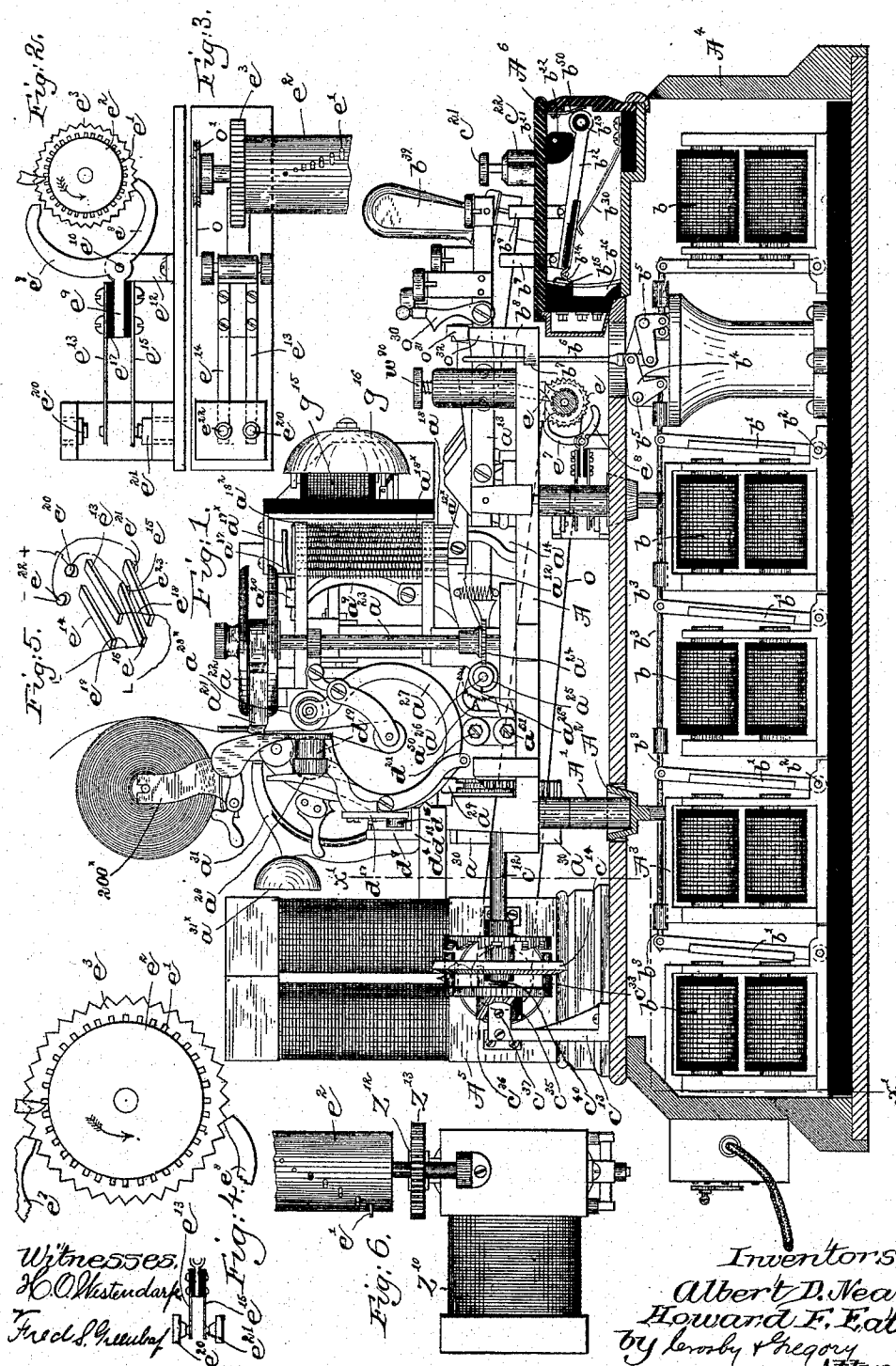
(No Model.)

14 Sheets—Sheet 1.

A. D. NEAL & H. F. EATON.
PRINTING TELEGRAPH.

No. 487,229.

Patented Nov. 29, 1892.



Witnesses,
H. O. Westendorp
Fred. S. Schuchert

Inventors
Albert D. Neal,
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(No Model.)

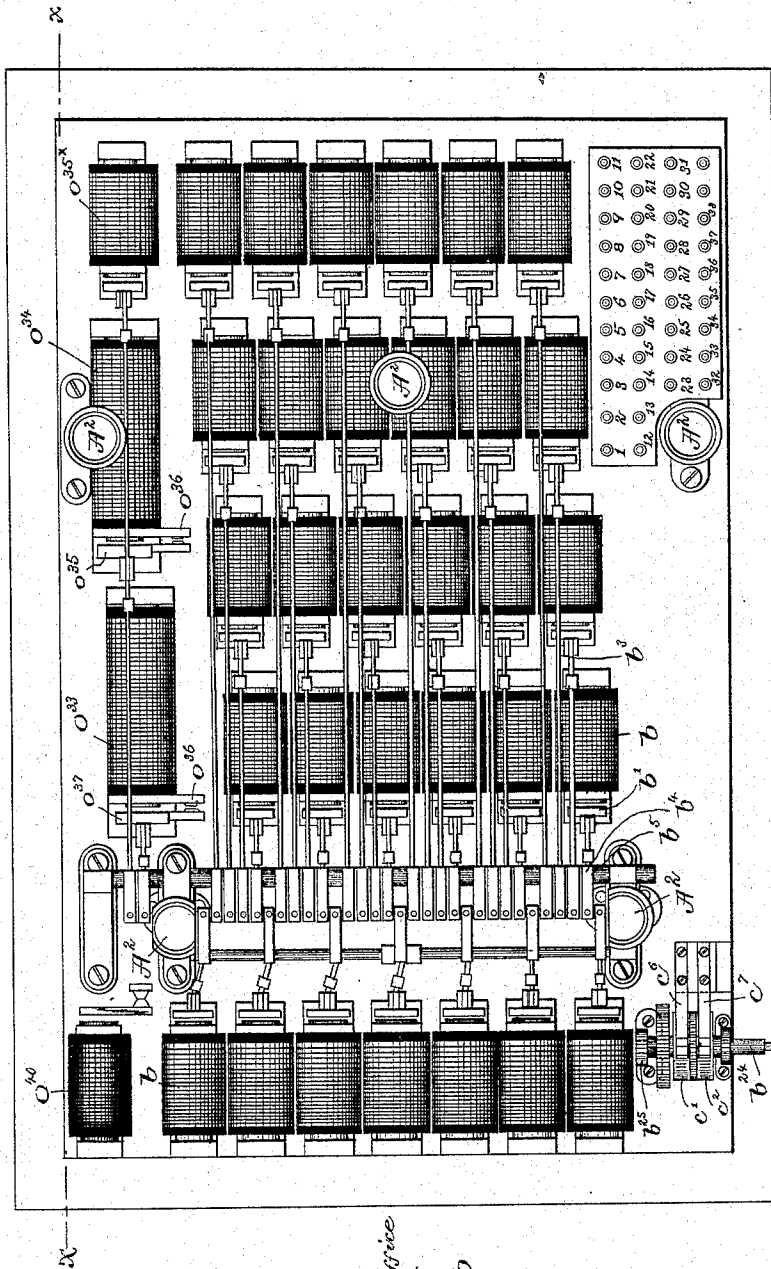
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A. D. NEAL & H. F. EATON.
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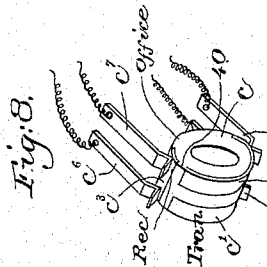
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Fig. 7.



Witnesses.
H. O. Westundarp.
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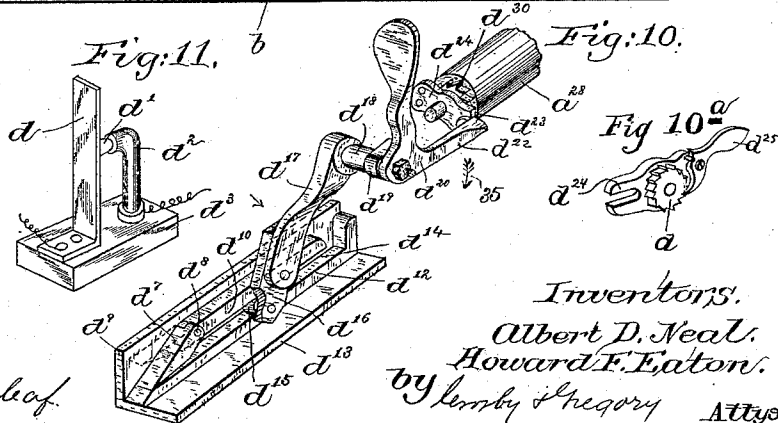
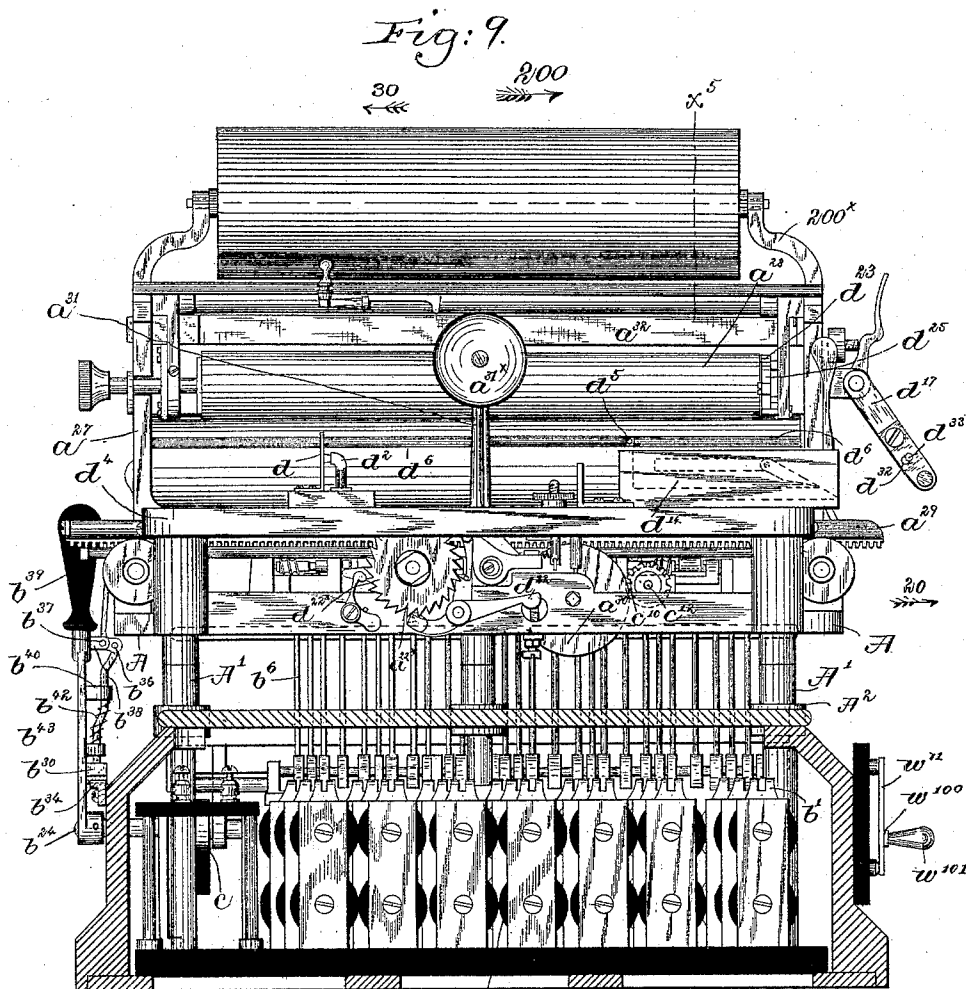


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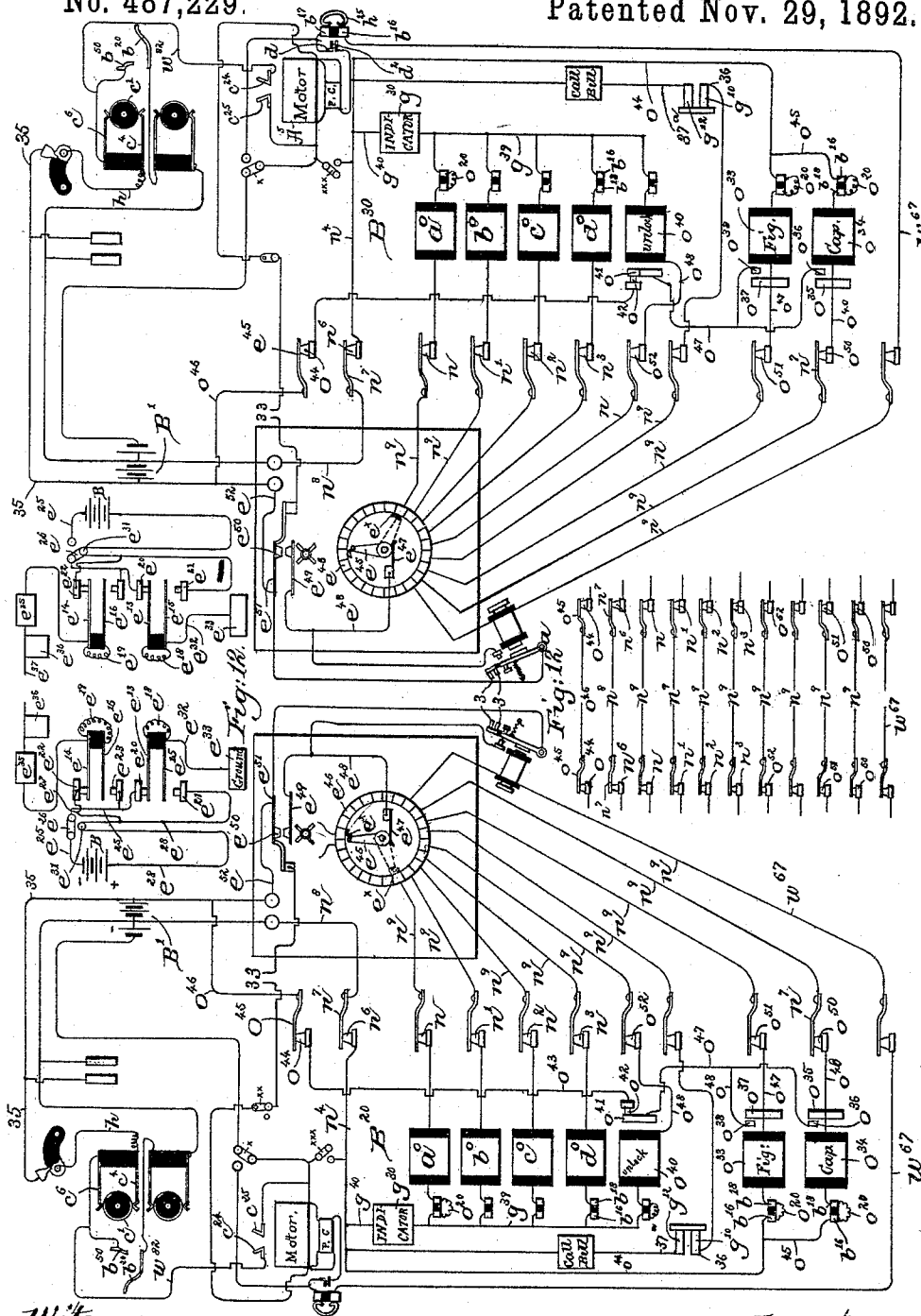
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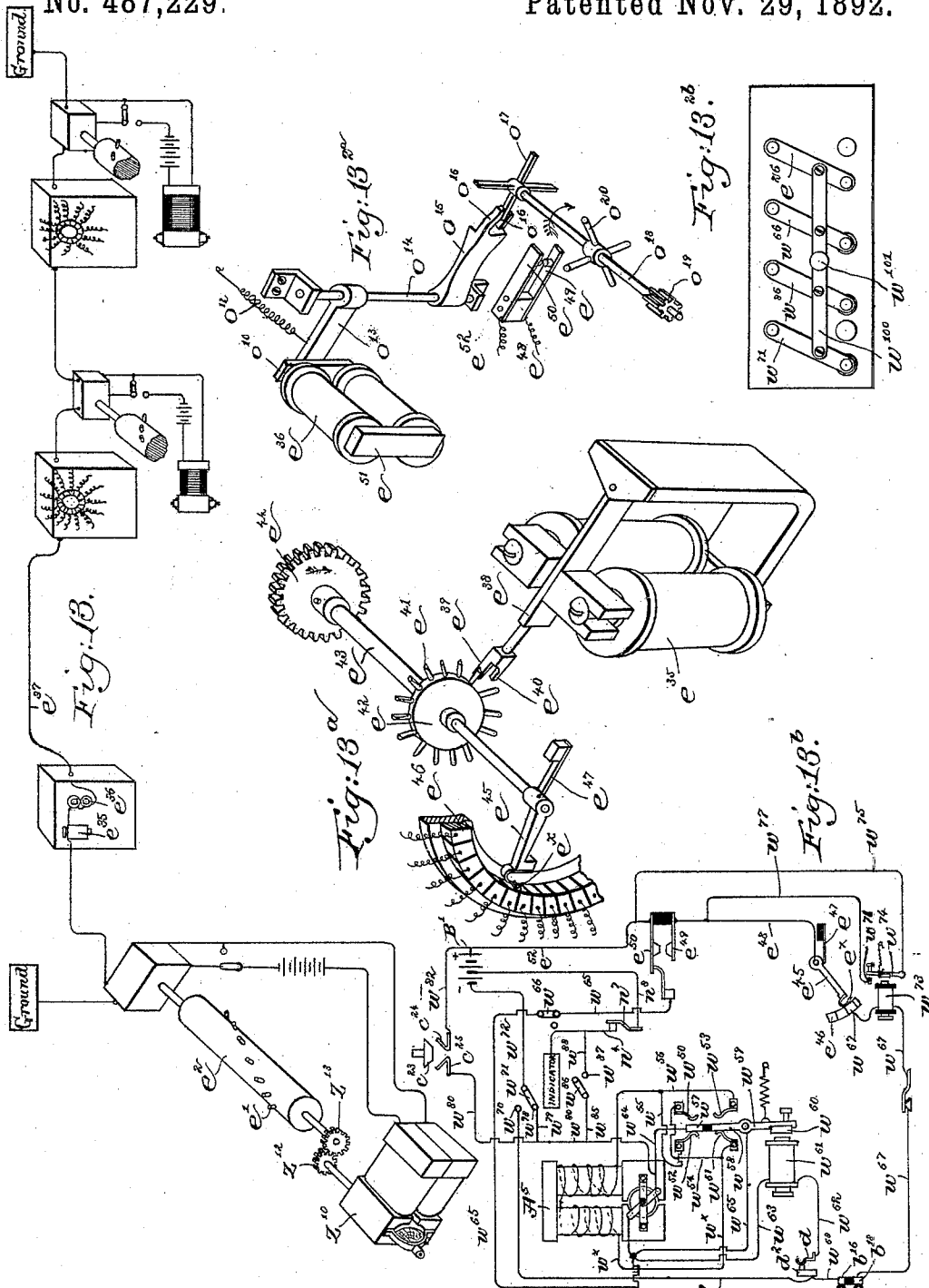
Witnesses.
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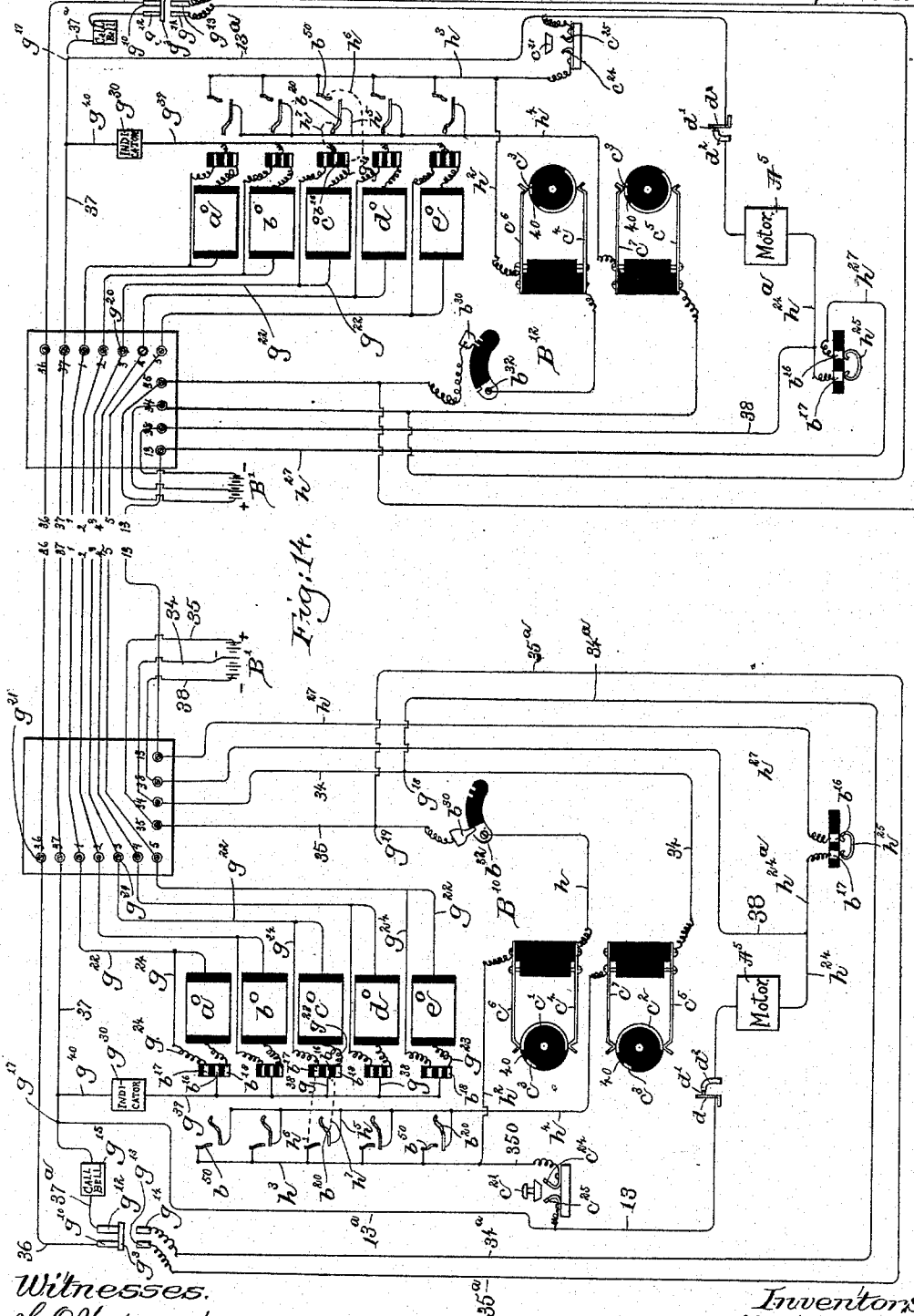
Witnesses.
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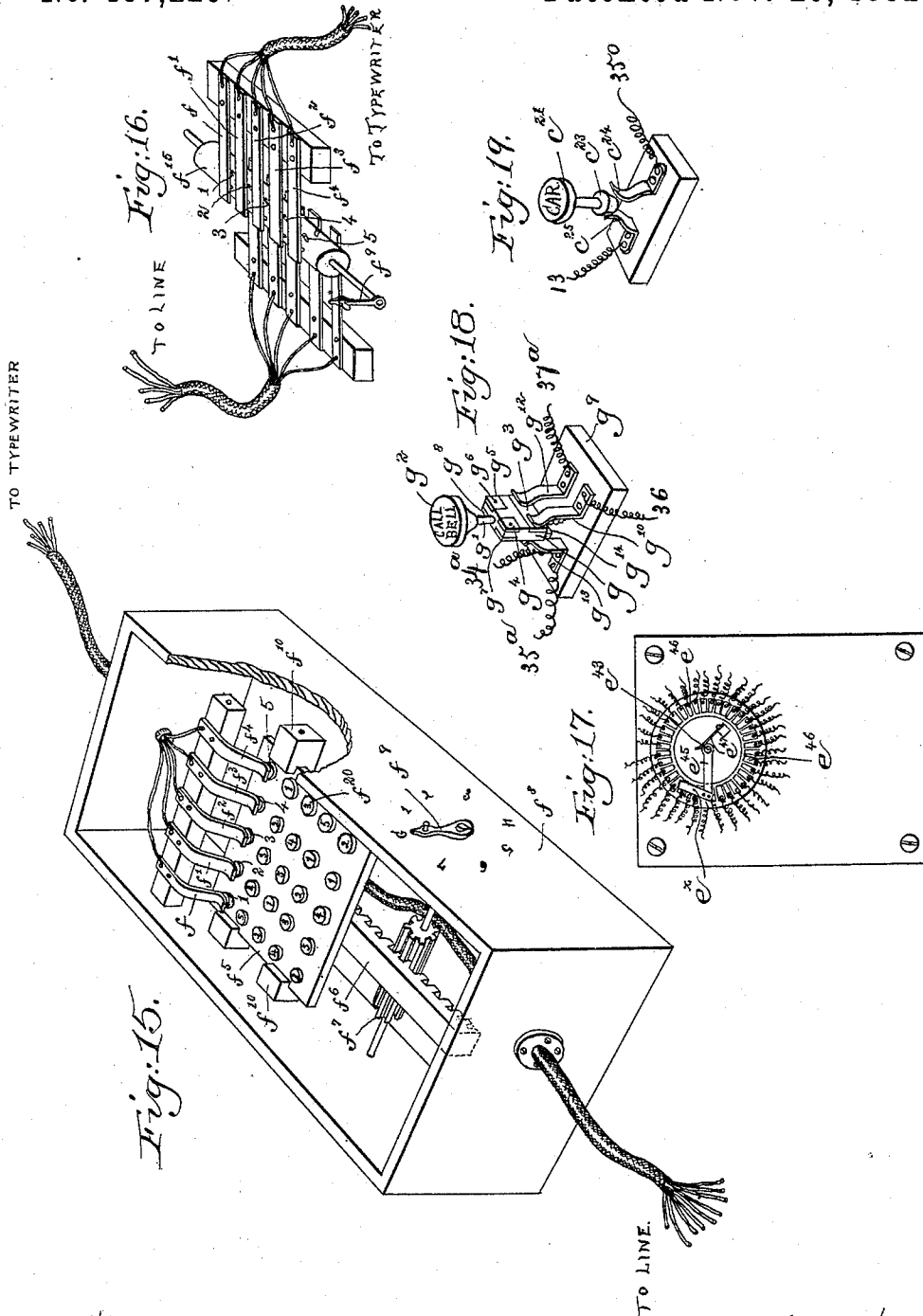
Witnesses.
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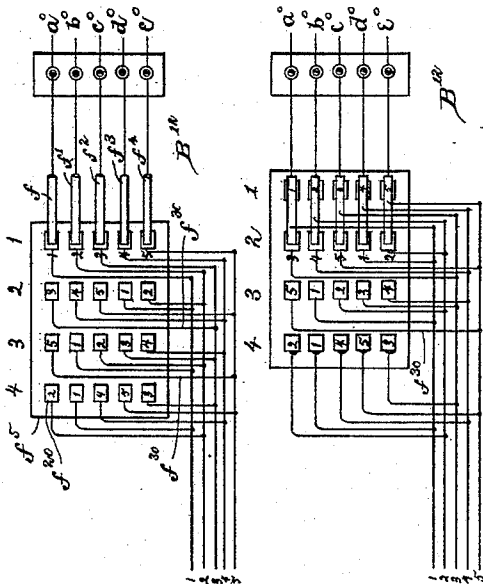
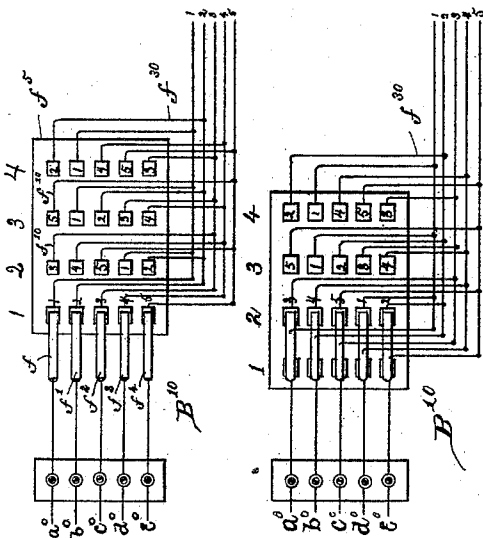


Fig. 20.

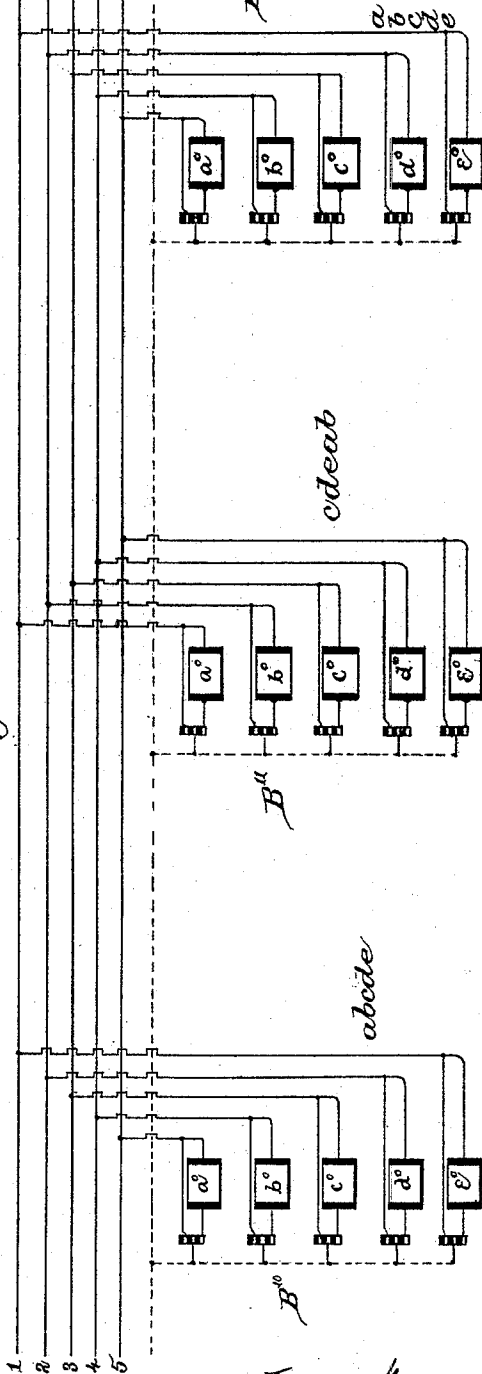
Fig. 21.

Fig. 22.



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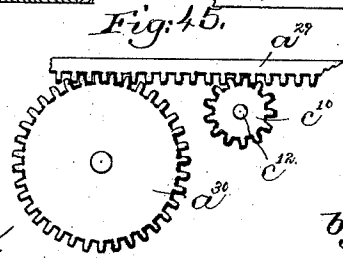
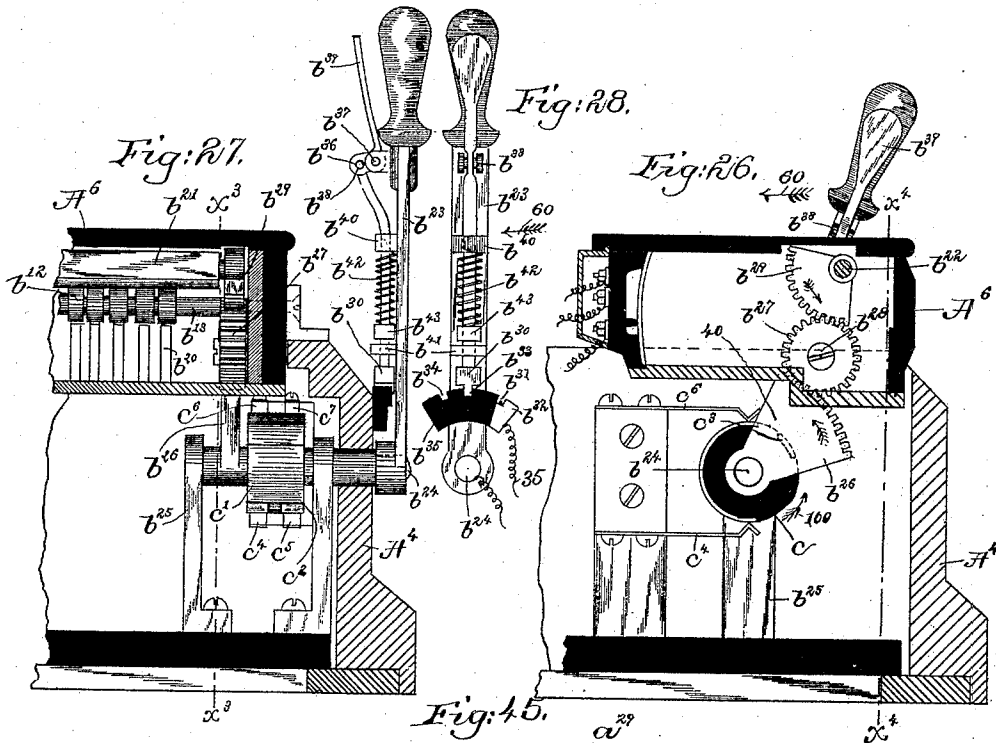
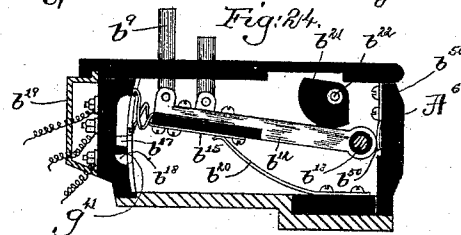
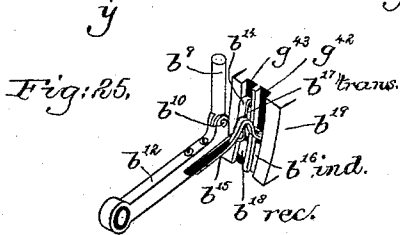
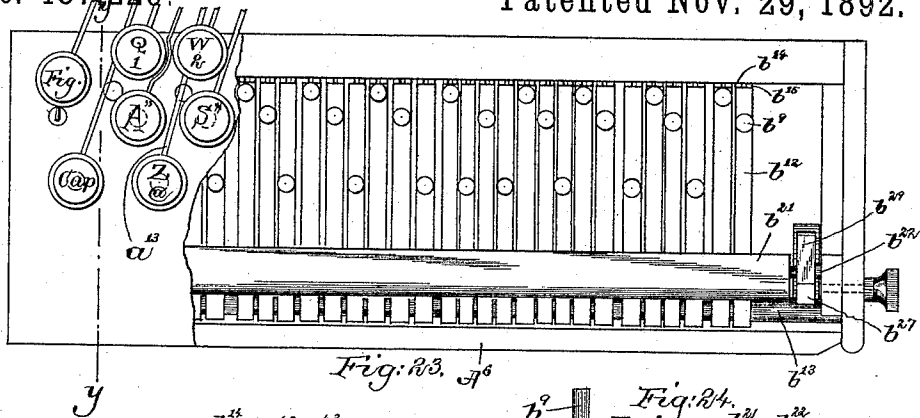
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14 Sheets—Sheet 9.

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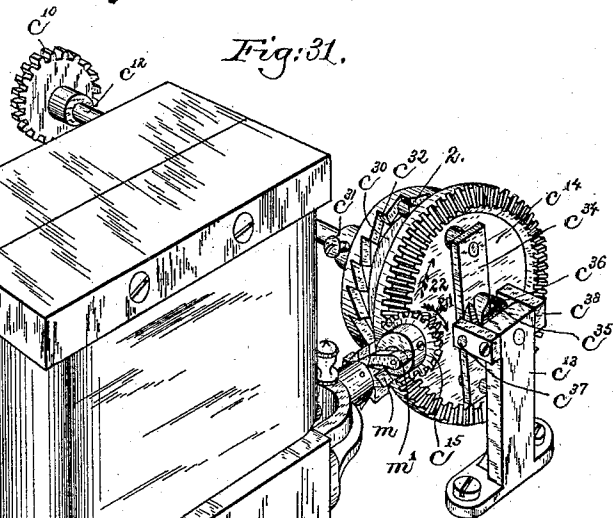
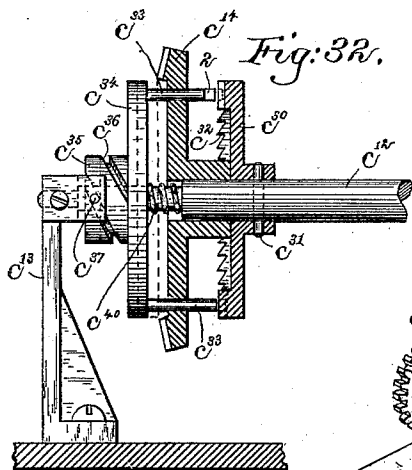
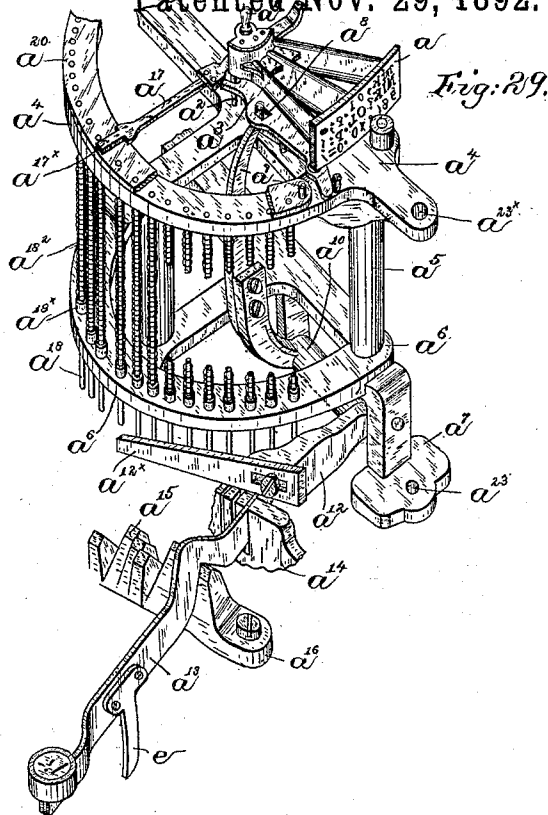
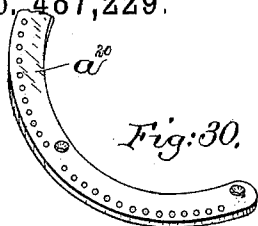
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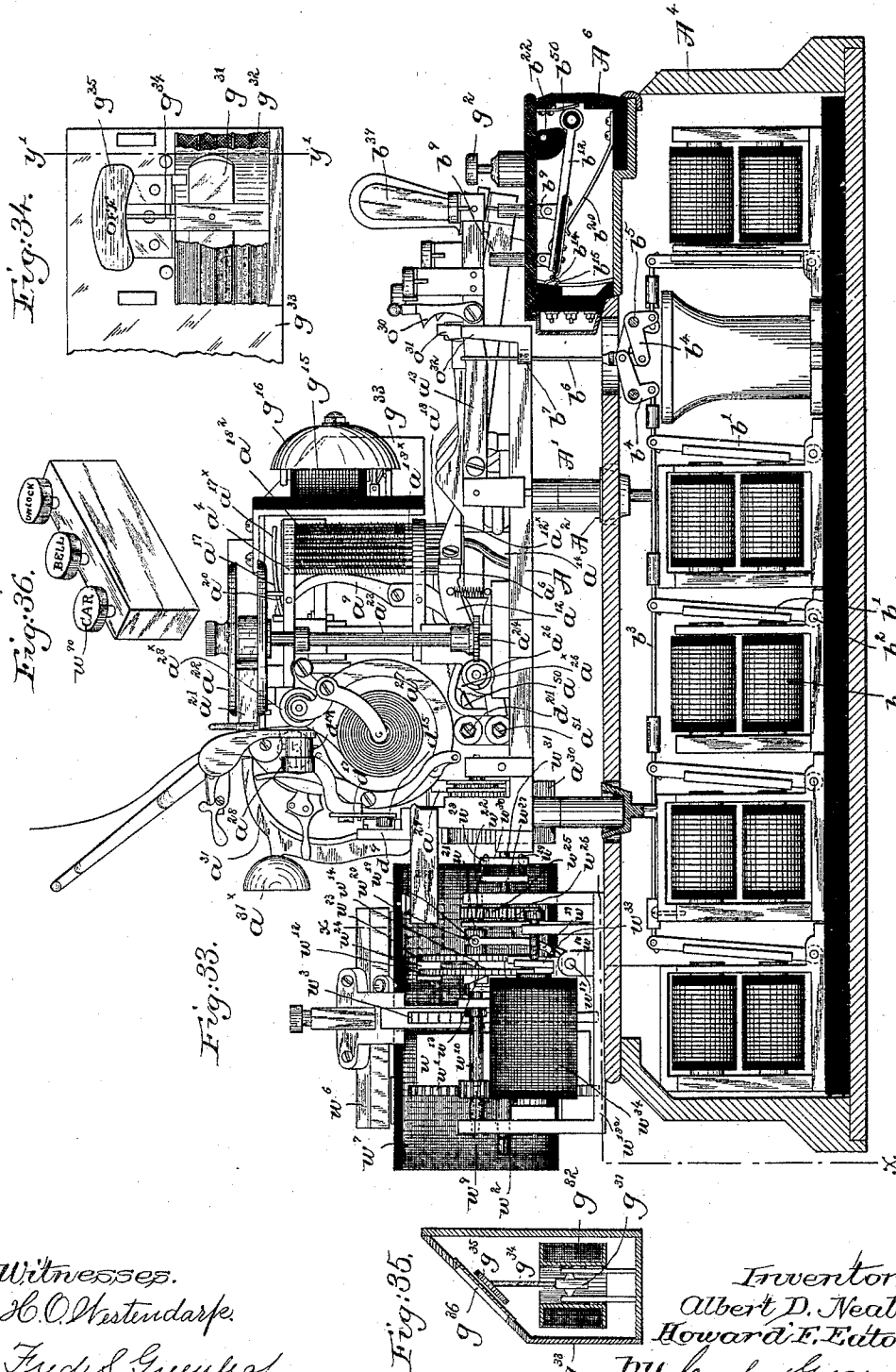
(No Model.)

14 Sheets—Sheet 11.

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PRINTING TELEGRAPH.

No. 487,229.

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(No Model.)

14 Sheets—Sheet 12.

A. D. NEAL & H. F. EATON.
PRINTING TELEGRAPH.

No. 487,229.

Patented Nov. 29, 1892.

Fig. 37.

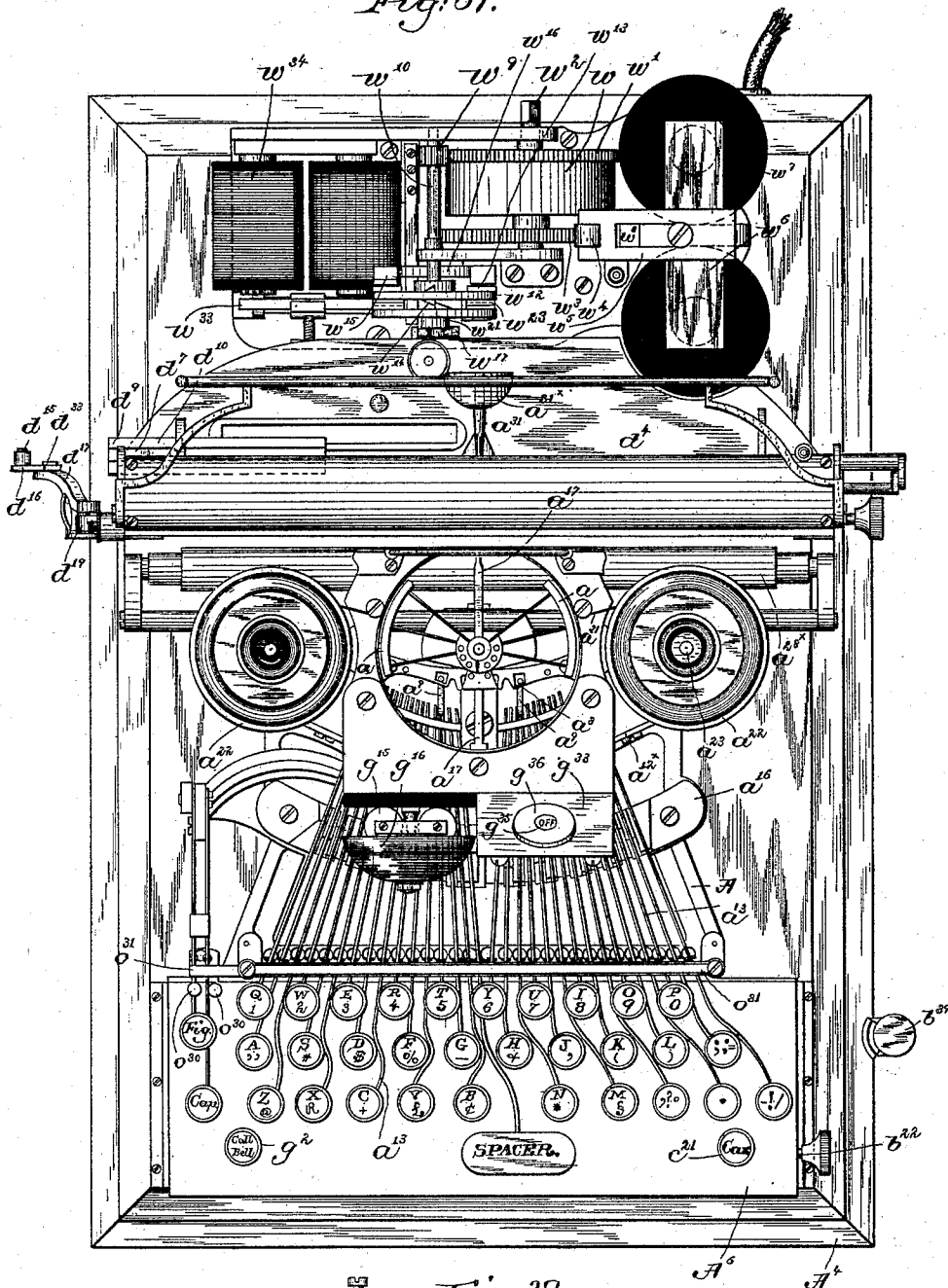
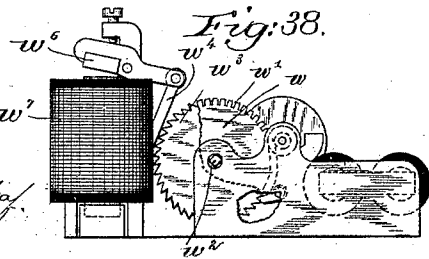


Fig. 38.



Witnesses.
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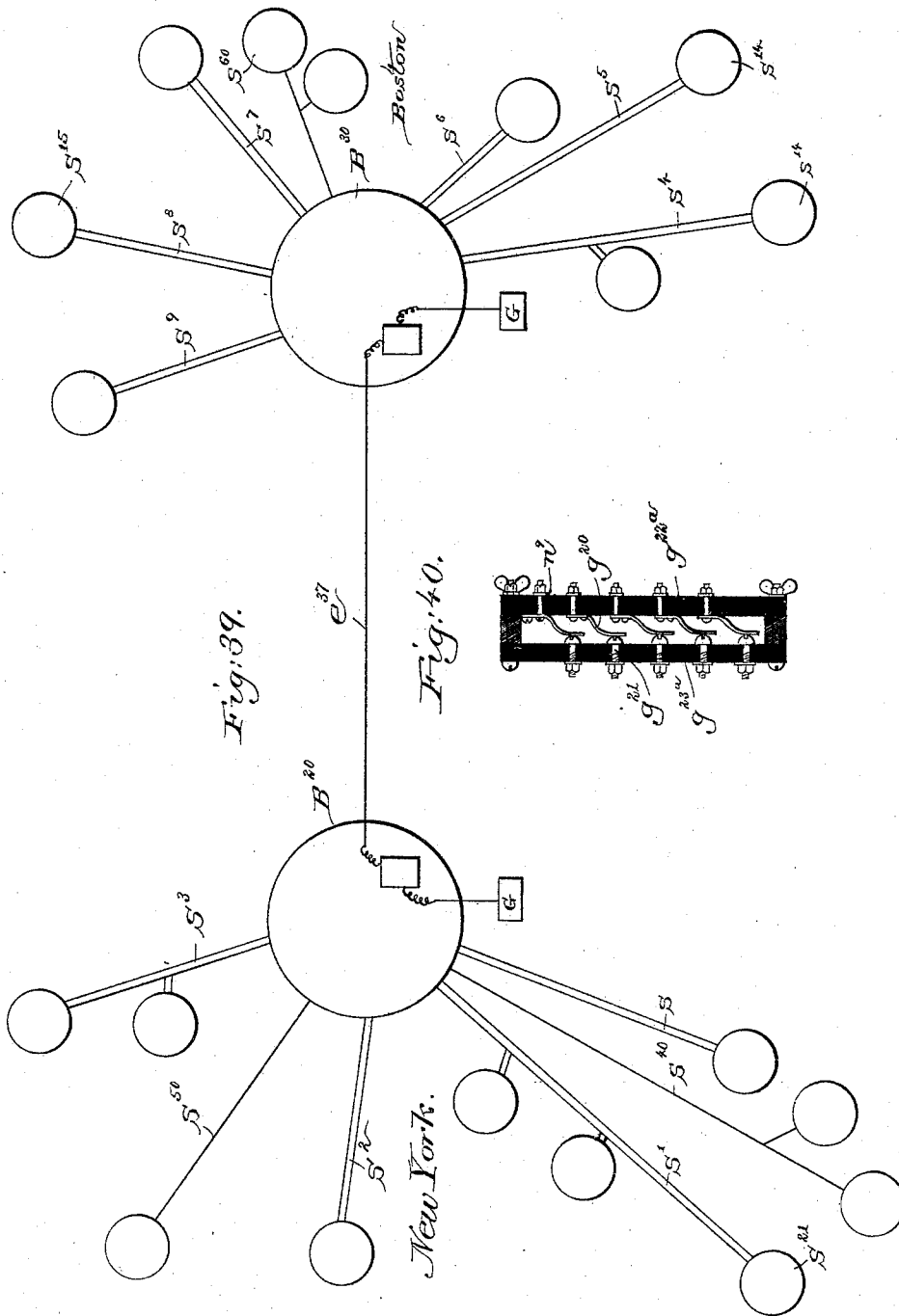
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Attys.

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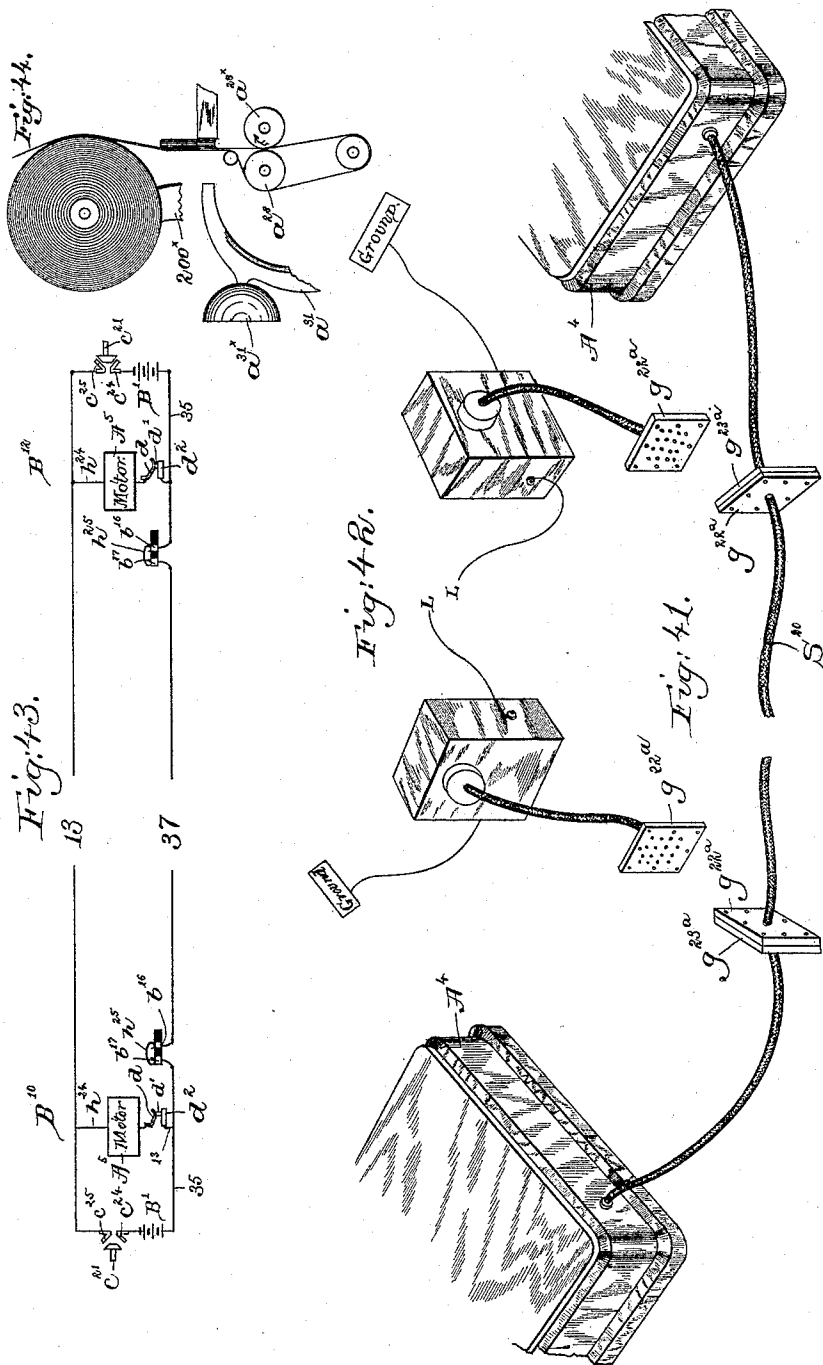
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UNITED STATES PATENT OFFICE.

ALBERT D. NEAL, OF BOSTON, AND HOWARD F. EATON, OF QUINCY,
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PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 487,229, dated November 29, 1892.

Application filed April 21, 1891. Renewed October 10, 1892. Serial No. 448,301. (No model.)

To all whom it may concern:

Be it known that we, ALBERT D. NEAL, of Boston, county of Suffolk, and HOWARD F. EATON, of Quincy, county of Norfolk, State of Massachusetts, have invented an Improvement in Printing-Telegraphs, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

The type-writer for intercommunication to be herein described contains as an element thereof a type-writer, the type-writer being capable, by means which will be hereinafter described, for use not only as an ordinary office type-writer, but also as a transmitting-instrument to operate one or more like type-writers at a distance, or to be put into a condition of receptivity as a receiver of a message from a distant station. Each type or character used in printing is under the control of a magnet of local circuit, which magnet is excited at the proper time, and by or through suitable mechanisms, acting, preferably, through a key-lever, effects the putting into position of the desired character to be printed.

In our experiments we have ascertained that a type-writing machine of the Hammond variety—such as represented in United States Patent No. 290,419—is best adapted for the work above outlined, and therefore we have in the embodiment of our invention herein contained shown our improvements as incorporated with the so-called “Hammond” type-writer; but it will be obvious to those skilled in the art that some parts of our invention with but slight mechanical changes and adaptations may be readily applied to other similar or suitable forms of type-writers, so that our invention is not to be construed in every instance so narrowly as to exclude therefrom other type-writers than those of the Hammond form; but the Hammond machine has some great advantages over others, among which is the fact that all the characters to be printed are mounted upon a plate or character-carrier, which is moved by the depression of a key-lever to place the character corresponding to the key-lever depressed opposite

or in line with the hammer, a single hammer being used on the machine.

The Hammond machine contains two like type or character carriers.

Our apparatus has been devised in such manner that for short distances, where great accuracy is required and speed desired, there is a separate wire for each character, the said wires being collected in a cable.

To bring into effect the cable, we have provided a series of cable-keys and circuit-controllers arranged in a separate part of the machine and each key being put under the control of one of the usual type or key levers of the type-writing machine, the said type or key levers being utilized by the operator when sending a message; but if a machine is to receive a message the cable-keys co-operating with it are thrown out of operative position, so as not to interfere with the movements of the usual type or key levers by the magnets of the receiving-machine, actuated, however, from a distant station. The key-levers are marked to designate the particular type-characters which they will, when actuated, cause to be displayed in a printed line, and hence said levers constitute what may be called “character-levers.”

Each “apparatus” or “instrument,” as we shall sometimes designate the type-writer, with the adjuncts added by us, has as a co-operating part of it a continuously-rotating selecting-drum and a circuit-selecting arm rotating in unison therewith, and when but one wire is to be used between stations the sending-operator when he arrests the rotation of the said drum will arrest the rotation of the circuit-selecting arm at the receiving-station, so that said arm will close a local circuit at the receiving-station and effect the putting into position at the printing-point of the receiving-machine the character to be printed, said character corresponding with the character predetermined at the sending-station. While the message is being sent from the sending-station, the circuit-selecting arm at the said station will rotate, but it will not operate the local magnets at the sending-station, for at such time a suitable switch, to be described, will be moved to open the operat-

ing-circuit in which said local magnets are contained.

Our improved apparatus may be readily changed from the cable system to the one-wire system, and vice versa, as desired, the same machines being utilized in both cases.

We have combined with the carriage holding the paper being printed upon means whereby the said carriage may be returned automatically to its starting-point, said mechanism being started by means of a circuit-controlling key forming part of a normally-open circuit. The means for producing this return movement of the carriage may either be an electromotor or an electro-mechanical motor having a spring. During this return movement of the carriage and before the carriage completes the end of its return stroke the current of the motor is checked or cut off, so that the carriage comes to rest without any injurious jar.

We have devised a combination-switch and placed it in circuit with the type-writers, the said switch having what we denominate "general" and "special" contacts, the general contacts being used for general or public work and the special contacts being employed by special subscribers for secrecy between themselves. When the combination-switches of the instruments are set with the general contacts closed, all the machines in receptive position, and having the circuits closed, the general contacts will receive the general messages as sent; but when any two or more subscribers desire secrecy upon notice each will set his instruments with the combination-switches on special contacts common to only the said particular subscribers and the sending-operator will manipulate his keys just as when sending a general message; but the message sent by him can be read only on the particular machines having the same special contacts, all other machines if in receptive condition receiving a jumble of letters or an unintelligible message. Any two or more subscribers may have special contacts arranged in a special manner for their own use, and when their instruments are set for special work no other subscribers can get the message intelligible. An instrument of one subscriber may have a special series of contacts for a second subscriber, and yet another special series of contacts for yet a third subscriber; but the special contacts of the second and third subscribers will not be alike.

Figure 1 is a side elevation and section of one form of an electro-mechanical type-writing apparatus embodying this invention, the section being supposed to be taken on the line $x x$, Fig. 7, looking in the direction of the arrow 2. Fig. 2 is a detail in side elevation of a pole-changing apparatus shown in Fig. 1 and to be hereinafter referred to; Fig. 3, a top or plan view of the apparatus shown in Fig. 2; Fig. 4, details of parts of the pole-changer and its operating-wheel shown in Fig. 2 on an enlarged scale; Fig. 5, a detail to

more clearly show the circuits of the pole-changer; Fig. 6, a modification to be referred to, it showing an independent motor for rotating the selecting-drum. Fig. 7 is a top or plan view of the magnet-containing case and the parts located therein and shown in Fig. 1. Fig. 8 is a detail of the battery-controlling switch shown in Fig. 7 and to be hereinafter described. Fig. 9 is a rear side elevation and section of the apparatus shown in Fig. 1, the section being supposed to be taken on the irregular line $x' x'$, Fig. 1. Fig. 10 is a detail, on an enlarged scale, of the device employed to rotate the printing-cylinder to obtain spaces between the lines; Fig. 10^a, a detail of the actuating-pawl for rotating the printing-cylinder. Fig. 11 is a detail of a circuit-controller to govern the return movement of the carriage. Fig. 12 is a diagram of circuits to more clearly show the operation of the apparatus. Fig. 12^a is a detail to be referred to; Fig. 13, a diagram of circuits, showing three instruments connected together and arranged for intercommunication by means of a single wire; Fig. 13^a and Fig. 13^a, details of apparatus employed in the one-wire system; Fig. 13^b, a diagram of circuits used in the one-wire system; Fig. 13^b, a detail of switches to be referred to; Fig. 14, a diagram of circuits, showing parts of the apparatus connected together for intercommunication by a plurality of wires, to be hereinafter designated as the "cable system." Fig. 15 is a detail partially broken out and on an enlarged scale of one form of individualizing device or combination-switch; Fig. 16, a detail showing a modified form of individualizing device or combination-switch. Fig. 17 is a detail of the circuit-selecting device employed when the machine is used on the one-wire system; Fig. 18, a detail of the circuit-controller or switch for the call-bell; Fig. 19, a detail of the switch employed to control the backward movement of the carriage in the cable system; Fig. 20, a diagram of circuits to more clearly illustrate the operation of the individualizing device or combination-switch; Fig. 21, a diagram of circuits shown in Fig. 20 with the combination-switch in a different position to obtain a different combination, as for special or private signaling over the same wires. Fig. 22 is a diagram of circuits, representing three instruments or stations connected in circuit in accordance with the cable system; Fig. 23, a plan view, enlarged and partially broken out of the box containing the circuit-controllers, adapted to be operated by the type keys or levers shown in Fig. 1; Fig. 24, a section through the box shown in Fig. 23 on the line $y y$ looking toward the right; Fig. 25, a detail of a circuit-controller which in practice is operated by a key. Fig. 26 is a sectional detail, on an enlarged scale, to more clearly show the mechanism for controlling the battery-circuit, the section being supposed to be taken on the line x^3 , Fig. 27; Fig. 27, a sectional detail on an enlarged scale, the section

being supposed to be taken on the line x^4 , Fig. 26; Fig. 28, a detail to be referred to; Fig. 29, a detail, on an enlarged scale, of a part of the printing mechanism of the type-writer; Fig. 30, a detail of the detachable reinforcing-plate to be referred to; Fig. 31, a perspective view of a motor mechanism shown in Fig. 1 for operating the carriage and the selecting-drum; Fig. 32, a sectional detail of the form of clutch mechanism shown in Figs. 1 and 31 to couple the armature-shaft with the carriage; Fig. 33, a side elevation of a modified form of apparatus with the magnet-containing case in section, the mechanism being actuated by an electrically-controlled drum; Fig. 34, a detail in elevation of a circuit-indicating device attached to the apparatus and shown in Figs. 1 and 33; Fig. 35, a sectional detail of the indicating device shown in Fig. 34, the section being supposed to be taken on the line $y' y'$, looking toward the left. (See Fig. 34.) Fig. 36 is a detail to be referred to, showing some of the buttons or keys used on the one-wire system. Fig. 37 is a top or plan view of the apparatus shown in Fig. 33; Fig. 38, a detail of the motor mechanism shown in Figs. 33 and 37; Fig. 39, a diagram of circuits, representing two central stations or cities connected in accordance with the one-wire system and the instruments in the said cities joined to the central offices by the cable system; Fig. 40, a sectional detail of one form of circuit connection or switch-board used to couple two instruments together; Fig. 41, a detail representing two instruments coupled together on the cable system; Fig. 42, a detail of the one-wire system to be referred to; Fig. 43, a diagram of circuits to represent the manner of connecting the electric motors of the various instruments; Fig. 44, a section of the carriage on the line $x^5 x^5$, Fig. 9; Fig. 45, a detail of the rack-bar of the carriage and drum operating the same.

In illustrating our invention we have shown the principal parts of the Hammond machine usually found in the market; but we have not considered it necessary to show all the parts thereof, as the said machine is well understood.

In the drawings, A represents a bed-plate, A' its feet, and a a type or character carrier, (see Fig. 29,) it having upon it the characters to be printed. This character-carrier is herein represented as forming part of a segmental arm mounted loosely upon and to rotate freely about a central stud a' .

In practice there are two type or character carriers in each type-writer. The hub of each character-carrier has suitable pins or teeth a^2 , which are engaged by the toothed inner end of a lever a^3 , having a slot a^8 , which is entered by an arm a^9 of a rock-shaft a^{10} , having a second arm a^{12} provided with an adjustable arm a^{12x} . There is a rock-shaft a^8 , a rock-shaft a^{10} , and arm a^{12} for each character-carrier. The type-keys or character-levers a^{13} , provided at their outer ends with suitable

buttons representing letters or figures corresponding with the type-characters of the type or character carrier, have their fulcrum on knife-edges a^{15} of a block a^{16} , properly secured in practice to the bed of the machine. The inner ends of the levers are kept separated by a slotted comb-like guide a^{14} , forming part of the bed-plate, and the inner end of each lever terminates under one of the series of vertically-reciprocating pins or rods a^{18} , provided with suitable collars a^{18x} , acted upon by suitable springs a^{18z} , which normally keep the said pins or rods down, each lever a^{13} also when moved acting upon the arm a^{12x} above it to thus effect the movement of the lever a^3 and the vibration of the character-carrier a . The center pivot a' contains a stop-lever a^{17} , which as a character-carrier is oscillated, as described, acts upon and moves the said stop-lever with it until its outer end a^{17x} is arrested by one or the other of the pins or rods a^{18} , which may be lifted by the particular key then depressed, the said rods or bars acting as stops, and as one or the other is raised to stop the lever a^{17} one or another character of the character-carrier is left in position opposite the hammer a^{31} , said hammer being actuated to strike a pad a^{32} , which supports the rear side of the paper to be printed on opposite the usual ink-ribbon a^{21} and opposite the particular character to be printed. The ink-ribbon a^{21} is taken from one to the other of the reels a^{22} , mounted each upon a suitable shaft a^{23} , having its bearings in like holes a^{23x} , one formed in an ear of the top plate a^4 and the other in the feet a' of the bottom plate a^6 , in which the pins or rods a^{18} reciprocate.

Each shaft a^{23} is provided with a suitable worm-pinion a^{24} , which is engaged and rotated intermittingly by a worm a^{25} on a shaft a^{26} , said shaft having upon it a suitable ratchet-wheel a^{26x} , which derives its motion from a pawl a^{30} on a suitable rock-shaft pivoted at a^{51} and moved by the key-lever.

The framework a^{27} of the carriage has connected to its under part a rack a^{29} . This carriage contains a pair of rolls a^{28} and a^{28x} , between and by which the paper is fed in the direction of its length, the roll a^{28} being simply a pressure-roll. The roll a^{28} has at one end a suitable ratchet d^{30} , (see Figs. 9 and 10,) which is engaged by a pawl d^{25} , carried by a pawl-carrier d^{24} , mounted loosely on one journal of the said roll, the said pawl-carrier being notched at one end to be engaged by the projection of a lever d^{20} , mounted on a suitable shaft d^{18} in a bearing d^{19} . The rack-bar a^{29} is engaged and rotated by external teeth of a drum a^{30} , containing a spring, the said drum and spring being permitted to act whenever the detent d^{22} is released from the ratchet-wheel d^{23x} .

The devices so far described and referred to and lettered are common to the Hammond type-writer. We will now describe the alterations and additions which we have made thereto and the means which we have de-

vised for operating the said type-writer as a telegraphic transmitter and permitting it to be actuated as a telegraphic receiving-instrument.

5 To avoid wear of the upper plate a^4 of the framework of the type-writer, we have added thereto a reinforcing-plate a^{20} , on which the stop-lever a^{17} travels, and as the said plate becomes worn we may readily replace it by
10 another one. The legs A' of the type-writer, as represented herein, are set into suitable cup-bearings A^2 , supported in suitable manner upon or within a box or case A^4 , containing a series of electro-magnets b , one magnet for each lever or character-key of the
15 type-writer. Each magnet, as herein represented, is composed of two coils and has co-operating with it an armature b' , operatively connected with the character or type carrier, through the movement of which and suitable
20 intermediate devices the character to be printed will be brought into printing position. In this embodiment of our invention, as stated, the characters are on a character-carrier (shown as a segmental plate) and each
25 armature pivoted at b^2 is connected by a suitable link, as b^3 , to an elbow-lever b^4 , having its pivot upon a rod mounted loosely on a rod b^5 , extended across the box or case A^4 . Each
30 elbow-lever b^4 has pivoted to it a link b , which is extended up through the top of the box or case and through a hole in a suitable guide-bar b^7 , secured to or forming part of the casting or bar b^8 , slotted for the reception and
35 guidance of the key-levers, each link b^6 being connected at its upper end with one of said key or character levers, the link having, preferably at its upper end, a hook to fit over or embrace a part of the said lever, so
40 that when a lever b^4 is moved by the attraction of the armature of a magnet the link connected with the armature so moved will turn a lever b^4 and depress or pull down a key-lever, the keys actuating the pins or rods
45 and other devices all in manner usual or common to the Hammond type-writer, to thereby place in position the desired character on the character-carrier. The contacts b^{17} b^{18} , as
50 herein shown, are arranged in a substantially-vertical line with and separated from each other by insulation g^{41} , (see Fig. 24,) so that in the movement of a pen or wiper from one contact-plate, as b^{17} , to the other contact-plate
55 b^{18} a dead-break is made in the circuit. The contact-plate b^{16} , as shown, is arranged at one side the contact-plates b^{17} b^{18} and is located substantially near the bottom of the contact-plate carrier b^{19} , so that when the pen or wiper
60 b^{14} is in contact with the contact-plate b^{17} the pen or wiper b^{15} will be in contact with the plate b^{16} .

Each cable-circuit-controlling lever b^{12} (see Fig. 24) is held up by a suitable spring b^{20} , secured to the bottom of the case A^6 and having its free end bearing against the under
65 side of the said lever. The levers b^{12} are adapted to and may be moved downward si-

multaneously, preferably by means of a cam-shaped depressor b^{21} , attached to a shaft b^{22} , supported in suitable bearings within the case A^6 and extended across the said case, the said depressor b^{21} constituting what we shall hereinafter in some instances designate as a "circuit-controller actuator." The depressor will preferably be moved by means of a lever b^{23} , fast on a short shaft b^{24} , having bearings in the case A^6 and in an upright b^{25} and having fast on it a segmental gear b^{26} in mesh with a pinion b^{27} , mounted on a stud or arbor b^{28} , (see Figs. 26 and 27,) the said pinion meshing
7 with a segmental gear b^{29} on the shaft b^{22} .

The lever b^{23} has secured to it a locking device, herein shown as a rod b^{30} , adapted to engage a notch b^{31} in a metal plate or segment b^{32} and to enter notches b^{33} b^{34} in a plate b^{35} of insulating material, the plate b^{32} and the insulated plate b^{35} being secured to the side of the box or case A^6 , the said plate b^{35} being secured to the plate b^{32} , for a purpose as will be described. The rod b^{30} is jointed to a lever b^{36} , pivoted, as at b^{37} , in lugs or ears b^{38} on the lever b^{23} , the lever b^{36} having a substantially-long arm b^{39} , by which the said lever may be turned on its pivot to withdraw the locking-bar b^{30} from one of the notches. The locking-bar is extended through suitable guiding lugs or studs b^{40} b^{41} , and between the said lugs or studs the locking-bar is encircled by a spring b^{42} , one end of which presses against the lug b^{40} and the other against a collar b^{43} , fast on the bar, the said spring normally acting to press the locking-bar into engagement with one of the notches referred to.

Each circuit-controlling lever b^{12} has co-operating with it a spring b^{50} , (see Figs. 1 and 24,) to which is connected a wire h^3 , leading to the battery, (see Figs. 12 and 14,) another wire leading to the battery being connected to the spring b^{50} .

The shaft b^{24} (see Figs. 26 and 27) has mounted upon it a drum c , of insulating material, provided with two strips c' c^2 , (see Fig. 8,) extended around the periphery of the drum c preferably a little over half-way, and the said drum of insulating material is also provided with a contacting strip c^3 , extended axially across the drum, for a purpose as will be described. The drum c has co-operating with it contact pens or brushes c^4 c^5 , located, as herein shown, below the drum, and contact pens or brushes c^6 c^7 , located above the drum, the upper and lower brushes being connected electrically by the conducting-strips c' c^2 when the latter in the revolution of the drum are brought into contact with the said brushes, the upper brushes being electrically connected at other times by the strip c^3 .

The drum c , its contact-strips, and the pens and brushes co-operating therewith constitute one form of transforming-switch or circuit-controlling device, by which the instrument may be easily changed from a transmitter to a receiver, and vice versa, and from either to a mechanical type-writer, as will be

described. The contact pen or brush c^6 is connected in circuit with the brushes b^{50} , (see Fig. 14,) and the contact-pen c^7 is connected in circuit with the lower springs b^{20} , while the contact-springs c^4 c^5 are connected in circuit, as will be described, with the opposite sides of the battery. The drum c and its contact-strips $c' c^2 c^3$ form, with their co-operating pens or brushes, one form of a circuit-controlling device or switch for the battery, whereby the latter may be cut out and the line closed to complete the circuit through the magnets, in order that the machine may be used as a receiver and the key-levers be electro-mechanically operated through the armatures of the magnets, as will be described. The drum c^{30} , which by its contained spring rotates the carriage a^{27} in a forward direction, has external teeth which mesh with a pinion c^{10} , mounted on a shaft c^{12} , having bearings in an upright c^{13} , the said shaft having loosely mounted upon it a gear-wheel c^{14} in mesh with a beveled pinion c^{15} on the armature-shaft c^{16} of an electromotor A^5 , which may be of any usual or well-known construction, the said armature-shaft having mounted upon it a commutator c^{17} , with which co-operate brushes c^{18} , secured to brush-holders c^{19} c^{20} , to which the line-wires are connected, as will be described.

The circuit of the electromotor is preferably controlled, as herein shown, by means of a carriage-key c^{21} , (see Fig. 19,) extended through a suitable box or hub c^{22} (see Fig. 1) on the top of the auxiliary box A^6 and provided at its lower end with a contact-block c^{23} , adapted to be inserted between contact members c^{24} c^{25} of the switch controlling the motor.

The motor mechanism is designed to be utilized to restore the carriage to its normal or starting position after it has reached the end of its forward feed or movement in the direction of the arrow 200, Fig. 9, and in order that the armature of the electromotor may not be mechanically rotated during the normal working of the apparatus by the depression of the key-levers a^{13} we have mounted the bevel-gear c^{14} loosely on the shaft c^{12} and provided a clutch mechanism, constructed as will be described, whereby the said bevel-gear is rendered fast on the shaft c^{12} when the circuit of the electromotor is completed. The clutch mechanism which we prefer is constructed substantially as shown in Figs. 1, 31, and 32, and consists, essentially, of a disk c^{30} , made fast on the shaft c^{12} , as by the key or pin c^{31} , and provided on its inner face with a series of teeth or notches c^{32} , with which co-operate one or more pins or projections c^{33} , which are extended loosely through suitable holes in the beveled gear c^{14} and are secured to a disk c^{34} , loosely mounted upon the shaft c^{12} , the disk c^{34} having secured to or forming part of it a hub c^{35} , provided with spiral or cam-shaped grooves c^{36} , which are adapted to

embrace or to be entered by pins or lugs c^{37} , secured to ears c^{38} , extended from the upright c^{13} , the disk c^{34} being normally pushed away from the beveled gear c^{14} to disengage the pins or projections c^{33} from the teeth c^{32} on the disk c^{30} and to engage the spiral or cam-shaped groove c^{36} with the pins c^{37} by a spiral spring c^{40} , encircling the shaft between the beveled gear c^{14} and the disk c^{34} . The pins c^{33} are beveled or inclined on their edges, as at 2, (see Fig. 32,) so as to slip by the teeth c^{32} on the disk c^{30} when the beveled gear c^{14} is rotated in one direction, for a purpose as will be described.

As represented in Fig. 32, the spiral or cam grooves c^{36} of the hub c^{35} are in engagement with the pin c^{37} , and the disk c^{34} is in its normal position, with the pin c^{33} out of engagement with the teeth c^{32} of the disk c^{30} , and the machine at such time is in condition to be used in regular work without producing rotation of the armature of the electromotor; but as soon as the circuit of the electromotor is completed through the carriage-controlling key c^{21} (shown in Fig. 19) the beveled pinion c^{15} of the armature-shaft is rotated in the direction of arrow 21 and the beveled gear c^{14} is rotated in the direction of the arrow 22, and as the beveled gear c^{14} is rotated in the direction of its arrow 22 the cam-hub c^{35} is rotated in the same direction and the said cam-hub is forced forward by the pins c^{37} until the pins c^{33} are in engagement with the teeth c^{32} of the disk c^{30} , and when they are thus engaged with the teeth c^{32} the beveled gear c^{14} is locked or clutched to the shaft c^{12} , and the continued rotation of the beveled gear will produce a rotation of the main drum a^{30} in a backward direction, and the carriage will thus be moved backward or in the direction indicated by the arrow 30, Fig. 9, into its normal or starting position.

In practice the carriage-controlling key c^{21} will be maintained closed a sufficient length of time to enable the carriages of all the instruments included in circuit with the particular instrument being used as a transmitter to be brought back to their normal or starting position ready to commence a new line.

In order to prevent jar or shock to the carriage, we have provided a circuit-controller for the electromotor, which is automatically opened by the carriage before the latter reaches the end of its backward movement, and the said circuit-controller is located on the machine, so as to be operated when the carriage has nearly reached the end of its backward movement, the momentum of the carriage carrying it to its normal or starting position. The circuit-controller for the motor referred to (shown in Figs. 9 and 11) consists of a spring strip or plate d , provided, preferably, with a contact-point d' , which co-operates with an upright d^2 , secured to an insulating-block d^3 , fastened to a back plate d^4 .

secured to and forming part of the frame of the machine. The circuit-controlling device referred to is operated, preferably, by a projection d^5 , adjustably secured in any suitable manner to a rod d^6 , fastened to the carriage, the said projection in the backward movement of the carriage striking the spring d and withdrawing its contact-point d' from engagement with the upright d^2 , opening the motor-circuit.

In order to automatically rotate the feed-roll a^{28} to feed the paper and space the same for a new line, we have provided a mechanism, (see Figs. 1, 9, and 10,) which we will now describe. This mechanism, as shown, consists, essentially, of a mechanical switch-cam d^7 , represented as pivoted at d^8 to an upright plate d^9 , having secured to or forming part of it, as herein shown, a guide-bar d^{10} , forming, with a second bar d^{12} , secured to a bottom plate d^{13} , a passage d^{14} , into which extends a roller d^{15} on an arm d^{16} , pivoted to a crank d^{17} on a shaft d^{18} , having suitable bearings in a lug d^{19} , secured to or forming part of the carriage, the said shaft having fast on it at its opposite end an elbow-lever d^{20} , extended toward the cylinder a^{28} and engaging the forked end d^{23} of a pawl-carrier d^{24} , loosely mounted on the shaft of the cylinder a^{28} , and provided with a pawl d^{25} in engagement with the ratchet-wheel d^{30} , fast on the shaft of the cylinder a^{28} . The arm or lever d^{16} is provided with a slot d^{32} , into which is extended a pin d^{33} on the crank-arm d^{17} , the said pin acting to hold the arm d^{16} in proper position, so as to cause the roller d^{15} to enter the passage d^{14} on the forward movement of the carriage and to permit the said arm to be lifted up by the switch d^7 on the backward movement of the carriage. During the forward movement of the carriage, occasioned by the depression of the key-levers, the roller d^{15} enters the passage d^{14} and passing under the switch-cam d^7 lifts the latter, and when on the continued forward movement of the carriage the roller d^{15} has cleared the switch-cam d^7 the latter drops into its normal position, (shown in Fig. 10,) resting upon the bar d^{12} , so that when the carriage is moved backward the roller d^{15} will travel up the inclined switch-cam d^7 and turn the arm d^{22} of the lever d^{20} downward or in the direction of arrow 35, Fig. 10, thereby rocking the plate d^{24} on the cylinder-shaft and moving the pawl d^{25} , pivoted to said plate, into engagement with an adjacent tooth of the ratchet a^{30} , so that when the roller d^{15} has cleared the guide-bar d^{10} a spring on the pivot of the shaft d^{18} will throw the arm d^{17} downward and will move the arm d^{23} of the lever d^{20} in the direction opposite to that indicated by arrow 35, thereby carrying the forked end of the lever d^{24} upward and by means of the pawl d^{25} rotating the ratchet-wheel d^{30} the distance of one tooth, and thus rotating the cylinder one step, or the distance of one line.

Our improved instrument as thus far described is designed to be used on what we

designate as the "cable system," in which the magnets of one instrument are connected to corresponding magnets of another instrument.

Each instrument may be used as a mechanical type-writer, as a transmitter, and as a receiver.

When the instrument is used for office work—that is, as a mechanical type-writer—the lever b^{23} is moved in the direction of arrow 60, Figs. 26 and 28, and the locking-bar b^{30} is made to engage with the notch or tooth b^{34} , the machine at such time being cut out of the main-line circuit, as will be described, with the exception of the call-bell, which is always in circuit with the other call-bells on the line. This feature may be clearly understood by referring to Figs. 14 and 18. Referring to Fig. 18, the call-bell key is shown as constructed of a block g of insulating material, to which is secured a stud or post g' , having a button g^2 , (marked "Call-Bell" in said figure.) The insulating-block g has secured to it on one side, near its lower edge, a contact-strip g^3 and above the said contact-strip the said block has secured to it two independent contact-plates g^4 g^5 , electrically connected, as by screws or pins g^6 , to like contact-plates g^7 g^8 . The rod g' is extended through a base block or plate g^9 , to which are secured on opposite sides of the insulating-block g contact springs or brushes g^{10} g^{12} g^{13} g^{14} . The contact-springs g^{10} g^{12} have connected to them line-wires 36 37^a, the latter having connected to it the magnet g^{15} for the call-bell g^{16} , fastened to the front of the machine, as shown in Fig. 1. The wire 37^a is connected or tapped onto a common return-wire 37 at the point g^{17} . (See Fig. 14.) The contact springs or brushes g^{13} g^{14} have attached to them wires 34^a 35^a, connected to battery-wires 34 35 at the points g^{18} g^{19} , the wires 34 35 being in circuit with the battery B'. When it is desired to call from one station, as B¹⁰, to another, as B¹², the call-bell button g^2 in the station B¹⁰ is depressed and the battery B' in the station B¹⁰ is put into circuit through the contact-springs g^{13} g^{14} and plates g^4 g^5 , pins g^6 , contact-plates g^7 g^8 , and brushes g^{10} g^{12} , the wires 36 37^a, the call-bell in station B¹⁰, and wire 37, extended to the station B¹². The circuit of the call-bell is completed through the wires 36 37^a, brushes g^{10} g^{12} , and contact-strip g^3 on the insulating-block g of the call-bell key in the station B¹². The bell g^{16} in the station B¹² will ring and notify the operator that station B¹⁰ wants to communicate with station B¹².

In Fig. 14 we have shown a diagram of circuits representing a sufficient number of magnets of two instruments to enable the adaptation of our improved instrument to the cable system to be clearly understood. In the two stations marked B¹⁰ B¹² (shown in Fig. 14) we have represented only five magnets (marked, respectively, a^0 b^0 c^0 d^0 e^0) corresponding to the keys of the instrument. In practice we prefer to have the cable-wires separate from

but connected to the machine-wires by means of contact springs and studs g^{30} g^{21} on plates or boards g^{22a} g^{23a} . (Shown separately in Figs. 40 and 41.)

5 In Fig. 14 we have shown five cable-wires (numbered 1 2 3 4 5,) connected to the contact-studs g^{20} , the opposite ends of the wires near said studs being also marked 1 2 3 4 5, each stud g^{20} being connected by a wire g^{22} , with
10 one end of the coil-wire of one magnet a^0 b^0 c^0 d^0 e^0 , &c. The other ends of the coil-wires of the magnets are connected each by a wire g^{23} with the contact-plate b^{18} , with which co-operates the pen or brush b^{14} on the circuit-controlling lever b^{12} , (see Figs. 24 and 25,) governed by the keys of the instrument.

The magnets of each instrument are included in the line-circuit, as will be described, when the instrument is used as a receiver; but when the said instrument is used as a transmitter we prefer that the magnets of the said transmitting-instrument should be cut out of the line of circuit, and thus rendered inoperative. This result may be effected by connecting a contact plate or strip b^{17} with a magnet-wire g^{22} beyond the said magnet by means of the wire g^{24} , so that when the circuit-controlling lever b^{12} is depressed by a key-lever and the pen or brush b^{14} is brought in contact with the plate b^{17} a shunt-circuit around the magnet of the transmitter is formed and the circuit of the magnet of the receiving-instrument corresponding to the actuated key of the transmitting-instrument will be completed, which circuit will be herewith particularly pointed out, and the said receiving-magnet will be energized to operate the type-lever of the receiving-instrument corresponding to the key-lever of the transmitting-instrument which has been depressed. The pen or brush b^{15} on each circuit-controlling lever b^{12} co-operates with the contact plate or strip b^{16} and when brought in contact with the said strip the circuit of the indicating device g^{30} (shown in Figs. 1, 34, and 35) is completed at the transmitting-instrument.

The indicating device herein shown consists of a pivoted armature g^{31} , located within a magnetic coil g^{32} , inclosed within a case g^{33} , secured to the front of the machine and preferably alongside of the bell. The armature g^{31} has fastened to it an arm g^{34} , to which is secured a disk or plate g^{35} , preferably having on its face the word "Off," which normally appears in line with an opening g^{36} in the top of the case g^{32} . The disk or plate normally appears before the opening g^{36} when the apparatus is electrically inoperative; but if the circuit of the magnet between the stations is complete and in working condition the armature g^{31} will be moved on its pivot to withdraw the disk g^{35} from out of line with the opening g^{36} . The circuit through the coil g^{32} of the indicator of each instrument is completed when the pen or brush b^{15} on the circuit-controlling lever b^{12} is brought into engagement with the contact-strip b^{16} , the said

strip being connected by wire g^{38} (see Fig. 14) to one end g^{39} of the indicator-coil g^{32} , the other end g^{40} of the said coil being joined to the common return-wire 37.

Referring to Figs. 24 and 25, it will be seen that the contact-plates b^{17} b^{18} are substantially in line with each other and electrically separated by insulation g^{41} and that the contact-plate b^{16} is located beside the contact-plates b^{17} b^{18} and substantially in horizontal line with the contact-plate b^{18} , but preferably somewhat longer than the contact-plate b^{18} , the part above and in line with the contact-plate b^{18} being of insulation g^{42} .

For sake of clearness we prefer to designate the contact-plate b^{17} as the "transmitting" contact-plate, the contact b^{16} as the "indicator" contact-plate, and the contact b^{18} as the "receiving" contact-plate.

As represented in Figs. 24 and 25, the contact pens or brushes b^{14} b^{15} are bent or shaped so that when the circuit-controlling lever b^{12} is in its normal or inoperative position the pen b^{14} is in contact with the insulation g^{43} above the contact-plate b^{17} and the pen b^{15} is in contact with the insulation g^{42} , and the machine or apparatus will be cut out of circuit.

As represented in Fig. 24, the contact-pen b^{14} is electrically connected to the spring b^{50} through the lever b^{12} , and the contact-pen b^{15} is in contact with the spring b^{20} .

Referring to Figs. 26 and 27, the drum c , of insulating material, fast on the shaft b^{24} and having the circumferential conducting-strips c^1 c^2 and axial conducting-strip c^3 , forms the movable member of the transforming-switch referred to, and the contact springs or brushes c^4 c^5 , located below the drum c , and the contact springs or brushes c^6 c^7 , located above the said drum, form the stationary member. The drum c is rotated by movement of the lever b^{23} . The contact spring or brush c^4 is connected by wire h to the conducting plate or frame b^{32} , and the lever b^{23} is connected by wire 35 to one pole of the battery B' , herein shown as the positive pole. The contact-spring c^6 , normally connected to the spring c^4 by the conducting-strip c^1 on the drum c , is joined by wire h^2 (see Fig. 14) to the wire h^3 , to which all the springs b^{50} are connected. The contact spring or brush c^5 is connected by the wire 34 to the other or negative pole of the battery, the wire 34 being shown in Fig. 14 as connected to substantially the middle of the battery B' , and the contact spring or brush c^7 , normally connected to the brush or spring c^5 by the conducting-strip c^2 , is connected by the wires h^4 h^5 to the springs b^{20} .

The drum or movable member c of the transforming-switch occupies three positions with relation to the contact springs or brushes c^4 c^5 c^6 c^7 .

When the instrument is to be used as a transmitter, the drum c occupies the position shown in station B^{10} in Fig. 14, with the contact springs or brushes c^4 c^5 c^6 c^7 in contact with

the conducting-strips c' c^2 , thereby placing the battery B' in circuit with the magnets, and this position we shall designate as the "normal" position.

5 When the instrument is to be used as a receiver, the drum c is partially rotated in the direction of arrow 100, Fig. 26, by moving the lever b^{23} in the direction of arrow 60 in said figure until the conducting-strip c^3 has been
10 brought beneath and in engagement with the contact springs or brushes c^6 c^7 , as clearly shown in the station B^{13} in Fig. 14, the said conducting-strip completing the circuit between the brushes c^6 c^7 .

15 When the drum c has been turned into the position shown in station B^{12} to enable the instrument in said station to be used as a receiver, the contact springs or brushes c^4 c^5 are in contact with the conducting-strip $c' c^2$; but
20 the circuit of the battery is opened between the conducting-strips $c' c^2$ by the insulated part of the drum c , (marked 40 in Fig. 14.)

When the lever b^{23} is moved in the direction of arrow 60, Fig. 26, to transform the instrument into a receiver, the depressor b^{21} depresses the circuit-controlling levers b^{12} and brings the contact pens or brushes b^{14} on all the said levers below the transmitting contact-plates b^{17} and into engagement with the
30 receiving contact-plates b^{18} , the pens or brushes b^{15} being brought into engagement with the indicator contact-plates b^{16} .

When the pens or brushes b^{14} b^{15} are in engagement with the contact-plates b^{18} b^{16} , respectively, they are preferably locked against accidental movement by means of the lever-locking bar b^{30} , which at such time is in engagement with the notch b^{33} of the plate b^{35} .

The operation of the transmitting and receiving instruments may be readily comprehended by tracing the circuit of one magnet of one instrument to the corresponding magnet of the receiving-instrument.

To avoid confusion, we have in Fig. 14 represented the transmitting-pen b^{14} and lever b^{12} by a dotted line h^6 and the indicator-pen b^{15} by the dotted line h^7 , and to still further avoid confusion, and thus enable the operation of the instruments to be easily understood, we
50 have shown the dotted lines h^6 h^7 in connection with only the magnet corresponding to the type-lever c of the transmitting and receiving instruments.

In the normal operation of the transmitting-instrument the operator depresses the key-lever c , which strikes the stud or post b^9 on the circuit-controlling lever b^{12} , corresponding to the key-lever c , and brings the transmitting-pen b^{14} in contact with the transmitting contact-plate b^{17} , the indicator-pen b^{15} being at the same time brought into engagement with its contact-plate b^{16} . This position of the controlling-lever b^{12} and its attached contact-pens is indicated by the dotted lines
65 h^6 h^7 . The circuit is now completed from the transmitting-station B^{10} to the receiving-station B^{12} through the magnet c^0 of the receiv-

ing-instrument. This circuit may now be traced as follows, viz: from a positive pole of the battery B' , located in the transmitting-station B^{10} , by wire 35, locking-bar b^{30} , plate b^{32} , wire h to spring c^4 of the transforming-switch in station B^{10} , thence by conducting-strip c' , spring c^6 , wires h^2 h^3 to spring b^{50} , thence by dotted line h^6 , representing circuit-controlling lever b^{12} and contact-pen b^{14} , to transmitting contact-plate b^{17} , thence by wire g^{24} around the transmitting-magnet c , wire g^{22} to contact-stud g^{20} , (marked 3,) thence by magnet line-wire 3 to contact-stud g^{20} (marked 3) in receiving-station B^{12} , thence by wire g^{22} , through the receiving-magnet c and wire g^{23} , to the receiving contact-plate b^{18} , thence by dotted line h^6 , representing lever b^{12} and contact-pen b^{14} , to spring b^{50} , thence by wires h^3 h^2 to brush c^6 of transforming-switch in the receiving-station B^{12} , thence by conducting strip c^3 , brush c^7 , wires h^4 h^5 to spring b^{20} , thence by dotted line h^7 , representing contact-pen b^{15} , to contact-plate b^{16} , thence by wire g^{39} , indicator g^{30} , and wire g^{40} in receiving-station to return-wire 37, thence by said wire 37 to the wire g^{40} , indicator g^{30} , and wire g^{39} of transmitting-station B^{10} , and thence by wire g^{38} , contact-plate b^{16} , dotted line h^7 , representing contact-pen b^{15} , spring b^{20} , wire h^5 h^4 , contact-brush c^7 , conducting-strip c^2 , contact-brush c^5 , and wire 34 to the battery B' . It will thus be seen that the magnet c^0 of the receiving-instrument is energized, thereby attracting its armature b' , and through the link b^3 , elbow-lever b^4 , and link b^6 , pulling down the key-lever c of the receiving-instrument and causing the letter "c" to be imprinted upon the recording-sheet or surface. The operation of the remaining magnets is effected in the same manner by depressing the required key-lever of the transmitting-instrument, which depression will energize the magnet of the receiving-instrument corresponding to the key depressed. At each depression of a key-lever of the transmitting and receiving instruments the paper-carrying carriages of said instruments are moved forward in the direction of arrow 200, Fig. 9, until the end of a line on the paper or recording-sheet has been reached, or until such other time as it is desired to return the said carriage to its normal or starting position.

When it is desired to return the carriages back to their normal or starting position, the operator at the transmitting-station depresses the key or button c^{21} (see Figs. 1, 14, 19, and 43) and closes the circuit of the motor A^5 of the transmitting-instrument, and inasmuch as the motors A^5 of all the instruments in the different stations are preferably in multiple arc, as clearly shown by the diagram of circuit in Fig. 43, the circuit of all the motors will be closed and the carriages will be returned to their normal or starting positions.

The circuit of the motor A^5 in the transmitting-station B^{10} , as shown in Fig. 14, may be traced as follows, viz: from the battery B'

by wire 35, locking-bar b^{30} , plate b^{32} , wire h , contact-spring c^4 , conducting-strip c' , spring c^6 , wires h^2 350 to contact c^{24} of the motor-controlling switch, through the said switch, contact c^{25} to wire 13, through the members d d' d^2 of the circuit-break 34, located on the frame of the machine and operated by the projection d^5 on the carriage on its return movement, as described, through the motor, and thence by wires h^{24} and 38 back to the battery B' .

The circuit of the motor A^5 in the receiving-station B^{12} may be traced from the positive pole of battery B' in station B^{10} by wire 35, locking-bar b^{30} , plate b^{32} , wire h , spring c^4 , strip c' , spring c^6 , wires h^2 350 to wire 13^a, to contact c^{24} of the motor-controlling switch, through the said switch, contact c^{25} , thence to the wire 37, wire 13^a in receiving-station, through the members d d' d^2 of the circuit-breaker, through the motor A^5 in the receiving-station, wire h^{24a} to contact-plate b^{17} , spring h^{25} , contact b^{16} , wire h^{27} to wire 13, and thence by h^{27} in station B^{10} , contact b^{16} , spring h^{25} , contact b^{17} , wire h^{24a} , wire 38, back to the battery.

The circuit of the motors A^5 may be more easily comprehended by reference to Fig. 43, wherein the multiple-arc arrangement of the motors and their circuit-breakers is shown.

It will be noticed that the motor-controlling switches are also in multiple arc with the motors and with each other, so that the circuit of each individual motor A^5 may be maintained closed independent of the other motor-circuits until each individual motor has opened its own circuit through its circuit-breaker and its carriage has been returned to its normal or starting position, the circuit of all the motors being governed by the switch in the transmitting-station until, as above described, all the carriages have been returned to their normal or starting position.

As illustrated in the diagram, Fig. 14, each magnet of one instrument is connected by a line-wire to a corresponding magnet of another instrument and intercommunication is carried on by the cable system.

The cable system possesses the advantages of rapidity in work, as messages may be sent from one station or subscriber to another very rapidly—in fact as fast as the type-writer can be operated; but on account of the number of wires employed in the cable system the said system would be too expensive between stations a considerable distance apart—as, for instance, between large cities, such, for example, as New York and Boston. To avoid the above-mentioned objection as to cost of the cable system, we have provided a one-wire system in which the two stations widely distant apart may be connected by a single wire, such as now commonly used on telegraph-lines. The single wire connecting the two or more stations is connected in circuit with each magnet of the instrument, as will be described, through the instrumental-

ity of a pole-changer on a selecting-drum, said pole-changer governing the operation of a circuit-selecting device or arm, the said pole-changer being itself controlled, as herein represented, by projections on the key-levers of the instruments.

When the instruments are used on the one-wire system, they are used as local instruments, having their magnets in local circuits controlled by the selecting device or arm referred to.

In the adaptation of our improved machine to a one-wire system each key-lever a^{13} has secured to or forming part of it a lug or projection e , which co-operates with a pin or projection e' on a selecting-drum e^2 , there being as many pins e' as there are key-levers—that is there are as many pins on the drum e^2 as there are keys. The pins e' are arranged spirally about the drum e^2 and the latter in practice is adapted at such time to be rotated substantially continuously by a motor mechanism, preferably the electromotor A^5 , the latter being coupled to the cylinder e^2 by a belt o , passing about a pulley o^2 on the armature-shaft and about a substantially-large pulley o' on the shaft of the cylinder e^2 . The cylinder e^2 has secured to or forming part of it an escapement-wheel, preferably of the form shown in Fig. 2, and with which co-operate pallets e^7 e^8 on a pallet-bar e^9 , pivoted, as at e^{10} , to an upright e^{12} , the said pallet-bar having secured to its opposite sides pole-changing arms e^{13} e^{14} e^{15} e^{16} electrically separated from the pallet-bar e^9 by insulation e^{17} . The pole-changing arms e^{13} e^{15} are electrically connected together, as by a wire e^{18} , and the pole-changing arms e^{14} e^{16} are connected together electrically by a like wire e^{19} . (See Figs. 5 and 12.) The pole-changing arms e^{13} e^{15} co-operate with circuit terminals e^{20} e^{21} , and the pole-changing arms e^{14} e^{16} co-operate with circuit-terminals e^{22} e^{23} . The circuit-terminals e^{22} e^{23} are both connected, as by the wire e^{25} , (see Fig. 12,) to one pole of a main-line battery B , the said wire having included in it a switch e^{26} , and the circuit-terminal e^{22} is connected by a wire e^{27} to a wire e^{28} , to which the circuit-terminal e^{21} is connected, and which wire is connected to the other or positive pole of the battery. The wire e^{28} , as represented in Fig. 12, has a contact stud or post e^{31} , with which the switch e^{26} may co-operate to cut the motor and battery B out of circuit when the instrument is to be used as a receiver on the one-wire system. The pole-changing arms e^{13} e^{15} are connected by a wire, as e^{32} , to the ground e^{33} , and the pole-changing arms e^{14} e^{16} are connected by a wire e^{34} to a polarized electro-magnet e^{35} , connected in series with an electro-magnet e^{36} , which is electrically connected by a wire e^{37} to a like electro-magnet e^{36} and polarized electro-magnet e^{35} of another instrument, as shown in Fig. 12, in the receiving-station. The polarized electro-magnet e^{35} has an armature e^{38} , (see Fig. 13^a.) provided with two lugs or fingers e^{39} e^{40} , adapted to engage, one

at a time, studs or projections e^{41} on the periphery of a disk or wheel e^{42} , mounted on a shaft e^{43} , rotated by a clock or other suitable motor mechanism, which may be of any usual construction, only one gear-wheel e^{44} of the clock mechanism being shown in Fig. 13^a. The shaft e^{43} has mounted on it a selecting device or arm e^{45} , adapted to be rotated over and in contact with a series of contact plates or segments e^{46} , each segment being electrically connected with one of the magnets. The contact-arm e^{45} is electrically connected, as represented in Figs. 12 and 13^a, by a spring e^{47} and wire e^{48} to one member e^{49} of a circuit-controller or switch, having its other member e^{50} operatively connected, as will be described, to the armature e^{51} of the electro-magnet e^{36} , the member e^{50} being connected by wire e^{52} to one pole of a battery B'.

In Fig. 12 we have shown a diagram of circuits illustrating the one-wire system, and the said figure, in connection with Figs. 13, 13^a, 13^{2a}, shows how the one-wire system may be carried into effect.

Referring to Fig. 12, we have shown in one station, as B²⁰, which may represent Boston, four type-lever-operating magnets $a^0 b^0 c^0 d^0$, having one end of their coil-wires connected to contact-studs $n n' n^2 n^3$ and the other ends of said coil-wires joined to the receiving contact-plate b^{18} , the indicator contact-plate b^{16} being connected to the indicator-wire g^{39} , as in the cable system shown in Fig. 14, the second wire g^{40} of the indicator being joined to the wire n^4 , corresponding to the return-wire 37 in the cable system. The wire n^4 is connected to the contact-stud n^6 , with which co-operates a spring n^7 , connected by wire n^8 to one pole, as the negative pole of the battery B'. The positive pole of the battery is connected by wire e^{53} to one member e^{51} of a normally-open circuit-controller, the other member e^{49} of said circuit-controller being connected by wire e^{48} to a contact-spring e^{47} , co-operating with the circuit-selecting device or arm e^{45} , the said selecting device or arm being provided, as represented, with a contact spring or pen e^x in engagement with the segmental contact strips or plates e^{46} , which are electrically connected by wires to the spring n^9 , co-operating with the contact-studs $n n'$, &c. The circuit-selecting device or arm e^{45} , fast on the shaft e^{43} , is rotated, as above described, by a clockwork or other motor mechanism, only one gear e^{44} of said mechanism being shown in Fig. 13^a. The rotation of the shaft e^{43} is controlled by the polarized electro-magnet e^{35} , governed in its operation by the pole-changer $e^{13} e^{14} e^{15} e^{16}$, operated by the escapement-wheel e^3 , fast on the shaft of the roll e^2 , the said roll being rotated, as represented in Figs. 1 and 13, by the electric motor A⁵. The pole-changing arms $e^{13} e^{14} e^{15} e^{16}$ are alternately brought into contact with their respective contact-points $e^{20} e^{22} e^{21} e^{23}$ by the vibration of the pallet-bar acted upon by the escapement-wheel, and when the escapement-

wheel is arrested in its rotation all the pole-changer arms are in contact with their respective contact-points, and this position of the said pole-changing arms we will designate as the "neutral" position. (Shown in Fig. 4.) The rotation of the escapement-wheel is stopped by the arm or projection e on the key-levers engaging a corresponding stud e' on the drum e^2 , the said projection e being brought down into position to be engaged by a stud e' on the drum when a key-lever is depressed. For instance, let it be supposed that the key-lever a^{13} , representing the letter "a" on the machine in the station B¹⁰, has been depressed, the projections e of the key-lever a^{13} will engage the stud e' on the drum e^2 , corresponding to the letter "a," and will bring the pole-changing arms into their neutral position—that is, with the arms $e^{14} e^{16}$ in contact with their co-operating studs $e^{22} e^{23}$ and the arms $e^{13} e^{15}$ in contact with their co-operating studs $e^{20} e^{21}$ —thereby short-circuiting the main-line battery B in the station B²⁰, and thus shunting the current from the polarized electro-magnet e^{35} and from the electro-magnet e^{36} . When the pole-changing arms are in their neutral position, the resilience of the said arms permits them to make contact with their co-operating studs.

The shunt-circuit referred to may be traced in Fig. 12 as follows, viz: from the positive pole of the battery B in station B²⁰ by wire e^{23} to contact-studs e^{21} , pole-changing arm e^{15} , wire e^{18} , connecting the arm e^{15} with arm e^{13} , thence arm e^{13} , contact-stud e^{20} , wire e^{25} , switch e^{26} , and wire e^{125} to the negative pole of the battery B. The circuit through the other pole-changing arms $e^{14} e^{16}$ is as follows, viz: from the positive-pole of the battery B by wires $e^{28} e^{27}$ to contact-stud e^{22} , pole-changing arm e^{14} , wire e^{19} , pole-changing arm e^{16} , contact-stud e^{23} , wire e^{25} , switch e^{26} , and wire e^{125} to battery. When the battery is short-circuited, as thus described, the permanent magnetism of the polarized electro-magnet will attract the armature e^{38} of the said magnet and will hold it up against either the positive or negative pole-piece, according to the position of the armature when the said polarized magnet is shunted, and one of the fingers $e^{39} e^{40}$ is held in the path of movement of the studs e^{41} on the disk e^{42} and the said disk is prevented from rotating. The disk e^{42} is stopped when the projection e on the key-lever a^{13} , corresponding to the letter "a," strikes a pin or stud e' on the drum e^2 , and the contact pen or brush e^x on the selecting device or arm e^{45} is stopped in engagement with the contact-segment e^{46} in circuit with the type-lever-operating magnet of the instrument in station B²⁰, corresponding to the key-lever depressed, and the circuit of the corresponding type-lever-operating magnet in the receiving-station B³⁰ is also closed by the selecting-arm in the station B³⁰. The circuits of the type-lever-operating magnets in both the transmitting and receiving stations are still open at the cir-

uit-controllers e^{50} e^{49} in the respective stations; but as soon as the current is shunted from the polarized magnet e^{85} and from the electro-magnet e^{86} the armature o^{10} of the said electro-magnet is withdrawn by the spring o^{12} , connected, as shown, to an arm o^{13} (see Fig. 13^{2a}) on the shaft o^{14} , provided with a second arm o^{15} , having stop-fingers o^{16} , causing said stop-fingers to release the pins o^{17} of the shaft o^{18} , permitting it to be rotated by the clock or other suitable motor mechanism for a distance equal to one finger, one of a second set of pins or arms o^{20} on the shaft o^{18} in the rotation of the said shaft being brought into engagement with the member e^{49} of the circuit-controller and moving it into contact with the member e^{50} , thereby closing the circuit of the magnet in each station, the polarized magnets e^{35} and the electro-magnets e^{86} of all the instruments in the main-line circuit being operated simultaneously.

In order that the operation of the instruments may be understood, let it be supposed that the selecting devices or arms of the transmitting and receiving instruments in the stations B²⁰ and B³⁰ are in the position indicated by dotted lines in Fig. 12, with their pens or brushes e^x on the contact plates or segments e^{46} in circuit with the magnets a . The circuits to the instruments are the same, and only the circuit of the transmitting-instrument need be traced, it being as follows, viz: from the positive pole of battery B' by wire e^{52} to contact member e^{50} , through contact member e^{49} of circuit-closer, wire e^{48} , pen e^{47} , arm e^{45} , pen e^x , wire n^9 , contact-stud n , magnet a^0 , contact-plate b^{15} , through the dotted line o^{20} , representing the path through the circuit-controlling mechanism shown in Figs. 24, 25, and 26, to wire g^{39} , indicator g^{30} , wire g^{40} , wire n^4 , contact-stud n^6 , spring n^7 , and wire n^8 to negative pole of the battery B'. The magnet a^0 of the transmitting-instrument, being thus energized, will attract its armature and will indicate to the operator by the pull upon the depressed key-lever that the letter has been sent and received at the other station.

As shown in Fig. 12, the switch-lever e^{26} is in position to complete the circuit of the line e^{25} , and this is the correct working position when the instrument in station B²⁰ is used as a transmitter and the corresponding switch e^{26} in the receiving-station is in position to open the line e^{25} , it being placed in the receiving-station B³⁰.

In the particular type of machine herein shown, which is commercially known as the "Hammond," the character carrier or platen a has the figures and capitals and small letters arranged in rows one above the other, and it is necessary to lock the key-levers a^{13} , (marked in Fig. 37 "Cap." and "Fig.") so as to hold the row of figures or the row of capitals opposite or in line with the hammer of the machine. In the Hammond mechanical type-writing machine this is accomplished by means of locking-pawls o^{30} , (see Fig. 1,) piv-

oted to the capital and figure key-levers and adapted to engage a locking-bar o^{31} , suitably supported in brackets o^{32} . To effect the same result electrically, we have provided our improved instrument with locking-magnets for the capital and figure key-levers, there being one magnet o^{33} for the figure key-lever and preferably two magnets o^{34} o^{35x} (shown in Fig. 7) for the capital key-lever, the diagram Fig. 1 representing, however, but a single magnet o^{34} . The armatures of the magnets o^{33} o^{34} o^{35x} are connected to the capital and figure key-levers by links in the same way that the other magnets are connected to their key-levers. We prefer to employ two magnets o^{34} o^{35x} to obtain the power required to lift the platen a up far enough to bring the capitals in line with the hammer.

When the capitals and figures are being printed, it is necessary to lock the capital and figure levers in their depressed positions, and this is effected, as herein shown, by maintaining the circuit of the capital and figure magnets closed until positively broken.

Referring to Figs. 7 and 12, the armature o^{35} of the capital-magnet o^{34} is shown as provided with a contact-point, which co-operates with a contact-point on a bar or terminal o^{36} in circuit with the battery B', as will be described, and the armature o^{37} of the figure-magnet o^{33} has a contact-point, which co-operates with a contact-point on a bar or terminal o^{38} , also in circuit with the battery B'.

When it is desired to use small letters after using capitals or figures, it becomes necessary to release or unlock the armature of the capital and figure magnets, and this may be accomplished, as herein shown, by means of an auxiliary or unlocking magnet o^{40} , having its armature o^{41} normally in circuit with the battery B', when the circuit of said battery is completed through the terminals o^{36} o^{38} . The armature o^{41} , as shown in Figs. 7 and 12, co-operates with a back stop or terminal o^{42} , joined by wire o^{43} to a contact-stud o^{44} , connected by a spring o^{45} and wire o^{46} to the positive wire e^{52} of the battery B'. The armature o^{41} is connected by wire o^{47} to the front stop or terminal o^{36} and by branch wire o^{48} to the front stop or terminal o^{38} .

As represented in Fig. 12, the figure-magnet o^{33} is connected in circuit with the wire n^4 , leading to the negative pole of the battery B', by contact-plate b^{18} , wire o^{20} , contact-plate b^{16} , and wire o^{44} , and the capital-magnet o^{34} is connected to the wire o^{44} by contact-plate b^{18} , wire o^{20} , contact-plate b^{16} , and wire o^{45} , while the unlocking-magnet o^{40} is connected by contact-plate b^{18} , wire o^{20} , and contact-plate b^{16} to the indicator-wire g^{39} . The capital, figure, and unlocking magnets o^{34} o^{33} o^{40} are respectively connected by wires o^{46} o^{47} o^{48} to contact-studs o^{50} o^{51} o^{52} , which are individually joined by springs n^7 and wire n^9 to individual contact plates or segments e^{46} .

The operation of printing with capitals and figures being the same, we shall briefly explain

but one. Let it be supposed that the operator in the transmitting-station B¹⁰ has depressed the key-lever marked "Cap." in Fig. 37. The projection *e* on said lever is brought into the path of movement of the pin *e'* on the drum *e*² and will stop the revolution of the said drum and bring the pole-changing arms into their neutral position, as above described, thereby short-circuiting the main-line battery B and stopping the selecting-arm with its pen *e*^x in contact with the segment or plate *e*⁴⁶, connected in circuit with the capital-magnet *o*³⁴, and at the same time the electro-magnet *e*³⁶ through its armature *o*¹⁰, shaft *o*¹⁴, arm *o*¹⁵, shaft *o*¹⁸, and pins *o*²⁰ thereon will close the circuit-controller of the battery B' and will complete the circuit of the capital-magnet *e*³⁴, which may now be traced as follows, viz: from the positive pole of the battery B' by wire *e*⁵², contact member *e*⁵⁰, member *e*⁴⁹, wire *e*⁴⁸, spring *e*⁴⁷, selecting-arm *e*⁴⁵, its pen *e*^x, contact plate or segment *e*⁴⁶, connected by wire *n*⁹ and spring *n*⁷, to contact-stud *o*⁵⁰, thence by wire *o*⁴⁶, magnet *o*³⁴, contact-plate *b*¹⁸, wire *o*³⁰, contact-plate *b*¹⁶, and wires *o*⁴⁵ *o*⁴⁴ *n*⁴ to contact-stud *n*⁶, and thence by spring *n*⁷, wire *n*⁸ to negative pole of the battery. The capital-magnet *o*³⁴ is thus energized and its armature is attracted, bringing it in contact with the stop *o*³⁶ and completing a loop or shunt circuit for the capital-magnet, which may be traced as follows, viz: from positive pole of the battery B' by wire *e*⁵², branch wire *o*⁴⁶, spring *o*⁴⁵, contact-stud *o*⁴⁴, wire *o*⁴³, front stop *o*⁴², armature *o*⁴¹ of unlocking-magnet, wire *o*⁴⁷, front stop *o*³⁶, armature *o*³⁵, through the magnet *o*³⁴, contact-plate *b*¹⁸, contact-plate *b*¹⁶, wires *o*²⁰ *o*⁴⁴ *n*⁴, spring *n*⁷, and wire *n*⁸ to negative pole of battery. The circuit is thus maintained closed as long as it is desired to use capitals; but if it is desired to use small letters or figures the operator depresses the unlocking-key lever shown in Fig. 36 and brings its projection *e* into the path of movement of the pin *e'* on the drum *e*², corresponding to the contact-plate *e*⁴⁶, connected to the unlocking-magnet *o*⁴⁰, and on the completion of the circuit of the battery B' by the closing of the circuit-controller *e*⁵⁰ *e*⁴⁹ the armature *o*⁴¹ is attracted and the loop-circuit is broken. It will be noticed that the wire *o*⁴⁴ is connected to the wire *n*⁴ beyond the indicator and independent of the said indicator, so that the circuit of the indicator through any other magnet than the capital or figure magnets when locked may be in operative condition and the indicator responsive.

The roll of paper to be printed upon may be carried within or upon the carriage *a*²⁷, as shown in Fig. 33; but preferably the said roll will be supported upon brackets or arms 200^x, extended above the machine, as in Fig. 1.

As represented in Fig. 1, the escapement-wheel for operating the pole-changer and the drum *e*² are rotated by means of the belt *o*, driven by the armature of the electromotor A⁵, and in order that the said belt may be

driven always in one direction the armature-shaft of the motor is provided on one end, as herein shown, with a ratchet-wheel *m*, having its teeth engaged by a pawl *m'*, pivoted to the bevel-gear *c*¹⁵, loose on the armature-shaft, the latter having fast on its other end a second ratchet-wheel *m*², (see Fig. 31,) having its teeth pointed in the direction opposite to that in which the teeth in the ratchet *m* are projected. The teeth of the ratchet *m*² are engaged by a pawl *m*³, pivoted to the pulley *o*², loose on the armature-shaft.

When the motor A⁵ is used to rotate the bevel-pinion *c*¹⁵ to restore the carriage to its normal or starting position, as above described, the armature-shaft is revolved in the direction indicated by arrow 21, Fig. 31, and the ratchet *m* acts against the pawl and practically renders the bevel-pinion fast on the armature-shaft, thereby rotating the bevel-gear *c*¹⁴ in the direction indicated by arrow 22. When the armature-shaft is rotated in the direction of arrow 21, the ratchet *m*² clicks by the pawl *m*³ and does not move the pulley *o*², so that the selecting-drum *e*² is not moved. When the motor A⁵ is used to rotate the said drum *e*², the current through the motor is reversed to produce rotation of the armature-shaft in a direction opposite to that indicated by arrow 21—viz., in the direction indicated by arrow 24, Fig. 31. As the armature-shaft is rotated in the direction of arrow 24 the ratchet *m*² acts against the pawl *m*³ and practically renders the pulley *o*² fast on the armature-shaft, and thereby drives the belt *o* and produces rotation of the drum *e*².

When the motor A⁵ is used with the one-wire system, the carriage may be returned to its normal or starting position by again rotating the armature in the direction of arrow 21. The reversals of the armature may be accomplished by means of a suitable reversing-switch or pole-changer, which may be constructed as shown in Fig. 13^b, it consisting, as shown, of four contacts *w*⁵⁰ *w*⁵¹ *w*⁵² *w*⁵³, the contacts *w*⁵⁰ *w*⁵¹ by wires *w*⁵⁴ and *w*^x, and the contacts *w*⁵² *w*⁵³ by wires *w*⁵⁵ *w*⁵⁶. The contacts *w*⁵⁰ *w*⁵² have located between them a contact member *w*⁵⁷ of one polarity, and the contacts *w*⁵¹ *w*⁵³ have located between them a contact member *w*⁵⁸ of the opposite polarity, the contact members *w*⁵⁷ *w*⁵⁸ being herein shown as secured to an armature-lever *w*⁵⁹, carrying the armature *w*⁶⁰ of an electro-magnet *w*⁶¹, the contact members *w*⁵⁷ *w*⁵⁸ being insulated from each other. The electro-magnet *w*⁶¹ has one of its wires *w*⁶² joined to the member *d* of the motor-circuit breaker, the other wire *w*⁶³ being connected to one brush of the armature of the motor A⁵, the other brush of the said motor being joined by wire *w*⁶⁴ to the contact member *w*⁵⁷, and the other contact member *w*⁵⁸ being joined by the wire *w*⁶⁵ to the wire *w*⁶³. The contact member *w*⁵³ is connected by the wire *w*⁵⁶ to one of the field-magnets of the motor A⁵, and the contact member *w*⁵¹ is connected to the other field-magnet of the motor

by the wire w^x . The motor A^5 is connected in circuit with the member e^{50} of the one-wire-circuit controller by wire w^{65} , provided with a switch w^{66} , by which the wire w^{65} may be opened and closed, as desired, the member e^{50} being also connected by wire e^{52} to the positive pole of the battery B' . The member e^{49} of the circuit-controller is connected, as already described, by wire e^{48} and pen e^{47} to the selecting-arm e^{45} and its pen e^x , co-operating with the contact plates or segments e^{46} . One of the contact-plates e^{46} is connected to the negative pole of the battery B' , as represented in Figs. 12 and 13^b, by wire w^{67} , contact-plate b^{18} , wire or connection w^{68} , contact-plate b^{16} , and wire w^{68} to member d^2 of the motor-circuit controller, thence by wire w^{69} to terminal w^{70} , switch w^{71} , and wire w^{72} to the battery B' . The wire w^{67} is in circuit with an electro-magnet w^{73} , which controls a shunt-circuit around the members e^{49} e^{50} of the one-wire-circuit controller e^{49} e^{50} , so that the circuit of the motor A^5 may be maintained closed after the members e^{49} e^{50} are out of contact with each other. The armature w^{74} of the electro-magnet w^{73} is connected by wire w^{75} to the positive battery-wire e^{52} , and the said armature when attracted by its magnet makes contact with a front stop w^{76} , connected by wire w^{77} to the wire e^{48} . The switch w^{71} co-operates with a second terminal w^{78} , joined by a wire w^{79} to a wire w^{80} , corresponding to the wire 13^a in Fig. 14, the wire w^{80} being connected to the armature-wire w^{64} and to one contact c^{25} of the motor-controlling switch, the other contact member c^{24} being connected to the positive pole of the battery B' by wire w^{82} , as represented in Fig. 13^b; but, as represented in Fig. 12, the wire w^{82} is connected to the battery through contact-spring c^6 , contact-stripe c' , contact-spring c^4 , and wires h and 35. The wire w^{80} is connected by a wire w^{83} to a switch w^{86} , co-operating with a terminal or stud w^{87} , joined by wire w^{88} to the common return-wire n^4 , connected by spring n^7 and wire n^8 to the battery B' . The switches w^{66} w^{71} w^{86} occupy the position shown in Fig. 13^b when the one-wire system is used, and when it is desired to return all the carriages of the instruments to their starting position the motor-circuit must be closed, which is done by the operator depressing a key w^{90} , (shown in Figs. 1 and 36,) causing its projection to engage the co-operating pin e' on the drum e^2 , thereby stopping the selecting-arm e^{45} , as before described, with its pen e^x in contact with the plate e^{46} , to which the wire w^{67} is connected. When the selecting-arm is stopped, the line-battery B is short-circuited by the selecting-drum releasing armature o^{10} , and the circuit of the motor is closed by the contact or member e^{49} and e^{50} . The circuit of the motor thus completed may be traced in Fig. 13^b as follows: from positive pole of the battery B' by wire e^{52} , contacts e^{50} e^{49} , wire e^{48} , arm e^{45} , pen e^x , contact-segment e^{46} , wire w^{67} , contact-plate b^{18} , wire 68, contact-plate b^{16} , circuit-breaker d^2 d' , wire w^{62} , magnet w^{61} , wire

w^{63} through armature of motor A^5 , wire w^{80} , wire w^{79} , switch w^{71} , and wire w^{72} to negative pole of battery. The magnets w^{73} and w^{61} are energized and attract their respective armatures w^{74} w^{60} . The armature w^{74} is brought forward into contact with the stop w^{76} and completes the shunt around the contact members e^{49} e^{50} , and as the said contact members are in contact for only a substantially-short space of time the motor-circuit is maintained closed by the armature w^{74} after the member e^{49} is withdrawn from contact with the member e^{50} . The shunt-circuit may be traced as follows, viz: from the positive pole of battery B' by wires e^{52} w^{75} , armature w^{74} , front stop w^{76} , wires w^{77} e^{48} , spring e^{47} , and selecting-arm e^{45} , &c., the same as above described. The motor-circuit remains closed until it is opened by the carriage separating the contact members d d^2 . When the circuit through the magnet w^{61} is completed, as described, its armature w^{60} is attracted and the contact members w^{53} w^{57} are brought into contact with their co-operating springs w^{53} w^{50} and a shunt-circuit through the field-magnets of the motor is completed, which shunt-circuit may be traced as follows, viz: from wire w^{63} by wire w^{65} to the member w^{53} , thence by spring w^{53} , wire w^{56} through the field-magnets in one direction, thence by wires w^x w^{54} to the spring w^{50} , thence by the contact member w^{51} , wires w^{64} w^{80} w^{79} , switch w^{71} , and wire w^{72} to the negative pole of the battery.

One of the objects of this present invention is to give a private line to each subscriber or instrument on either the cable or the one-wire system, having a number of instruments connected in circuit, and this is accomplished by means of a combination or individualizing switch, by which the line-circuit is converted into a private line for the instruments having the combination, while the other instruments may be still in circuit.

Referring to Fig. 15, we have shown five pens or brushes f f' f^2 f^3 f^4 , forming one member of one form of combination or individualizing switch, the other member consisting, as herein shown, of a series of metallic studs or buttons f^{20} , the buttons being also designated by the numbers "1 2 3 4 5," because said buttons so numbered are in circuit with the wires 1 2 3 4 5. The contact buttons or studs f^{20} are secured to a base or frame f^5 and to a rack-bar f^6 in mesh with a pinion f^7 , having mounted upon its shaft outside the case f^8 a pointer f^9 , which registers with the numbers on the side of the box f^8 . The base or frame f^5 is provided, as herein shown, with five like rows of buttons arranged in lines transversely, the buttons of each row being, however, differently numbered from the first row of buttons, the individual circuit-wires connected to the buttons numbered "1 2 3 4 5" of the first row being also connected to similarly-marked buttons of the remaining rows, for a purpose as will be described. The base or frame f^5 , as represented, is adapted to slide in suitable

guideways f^{10} , secured, as represented, to the sides of the box or case f^8 .

Before describing the operation of the combination-switch we will say that the first row of buttons may be used in common with all the instruments in the line; but if one or more subscribers desire to have private communication which cannot be understood by other than the proper subscriber the said subscribers will have the buttons in the second and other rows arranged as a code, and so that when the movable member of the switch is put into communication with a second or third row of buttons and the machine and all the machines in condition of receptivity, except those set up with the same code-row, it will print a jumble of letters; but the instrument having like codes will print correctly.

The operation of our improved combination-switch may be more readily understood by a reference to the diagram of circuits shown in Figs. 20 to 23, inclusive.

Referring to Fig. 20, two stations B^{10} B^{12} are represented, only a portion of the wires connected to the magnets of each being shown. In this figure the wires connected to the magnets a^0 b^0 c^0 d^0 e^0 , operated by the depression of the key-levers a^{13} in the said stations, are respectively connected by suitable wires to the contact-springs f f' f^2 f^3 f^4 of the stationary member of the combination-switch, and these latter are in contact with the first row of studs or buttons (marked, respectively, "1 2 3 4 5,") connected to the corresponding buttons of the combination-switch in the station B^{12} by line-wires marked 1 2 3 4 5, and all instruments print alike.

Referring now to the second row of contact buttons or studs—a code-row—the buttons are arranged in a different order from those shown in the first row and are connected by branch wires f^{30} to the line-wire corresponding to the number on the stud or button—as, for instance, the first button or stud in the second row, which is in line with the stud or button marked "1" of the first row, is marked "3," the second button "4," the third button "5," the fourth button "1," and the fifth button "2," and these buttons, as above stated, are connected by the wires f^{30} to line-wires 3, 4, 5, 1, and 2. The third and other rows of buttons are numbered yet differently from the first and second rows and are connected by the branch wires f^{30} to their respective line-wires. When the movable member f^5 of the combination-switch used in connection with the apparatus in each station occupies the position shown in Fig. 20, with the first row of contact-studs in contact with the brushes f to f^4 , inclusive, a signal sent from one station, as B^{10} , will be correctly transmitted to each instrument in circuit with it, provided it has the movable member of its co-operating switch in a like position. If now it is desired that two subscribers or stations on a line communicate with each other privately and without danger of having

their messages printed upon any other machines in circuit with them, the said subscribers may move their combination-switches so as to bring their private code-rows of studs or buttons in contact with the pens or brushes f to f^4 , inclusive.

In Fig. 21 the movable member f^5 of the combination-switches in the stations B^{10} B^{12} have been so moved, and the brushes f to f^4 , inclusive, co-operate with the second row of contact studs or buttons. If now the operator in station B^{10} depresses the lever-key of his instrument to close the circuit of magnet a^0 , the current will be transmitted through the contact-brush f , stud 3 of the second row, and branch wire f^{30} to the line-wire 3, thence by the branch wire f^{30} in the station B^{12} to the contact stud or button 3 of the second row, and thence through the contact pen or brush f to the magnet a^0 , controlling the operation of a key-lever of the receiving-instrument B^{12} , and the letter selected in the sending-station is printed in the receiving-station, provided the subscriber has put the second row of buttons of his instrument in proper place; but any other subscriber without the same code-rows, if their machine receive, will print a jumble. It will thus be seen that when the combination-switches occupy the position shown in Fig. 21, the line-wire 3 being in use, and that when the key-lever controlling the magnet a^0 at the sending-instrument is depressed, (see the diagram shown in Figs. 21 and 20) the line-wire 3 will complete the circuits of the magnets c^0 , operating the letters "c" of the other type-writers in the circuit, provided they do not have the same code-buttons, and, if they have, that the said code-buttons are not in place, or, if the brushes f f' are on the front row, the combination-switches occupy their normal position shown in condition for general work. It will also be readily seen that if the movable member of the combination-switch in any station is moved to place any other row of contact-studs than the row 2 in engagement with the brushes f to f^4 , inclusive, a different line-wire from the line-wire 3 will be energized and a magnet controlling a different key-lever from the magnet of the key-lever depressed manually will be operated, so that while the two stations having their combination-switches arranged, as it may be said, in unison, receive a perfectly correct and legible communication, the other instruments connected to the line-circuit will print a miscellaneous and confused mass of letters, which will mean nothing. It will thus be seen that by means of the combination-switch private communication may be had on a line-circuit in which is included a series of instruments, and with the same instruments and line-circuits that general communication between all the stations or subscribers may be obtained. In other words, the combination-switch renders it possible for a number of instruments to be connected together in one

common circuit, and at the same time give to each instrument or subscriber a private line-circuit whenever desired.

We have represented in Figs. 15, 20, and 21 one form of combination-switch or circuit-controller by which we may effect this result; but we do not desire to limit this particular feature of our invention to any particular form of combination-switch, for the same effect may be obtained with other forms—as, for instance, with the switch shown in Fig. 16, wherein the movable member is shown as a roller or cylinder f^{15} , provided with rows of contact studs or buttons. So, also, it is evident that the wires themselves may be arranged and connected together in different combinations, and in reality the forms of switch shown in Figs. 15 and 16 are merely convenient mechanical methods for carrying out such arrangement and combination of wires into effect.

In Fig. 22 we have shown three stations B^{10} B^{11} B^{12} merely to illustrate what may take place when the combination-switches in the stations B^{10} B^{12} occupy the position shown in Fig. 1 and the combination-switch in the station B^{11} occupies the normal position shown in Fig. 20—as, for instance, if the magnets a^0 b^0 c^0 d^0 e^0 of station B^{10} and controlling the key-levers at the other stations for printing the letters “a b c d” were depressed while their combination-switches are in the position shown in Fig. 21 the magnets controlling the said key-levers at the station B^{12} will be operated; but the magnets of the instrument in station B^{11} , controlling the keys for printing the letters “c d e a b,” will be electrically operated when the key-levers controlling the letters “a b c d e” of the instrument in station B^{10} are manually operated. It will thus be seen that if the operator in the station B^{10} sends any desired message—as, for instance, the word “Boston”—it would be received on the instrument in station B^{12} and the word “Boston” would be printed on said instrument; but every other instrument on the line would print a series of letters which would be mixed up and would signify nothing.

In practice each instrument, subscriber, or sub-station will be given a distinguishing or private character code-rows, one or more, by which it may be known how to couple up the combination-switches in the different stations.

We prefer to employ an electromotor to return the carriage back to its normal or starting position; but we do not desire to limit our invention in this respect, as the said carriage may be returned to its starting position by an electro-mechanical motor mechanism.

In Figs. 33, 37, and 38 we have shown one form of electro-mechanical motor mechanism by which the carriage may be restored to its normal position. The mechanical motor mechanism herein shown consists of a winding-drum w , provided with a gear w' . The drum w contains within it a spring (not shown) having one end fastened to the drum and its

other end secured to a winding-shaft w^2 , upon which is mounted a gear or ratchet wheel w^3 , engaged by a pawl on a pallet-bar w^4 , pivoted in an arm or casting w^5 , secured to or forming part of an armature w^6 of an electro-magnet w^7 , the said casting being pivoted to a standard or upright w^8 , which, as herein shown, is extended up through a slot in the said casting. The drum-gear w' meshes with a pinion w^9 on a shaft w^{10} , having fast on it a disk or wheel w^{12} , provided on its opposite sides or faces with projections or teeth w^{13} w^{14} . The teeth or projections w^{13} are adapted to be engaged by a stud or projection w^{15} on one member w^{16} of a forked lever, pivoted, as at w^{17} , to a lug or ear w^{18} on a base w^{18a} , fastened to the magnet containing the case or box. The second member w^{19} of the forked lever is also provided with a pin or pins to enter an annular groove w^{20} in a hub w^{21} , keyed or splined on a shaft w^{22} and secured to or forming part of a wheel or disk w^{23} , provided with one or more teeth or projections w^{24} , adapted to engage the teeth w^{14} on the disk or wheel w^{12} . The shaft w^{22} has fast on it a gear w^{25} in mesh with a gear or pinion w^{26} on a shaft w^{27} , having on it a coupling-disk w^{28} , provided with one or more pins w^{29} , which are extended through suitable openings in a second coupling-disk w^{30} on a shaft w^{31} , corresponding to the shaft c^{12} , (shown in Figs. 31 and 32,) the shaft w^{31} being provided with a gear corresponding to the gear c^{10} on the shaft c^{12} , which meshes with the drum a^{30} . The forked-lever referred to has secured to or forming part of it an armature w^{33} of an electro-magnet w^{34} . The electro-magnet w^7 is in circuit with all the electro-magnets b^0 and is energized at the depression of each key-lever a^{13} , so that as the carriage is fed forward the armature w^6 is attracted and the ratchet-wheel w^3 is rotated and the spring in the drum is wound up. While the ratchet-wheel w^3 is being rotated, as described, the drum is held stationary by means of the locking projection w^{15} on the member w^{16} of the forked lever engaging a tooth or projection w^{13} on the disk or wheel w^{12} , fast on the shaft w^{10} . When it is desired to return the carriage to its normal position, the circuit of the electro-magnet w^{34} is closed by means of the key c^{21} and the armature w^{33} is attracted, thereby disengaging the member w^{16} from the tooth or projection w^{13} on the disk or wheel w^{12} and sliding the hub w^{27} on its shaft by means of the member w^{19} of the forked lever and engaging the teeth w^{24} on the disk w^{23} with the teeth w^{14} on the disk w^{12} . When the projecting w^{15} on the member w^{16} of the forked lever is removed from engagement with the teeth w^{13} on the disk w^{12} , the said disk is free to be rotated by the spring in the drum, the ratchet-wheel w^3 at such time being held stationary by the pallet-bar w^4 . The rotation of the disk w^{12} produces rotation of the shaft w^{22} and movement of the carriage through the gear c^{10} and drum a^{30} .

In practice the switches w^{71} , w^{86} , w^{66} , and e^{26}

used in the one-wire system will preferably be pivoted to one side of the magnet-containing box or case (see Figs. 9 and 13^{2b}) and will preferably be connected by a bar w^{100} , provided with a handle w^{181} , by which the switches may be moved simultaneously.

In order that the practical utility and operation of our improved system of intercommunication may be readily comprehended, we have illustrated in Fig. 39 a diagram of circuits representing two main or central stations B^{20} B^{30} , which may be supposed to be located in two distant cities, as New York and Boston. Each central station may have connected to it any desired number of instruments, which may be connected to the central station by a cable or by a single wire, as shown in Fig. 39. Six cables are connected to station B^{30} and four cables connected to station B^{20} , while one single wire is connected to station B^{30} and two single lines connected to station B^{20} . The cables in New York, for sake of illustration, we will designate as S S' S^2 S^3 and the single wires as S^{40} S^{50} , and the cables in Boston as S^4 S^5 S^6 S^7 S^8 S^9 and the single wire S^{60} . Each line may have connected in circuit with it one or more instruments—as, for instance, the cable S has one instrument, the cable S' three instruments, the cable S^4 two instruments, the single wire S^{40} two instruments, and the single wire S^{60} two instruments. The central offices are connected together by a single wire, which may be the wire e^{37} in Fig. 12, it constituting the main-line wire between the two cities and being connected to the ground through the instruments at said station, as represented in Fig. 12.

Each central station may be provided with a suitable switchboard, one form of which is represented in Fig. 40, it consisting of two bases or boards g^{22a} g^{23a} , provided with contacts g^{20} g^{21} , the contacts g^{20} being connected by the wires n^9 (shown in Fig. 12) to the contact-segments e^{16} , and the contacts g^{21} being connected to the type-lever-operating magnets of each instrument.

In practice each instrument will preferably be provided with the contact-board g^{23a} , as represented in Fig. 41.

When it is desired to hold local communication—as, for instance, between two subscribers in the same city, say the subscriber S^{14} on the cable S^4 and the subscribers S^{15} on cable S^8 —the two cables are electrically connected together in the central station B^{30} . The cables S^4 and S^8 may be connected, as represented in Fig. 41 by the intermediate cable S^{20} , provided with a contact-board g^{22a} at each end, and when thus connected communication between the subscribers S^{14} and S^{15} is established.

If it is desired to communicate from the station or subscriber S^{14} with all the stations or subscribers in the same city, a cable having as many contact-boards S^{12} as there are cables leading into the central station may be used.

If it is desired to hold communication be-

tween the subscriber S^{14} in Boston and a subscriber S^{21} in New York, the operator in the central offices B^{30} B^{20} will connect the contact-boards g^{23a} of the cables S^4 S' to the contact-boards g^{22a} of the one wire and communication may be had by operating the transmitting-instrument in stations S^{14} S^{21} on the one-wire system, as heretofore described. If now the subscriber S^{14} should wish to hold private communication with the subscriber S^{21} , each of the said subscribers would operate his individualizing or combination switch and intelligible communication would be had between these two subscribers to the exclusion of all the other subscribers on their respective lines or cables.

Each instrument may be used on the cable or one-wire system, and communication can be held between subscribers in the same city or in different cities on the one-wire system as well as on the cable system, and each instrument may have the benefit of the cable and one wire.

The reinforcing-plate a^{20} is made detachable from the machine, so that it may be replaced by a new one as soon as the holes in it become worn or enlarged, thereby avoiding liability of the type-carrier a being carried out of its proper or correct position when swung round to place a character in line with the hammer. By means of the reinforcing-plate the type-carrier is always presented in correct position with relation to the hammer and the life of the machine is greatly increased.

As herein shown, the circuit-controllers b^9 are operated by means of the key-levers of the type-writer; but it is evident that the said circuit-controllers may, if desired, be operated by an independent set of keys, which in practice may be fitted upon the rods b^9 .

Instead of rotating the selecting-drum e^2 by means of a belt driven from the carriage-motor A^5 , the said drum may be rotated by an independent motor z^{10} , (see Fig. 6,) having its armature-shaft provided with a pinion z^{12} in mesh with a gear z^{13} on the roller-shaft.

We claim—

1. In a type-writer system of intercommunication, the combination, with a type-writer located at one station and having a character-carrier of the class described, it having a number of characters thereon, a series of electro-magnets, one for each character on the said character-carrier, armatures for said electro-magnets operatively connected to the character-carrier, and an independent circuit-controller for each of said electro-magnets and each consisting of a plurality of circuit-terminals and a movable member co-operating therewith, of a second type-writer having a character-carrier of the class described provided with a number of characters thereon, a series of electro-magnets, one for each character, having their armatures operatively connected to the character-carrier of the second type-writer, and an independent circuit-controller for each electro-magnet of the second

type-writer, consisting of a plurality of circuit-terminals and a movable member co-operating therewith, substantially as described.

2. In a type-writer system of intercommunication, the combination, with a type-writer located at one station and having its key-levers operatively connected to the armature of electro-magnets and independent circuit-controllers, one for each key-lever, and consisting of a fixed member and a movable member, the latter being adapted to be moved by the said key-levers, of a receiving type-writer having key-levers and electro-magnets in circuit with the circuit-controller of the transmitting type-writer and connected to the said key-levers, circuit-controllers governing the circuit of the electro-magnets of the receiving-instruments, one for each electro-magnet, and consisting of fixed and movable members, and means to act on the movable members to change the position of the said circuit-controllers, whereby either instrument may be used as a receiver or transmitter or as a mechanical type-writer, substantially as described.

3. In a type-writer system of intercommunication, the combination of the following instrumentalities, viz: a type-writer provided with a character-carrier of the class described, a hammer or striker co-operating with it, a plurality of key-levers, and intermediate mechanical devices actuated by the key-levers to operate the said character-carrier and hammer, a plurality of electro-magnets having their armatures operatively connected to the said key-levers, a plurality of circuit-controllers operated by the key-levers and consisting of fixed and movable members, and means to act on the movable members of said circuit-controllers to remove them out of the path of movement of the said key-levers, substantially as described.

4. In a type-writer system of intercommunication, two stations or offices, a main-line wire connecting the same, one or more type-writing instruments provided with character-keys and having their character-carriers operatively connected to the armatures of electro-magnets electrically connected to the said stations, and a plurality of circuit-controllers in each instrument, adapted to be operated by the character-keys and consisting of fixed and movable members, and a device to act on the movable members to change the condition of the circuit-controllers to enable the instrument at each station to be used as a transmitter or receiver, substantially as described.

5. A type-writer system of intercommunication containing the following instrumentalities, viz: a series of type-writers, each having a series of electro-magnets adapted to select particular letters or characters to be printed, the said magnets being connected in the same electrical circuit, a series of combination-switches included in the said circuit and having general and special contacts, one switch for each type-writer, whereby when

the combination-switches are set on the general contacts a message may be transmitted intelligibly to all the type-writers of the series which are in receptive condition, but when set on the special only those type-writers having like special contacts and in receptive condition on the said like special contacts will receive the message intelligibly, all type-writers not set on like special contacts printing, if in receiving condition, a jumble of letters or an unintelligible message.

6. The combination, with the movable carriage of a type-writer, of an electric motor normally disengaged from the said carriage while the latter is being moved forward, a clutch mechanism operated by the electric motor to couple the said electric motor to the movable carriage, and a circuit-controller to govern the operation of the electric motor and clutch mechanism, substantially as described.

7. The combination, with the movable carriage of a type-writer and a motor mechanism to move it in one direction, of an independent motor mechanism to move the said carriage in the opposite direction, a clutch mechanism normally disengaged from the movable carriage while the latter is moving in one direction, but acted upon by the independent motor mechanism to couple the latter to the carriage, and means to control the operation of the independent motor mechanism, substantially as described.

8. The carriage of a type-writer provided with a rack-bar, a shaft c^{13} , having a gear in operative connection with the said bar, a toothed disk fast on the said shaft, and a gear c^{14} , loose on said shaft and provided with one or more pins or rods extended through the said gear c^{14} and adapted to engage the teeth on the fast disk, combined with an electric motor having a pinion or gear and devices to engage the said pins with the teeth of the said disk when rotated in one direction and to disengage said pins when rotated in the opposite direction, substantially as described.

9. In a type-writer, the following instrumentalities, viz: a series of character-keys, a plurality of independent circuit-controllers adapted to be operated thereby when the said keys are actuated, contact-plates co-operating with said circuit-controllers, and an actuating device to move the said circuit-controllers out of the range of movement of the said keys, substantially as described.

10. In a type-writer, the combination, with the key-levers and a circuit-controller adapted to be operated by said levers, of a depressor or device to remove said circuit-controllers out of the range of movement of the said key-levers and a battery-controlling switch operatively connected to the said depressor to be moved therewith, substantially as described.

11. In a type-writer, the combination, with the key-levers, of electro-magnets having armatures and connecting devices between them and the said key-levers, a plurality of circuit-controllers adapted to be engaged by the key-

levers when the latter are operated, contact pens or brushes on said circuit-controllers, a transmitting contact-plate with which one of said pens co-operates, a receiving contact-plate connected in circuit with the electro-magnets, an indicator contact-plate with which the other of said pens co-operates, and an indicator on the type-writer, electrically connected to the indicator contact-plate, substantially as described.

12. The combination, with the movable carriage of a type-writer, of an electric motor normally disengaged from the said carriage while the latter is being moved forward, a clutch mechanism operated by the electric motor to couple the said electric motor to the movable carriage, and a circuit-controller to govern the operation of the electric motor and clutch mechanism, and a second circuit-controller operated by the carriage to govern the circuit of the electric motor, substantially as described.

13. In a type-writer system of intercommunication, the combination, with a series of type-writers having movable carriages, of electromotor mechanisms normally disconnected from the said carriages and clutch mechanisms operated by the electric motors to couple the said motors to the carriages to return the carriages to their starting position, the said electromotor mechanisms being arranged in multiple arc, and a motor-controlling key or switch to control the operation of all the electric motors, substantially as described.

14. In a type-writing system of intercommunication, the combination of the following instrumentalities, viz: a plurality of type-writing instruments having their key-levers operatively connected to the armatures of electro-magnets, a circuit-controller governing the circuit of the electro-magnets of each instrument, a pole-changer on each instrument, a main-line circuit in which the pole-changer is located, and devices to actuate said pole-changer intermittently, to operate substantially as described.

15. In a type-writer system of intercommunication, the combination of the following instrumentalities, viz: a plurality of type-writers having their key-levers operatively connected to the armatures of electro-magnets, a pole-changer on each instrument, rendered effective by the operation of a key-lever, a main-line circuit in which the said pole-changer is located, a circuit-selecting device, including a series of contacts arranged in a circle and in circuit with the electro-magnets of the instrument, and a rotatable arm having a brush or pen to sweep the said contacts in succession, an electro-magnet in the main-line circuit to control the operation of the said selecting device, a circuit-controller for the circuit of the selecting device, and an electro-magnet in the main-line circuit, governing the operation of the circuit-controller, substantially as described.

16. In a type-writer system of communica-

tion, the combination of the following instrumentalities, viz: a plurality of type-writers having their key-levers operatively connected to the armatures of electro-magnets, a selecting-drum, an electromotor to move it, a pole-changer on each instrument and actuated by said drum, a main-line circuit in which the pole-changer is located, a circuit-selecting device containing a circularly-arranged series of contacts in circuit with the electro-magnets of the type-writing instrument, a selecting-arm co-operating with the said contacts, a polarized electro-magnet in the main line, governing the movement of the selecting-arm, a circuit-controller in circuit with the selecting-arm, and an electro-magnet in the main-line circuit to govern the operation around the said circuit-controller to maintain the circuit of the electromotor complete after the said circuit is opened at the circuit-controller, substantially as described.

17. In a type-writer system of communication, the combination, with a main-line circuit, a battery therein, a plurality of type-writers having their key-levers operatively connected to the armatures of the electro-magnets connected in circuit with the battery, circuit-controllers to govern the circuit of the electro-magnets, an indicator on the type-writer in circuit with the battery, a circuit-controller to govern the circuit of the indicator, a transforming-switch on each type-writer to control the battery-circuit, whereby a type-writer may be used as a transmitter or receiver, a call-bell on each type-writer in circuit with the battery, and a switch on the type-writers to control the circuit of the call-bell of each instrument, of an electromotor on each type-writer in circuit with the battery, and connecting devices to return the movable carriage of the said type-writer back to its normal position, and a motor-controlling switch on the type-writer to control the circuit of the motor, substantially as described.

18. In a type-writer system of communication, the combination, with a main-line circuit, a battery therein, a plurality of type-writers having their key-levers operatively connected to the armatures of the electro-magnets connected in circuit with the battery, circuit-controllers to govern the circuit of the electro-magnets, an indicator on the type-writer in circuit with the battery, a circuit-controller to govern the circuit of the indicator, a transforming-switch on each type-writer to control the battery-circuit, whereby a type-writer may be used as a transmitter or receiver, a call-bell on each type-writer in circuit with the battery, and a switch on the type-writers to control the circuit of the call-bell of each instrument, of an electric motor on each type-writer in circuit with the battery to return the movable carriage of the said type-writer back to its normal position, a circuit-breaker for the motor-circuit, automatically operated on the backward movement of the said carriage, and a motor-controlling switch on the

type-writer to control the circuit of the motor, substantially as described.

19. In a type-writer system of intercommunication, two stations or offices, a main line connecting them, a battery in each station in circuit with the line-wire, a pole-changer in each station in circuit with the battery, type-writers having their key-levers operatively connected to the armatures of electro-magnets, a circuit-selecting device in each station, to which the electro-magnets are connected, a selecting-drum in each station to operate a pole-changer in said station, a circuit-controller in each station, also operated through the pole-changer, circuit-controllers on each type-writer to control the circuit of the electro-magnets, and character keys or levers to arrest the said selecting devices and pole-changer, to operate substantially as described.

20. In a type-writer system of intercommunication, two stations or offices, a main line connecting them, a battery in each station in circuit with the line-wire, a pole-changer in each station in circuit with the battery, type-writers having their key-levers operatively connected to the armatures of electro-magnets, a segmental circuit-controller in each station, to which the electro-magnets are connected, a selecting-drum in each station to operate a pole-changer in said station, a circuit-controller in each station, operated through the pole-changer, an auxiliary magnet on each machine for capitals or figures, and an unlocking-magnet to break the circuit of the capital or figure magnet, substantially as described.

21. In a type-writer system of intercommunication, two stations or offices, a main line connecting them, a battery in each station in circuit with the line-wire, a pole-changer in each station in circuit with the battery, type-writers having their key-levers operatively connected to the armatures of electro-magnets, a circuit-selecting device in each station, to which the electro-magnets are connected, a selecting-drum in each station to operate the pole-changer in said station, a circuit-controller in each station, also operated through the pole-changer, an auxiliary magnet on each machine for capitals or figures, an unlocking-magnet to break the circuit of the capital or figure magnet, circuit-controllers on each type-writer to control the circuit of the electro-magnets, an electromotor to actuate said selecting-drum in each station, and type-lever keys to stop said selecting-drum, substantially as described.

22. In a type-writer system of intercommunication, the combination, with a plurality of electro-mechanically-operated type-writers provided with a plurality of electro-magnets, each electro-magnet of one instrument being connected in circuit with the corresponding electro-magnet of another instrument, of a combination or individualizing switch for each instrument, said switch consisting of a

series of general contacts to which the electro-magnets are normally connected, and a series of specially-arranged contacts with which the said electro-magnets may be connected, whereby special communication may be had between two or more instruments having their electro-magnets connected to the special contacts and at the same time general communication be had between other instruments on the circuit having their electro-magnets connected to the general contacts, substantially as described.

23. The combination, with a type-writer having its key-levers operatively connected to the armatures of electro-magnets, of circuit-controllers for said electro-magnets adapted to be operated by the said key-levers, a circuit-controller actuator moved independently of said key-levers, and a locking device for said armatures, substantially as described.

24. In a type-writer system of intercommunication, two stations, a main line connecting them, a battery in each station in circuit with the line-wire, a pole-changer in each station in circuit with the battery, type-writing instruments having their type-carriers operatively connected to the armatures of electro-magnets, a circuit-selecting device in each station and to which the said electro-magnets are connected, a selecting device in each station to operate a pole-changer in said station, a circuit-controller in each station, operated through the pole-changer, a step-by-step movement on each type-writing instrument, and means to engage the said movement, to operate substantially as described.

25. In a type-writer system of intercommunication, the combination of the following instrumentalities, viz: a plurality of type-writers, each provided with a type-carrier having a plurality of characters, a plurality of electro-magnets in each instrument, one for each character, on the type-carrier of the said instrument, the said electro-magnets having their armatures operatively connected to the type-carrier of the said instrument, a circuit-selecting device for each instrument, consisting of a series of independent contacts or terminals, to which the electro-magnets of the said instrument are connected, a pole-changer on each instrument, a main-line circuit in which the pole-changer is located, devices to intermittently move the said pole-changer, and a circuit-controller governed by the operation of the pole-changer to control the circuit of the electro-magnets through the selecting device, substantially as described.

26. The combination, with a circuit-controlling device consisting of a series of independent contacts or terminals and a selecting-arm co-operating therewith, of a series of electro-magnets connected to the said contacts or terminals, there being an independent magnet connected to each contact or terminal, a circuit-closer co-operating with the armature of one of the said magnets, and an auxiliary magnet connected to one of the contacts or

terminals and controlled by the selecting-arm to open the circuit closed by the attraction of the said armature, substantially as described.

27. A combination-switch consisting of a plurality of pens or brushes, a series of general and special contacts or buttons, means to change the relative positions of the said brushes or buttons, a series of type-writers having electro-magnets to determine the selection of the different letters, and a series of branch wires f^{30} to connect the different contacts of buttons or the general and special series of contacts or buttons with the wires connecting the magnets of the different type-writers in different stations, substantially as described.

28. A type-writer system of intercommunication, including a series of type keys or levers at one station, a series of magnets, one for each type or key lever, a series of type keys or levers at another station, a series of magnets at said other station, having their armatures operatively connected with the type keys or levers at said station, a circuit between the magnets of the type-writers at the different stations, means to produce a polarized current, a selecting-drum located at one station, a circuit-selecting device at another station and under the influence of said polarized current, said selecting device comprising a series of separate contacts in circuit with the type key or lever magnets at its own station, and a movable brush or pen, and a magnet for said selecting device, the selecting device being adapted to co-operate with said contacts one after another under the influence of said polarized current, substantially as and for the purpose set forth.

29. A type-writer system of intercommunication, including a series of type keys or levers at one station, a series of magnets, one for each type key or lever, a series of type keys or levers at another station, a series of magnets at said other station, having their armatures operatively connected with the type keys or levers at said station, a metallic circuit between the magnets of the type-writers at the different stations, means to produce a polarized current, a selecting-drum located at one station, a circuit-selecting device at another station and under the influence of said polarized current, said selecting device comprising a circularly-arranged series of separate contacts in circuit with the type key or lever magnets at its own station, and a rotatable brush or pen, a magnet for said selecting device, the selecting device being made to travel over the said contacts step by step under the influence of said polarized current, and a combination-switch, including pens and general and special contacts and special wires f^{30} , leading from special contacts and in circuit with the magnets of a type-writer, to operate substantially as described.

30. A line-wire and a series of branch wires combined with a combination-switch com-

posed of a series of pens or brushes, a series of general contacts or brushes, and one or more series of special contacts or brushes, the latter being connected by the branch wires to the line-wire, to operate substantially as described.

31. The combination, with a mechanical type-writer provided with a plurality of key-levers, of a plurality of electro-magnets having their armatures connected to said key-levers, a plurality of circuit-controllers independent of the key-levers and adapted to be operated by the said key-levers when the said type-writer is used as a transmitter, and an actuating device to move the said circuit-controllers out of the path of movement of the said key-levers to permit the said type-writer to be used as a receiver, substantially as described.

32. In a type-writer system of communication, the combination of the following instrumentalities, viz: a plurality of type-writing instruments provided with rack-bars, a plurality of electric motors to move said carriages in one direction and normally disconnected from the rack-bars of the carriages, clutch mechanisms actuated by the motors to couple the said motors to the rack-bars, and a circuit-controller to govern the operation of the electric motors and thereby control the movement of all the carriages in one direction, substantially as described.

33. In a type-writer system of communication, the combination of the following instrumentalities, viz: a type-carrier provided with a plurality of characters and having a horizontal and vertical movement, a series of electro-magnets to effect the horizontal movement of the said type-carrier and a lifting electro-magnet to effect the vertical movement of the said type-carrier, a series of circuit terminals or contacts to which said electro-magnets are connected, a selecting-arm co-operating with the said circuit-terminals, a circuit-closer co-operating with the armature of the said lifting-magnet to maintain closed the circuit of the said magnet, as described, and an auxiliary magnet to open the circuit of the lifting-magnet, substantially as described.

34. The carriage of a type-writer provided with a rack-bar, a shaft c^{12} , having a gear in operative connection with the said rack-bar, a toothed disk fast on the said shaft, a gear c^{14} , loose on said shaft, and a disk loose on said shaft and provided with one or more pins or rods extended through the gear c^{14} and adapted to engage the teeth on the fast disk, combined with a motor mechanism provided with a gear or pinion in mesh with the gear c^{14} , and devices to engage the said pins with the teeth of the disk fast on the shaft when rotated in one direction and to disengage said pins when rotated in the opposite direction, substantially as described.

35. The combination, with a shaft c^{12} , having a toothed disk fast thereon, of a gear loose

on said shaft, a disk loose on said shaft and provided with one or more pins or rods extended through the loose gear and adapted to engage the teeth on the fast disk, a motor mechanism provided with a gear or pinion in mesh with the loose gear, and devices to engage the said pin or pins with the teeth of the disk fast on the shaft when rotated in one direction and to disengage said pin or pins when rotated in the opposite direction, substantially as described.

36. In a type-writer, the combination of the following instrumentalities, viz: a feed-roll, a ratchet attached thereto, a pawl in engagement with said ratchet, a plate provided with a guiding groove or passage, a switch-cam normally closing said passage, and intermediate devices in engagement with the said pawl and adapted on the forward movement of the type-writer carriage to enter the guiding-groove and pass under the switch-cam and on the backward movement of the said carriage to pass over or above the said switch-cam to operate the pawl, substantially as described.

37. In a type-writer system of communication, the combination, with a type-carrier provided with a plurality of characters arranged in rows one above the other, of character-levers operatively connected to the type-carrier, electro-magnets having their armatures connected to the said character-levers to actuate them, one or more of said electro-magnets when energized acting to lift the type-carrier, as described, a circuit selecting device consisting of a series of circuit-terminals or contacts, to which the said character-lever-operating electro-magnets are connected, and a selecting-arm co-operating with said terminals, means to move said selecting-arm, a circuit-closer co-operating with the armature of the said lifting electro-magnet to maintain closed the circuit of the said magnet, and an auxiliary magnet, also connected to one of the circuit-terminals and operating to open the circuit closed by the armature of the lifting-magnet to permit the character-carrier to be

restored to its normal position, substantially as described.

38. In a type-writer system of communication, the combination, with a type-writer provided with a type-carrier having a plurality of characters, of a carriage, a motor mechanism to move it in one direction, and an electric motor to move it in the other direction, independent electro-magnets to operate said type-carrier, a circuit-selecting device consisting of a series of circuit terminals or contacts, to which the said electro-magnets are connected and to one of which the said electric motor is connected, a selecting-arm co-operating with said circuit-terminals, a circuit-controller connected to said selecting-arm to govern the circuit through said arm, a shunt-circuit for said circuit-controller, and an electro-magnet in circuit with the terminal connected to the electric motor and controlling the shunt-circuit for the circuit-controller, whereby the circuit of the electric motor may be maintained closed after the said circuit is opened at the circuit-controller for the selecting-arm, substantially as described.

39. In a type-writer system of communication, the combination of the following instrumentalities, viz: a type-writer provided with the usual key-levers, electro-magnets to move said key-levers electromechanically, circuit-controllers co-operating with the key-levers and consisting of fixed and movable members, a device to act on the said movable members, a transforming-switch to control the operation of the said electro-magnets, and gearing to connect the transforming-switch to the device actuating the movable members of the circuit-controllers, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

ALBERT D. NEAL.
HOWARD F. EATON.

Witnesses:

GEO. W. GREGORY,
A. S. WIEGAND.