No. 812,542. PATENTED FEB. 13, 1906.

E. V. BEALS.

ATTACHMENT FOR KEYBOARD MACHINES.

APPLICATION FILED SEPT. 25, 1901. 14 SHEETS—SHEET 1.

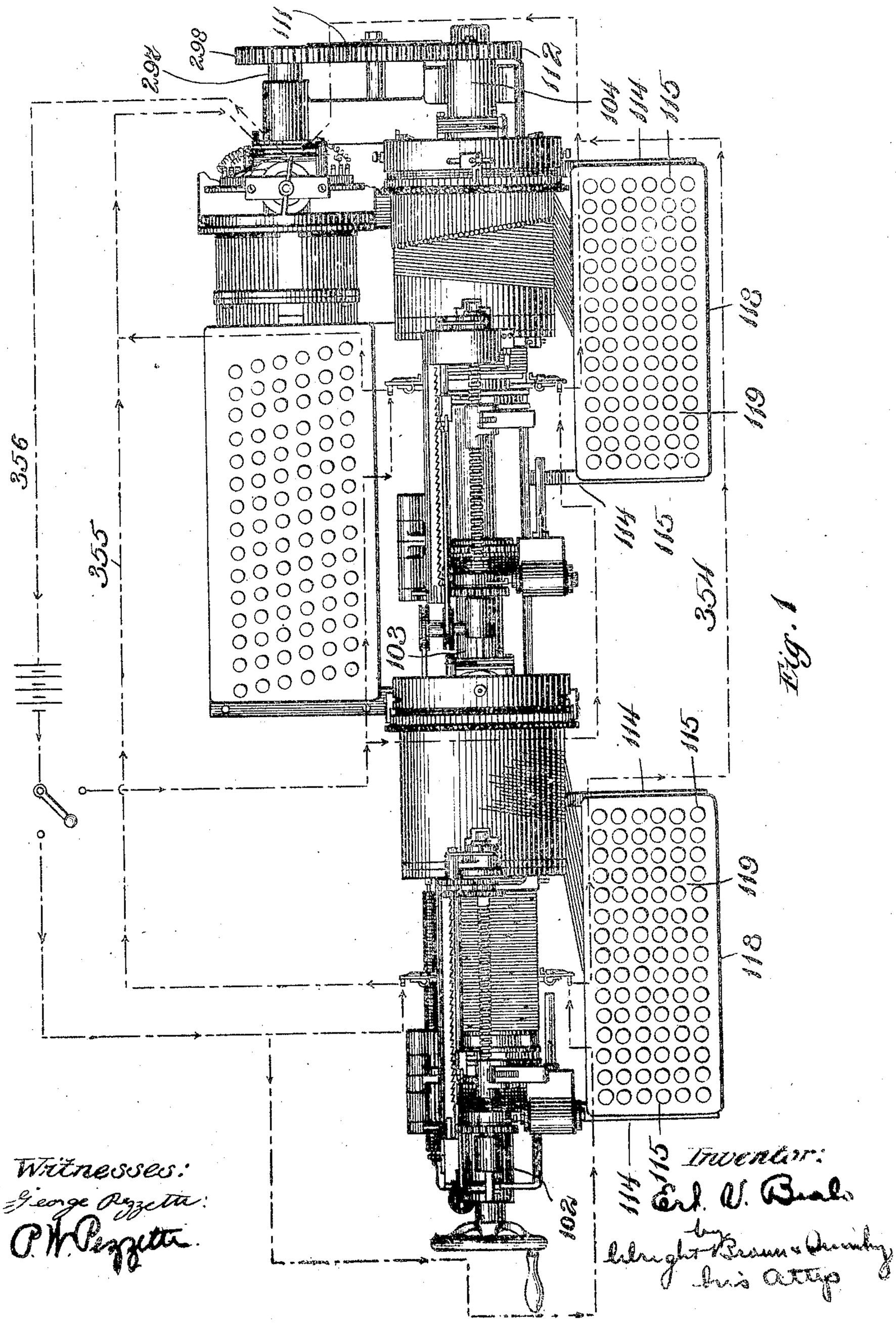

Fig. 1.

Witnesses:
George Ozzetta.
P. W. Pezzetta.

Inventor:
Earl V. Beals
by Albright Brown & Mundy
his Attys

No. 812,542. PATENTED FEB. 13. 1906.

E. V. BEALS.

ATTACHMENT FOR KEYBOARD MACHINES.

APPLICATION FILED SEPT. 25, 1901.

14 SHEETS—SHEET 2.

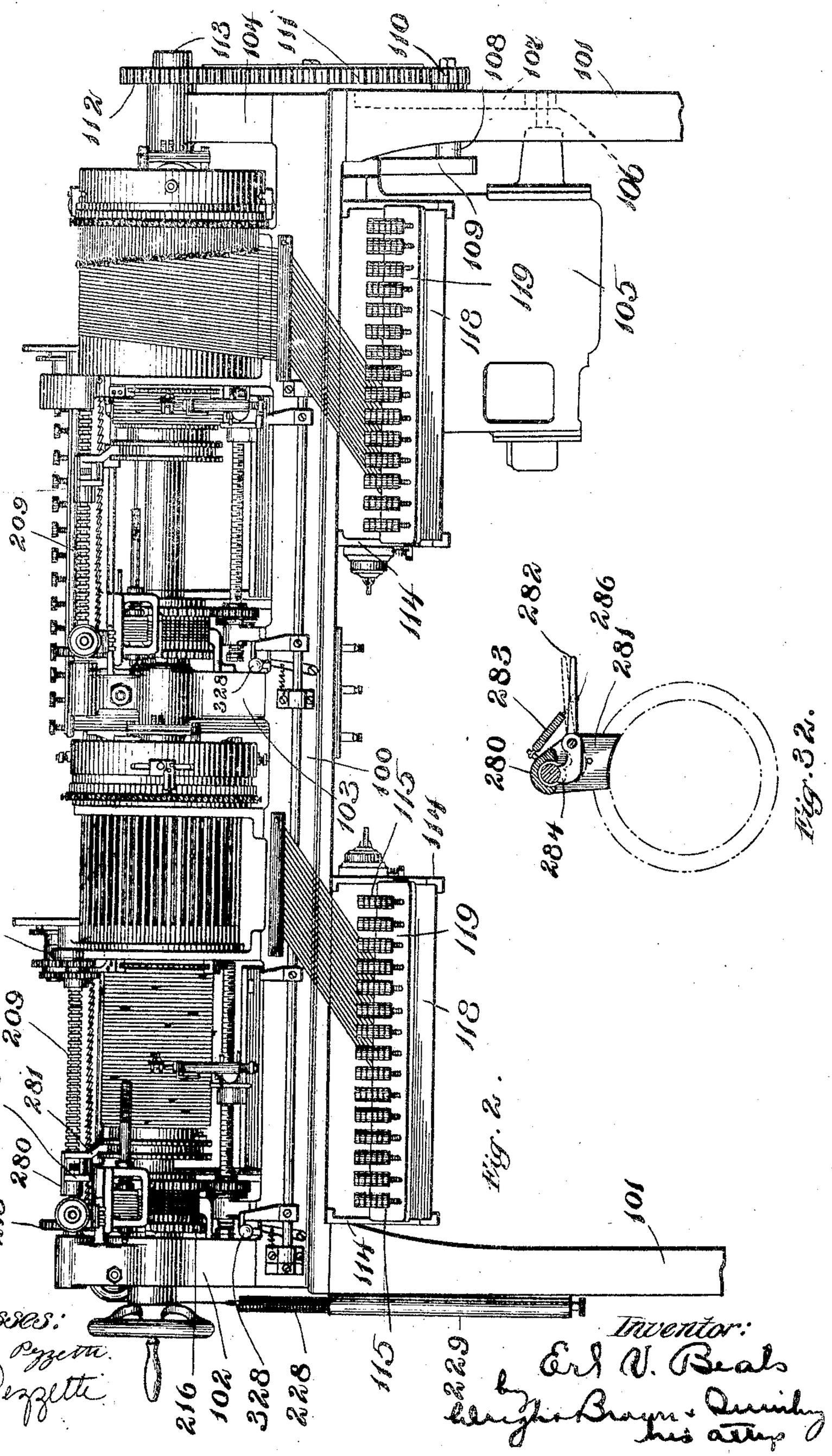

Fig. 2.

Fig. 32.

Witnesses:
George Pezzetti.
P. W. Pezzetti

Inventor:
Earl V. Beals
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No. 812,542. PATENTED FEB. 13, 1906.

E. V. BEALS.

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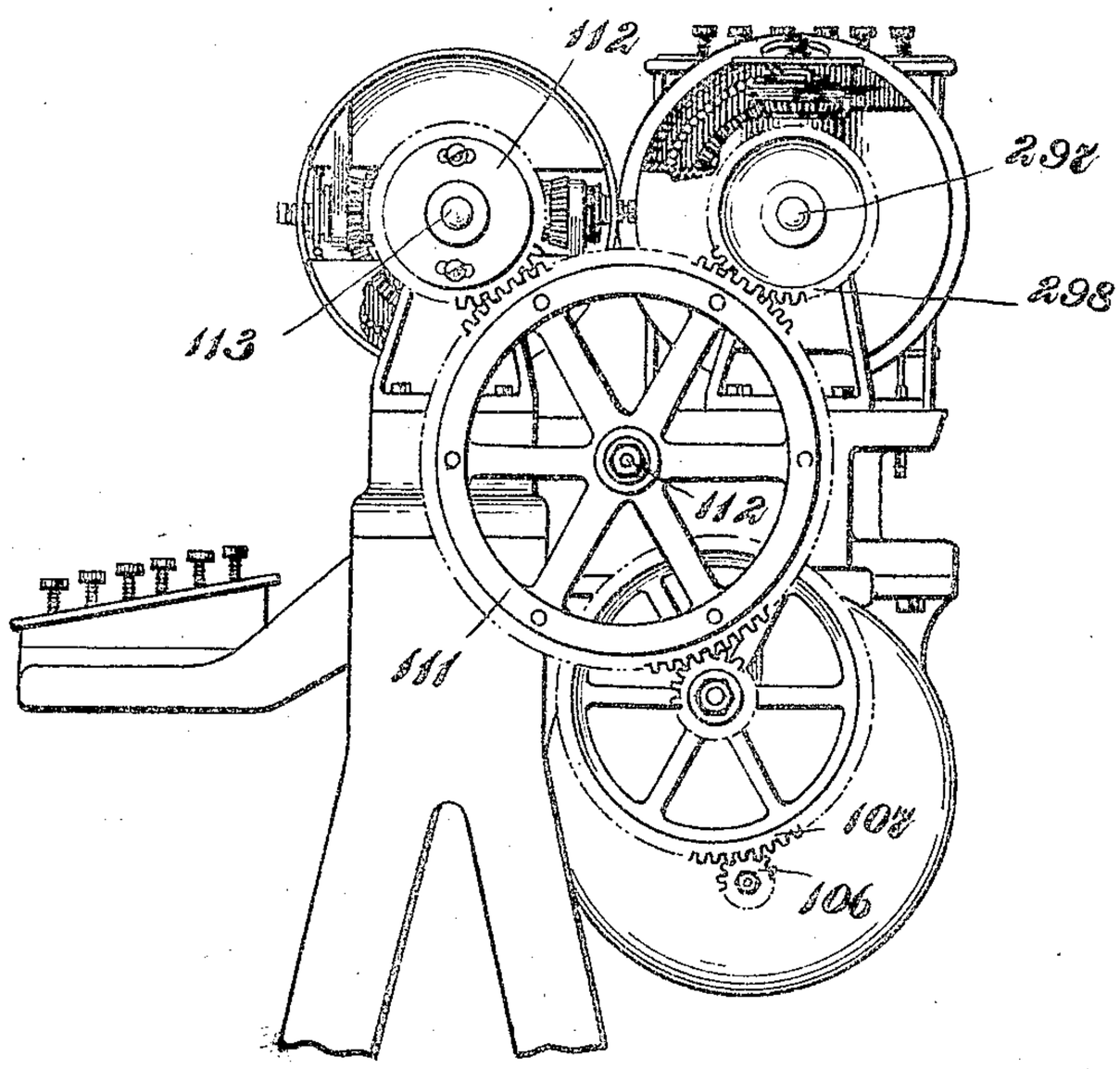
APPLICATION FILED SEPT. 25, 1901.

14 SHEETS—SHEET 3.



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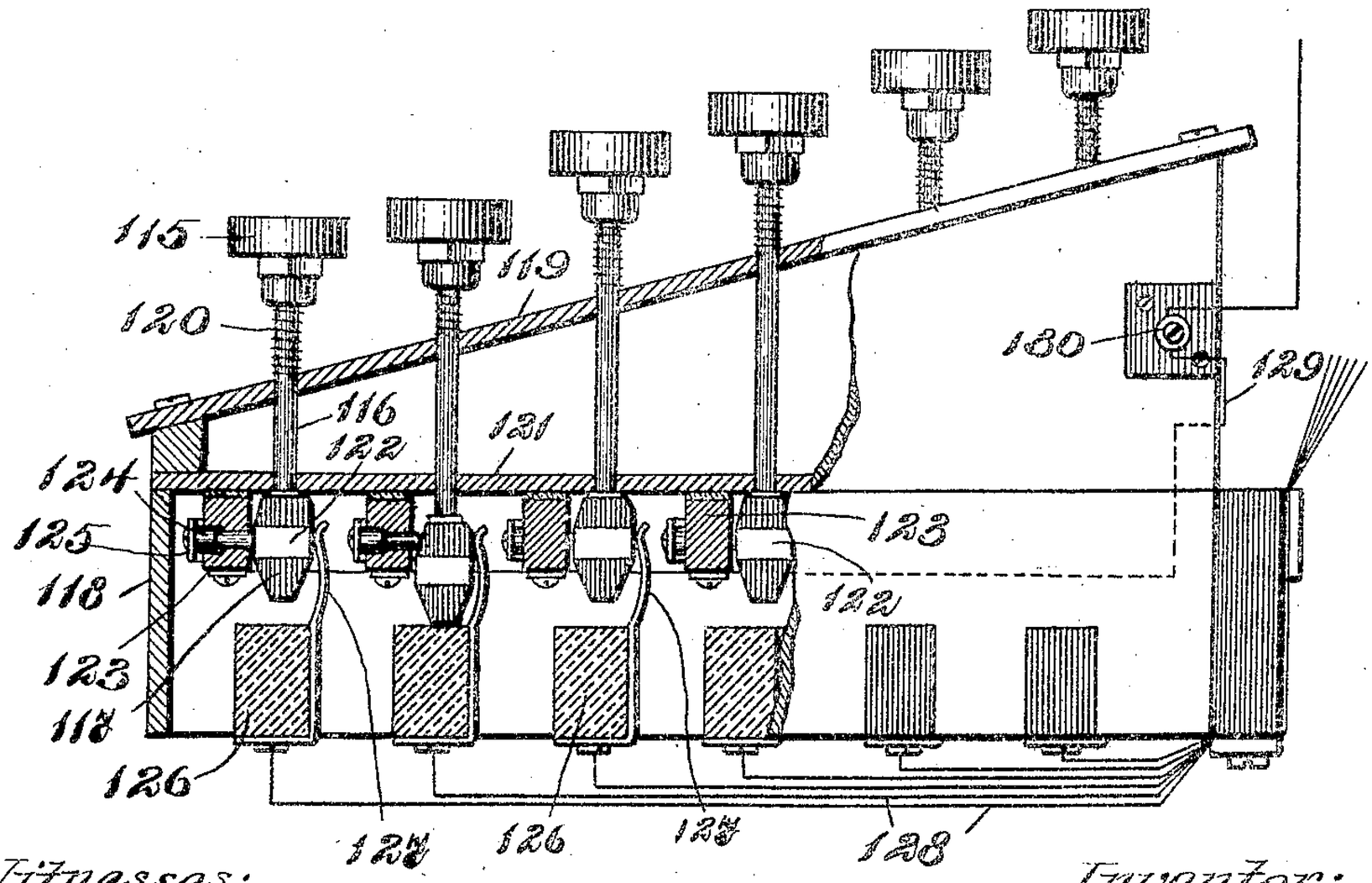


Fig. 4.

Witnesses:
George Pezzetti.
P. W. Pezzetti.

Inventor:
Earl V. Beals
by Albright Brown & Quinby
his Attys

No. 812,542. PATENTED FEB. 13, 1906.

E. V. BEALS.

ATTACHMENT FOR KEYBOARD MACHINES.

APPLICATION FILED SEPT. 25, 1901.

14 SHEETS—SHEET 4.

Fig. 5.

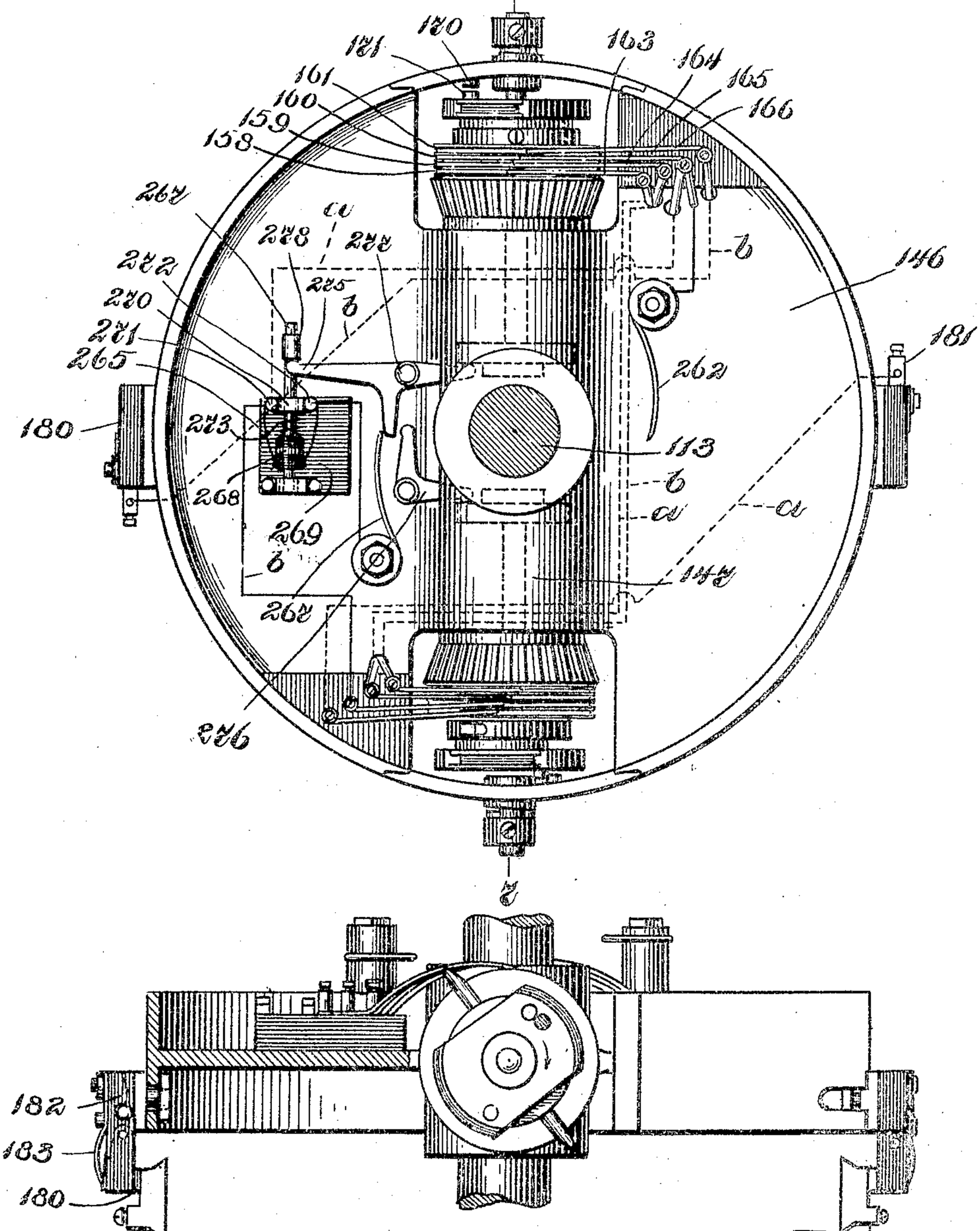


Fig. 6

Witnesses:

George Pezzetti.

P. W. Pezzetti

Inventor:

Edward V. Beals

by Wright Brown & Quinby

his attys.

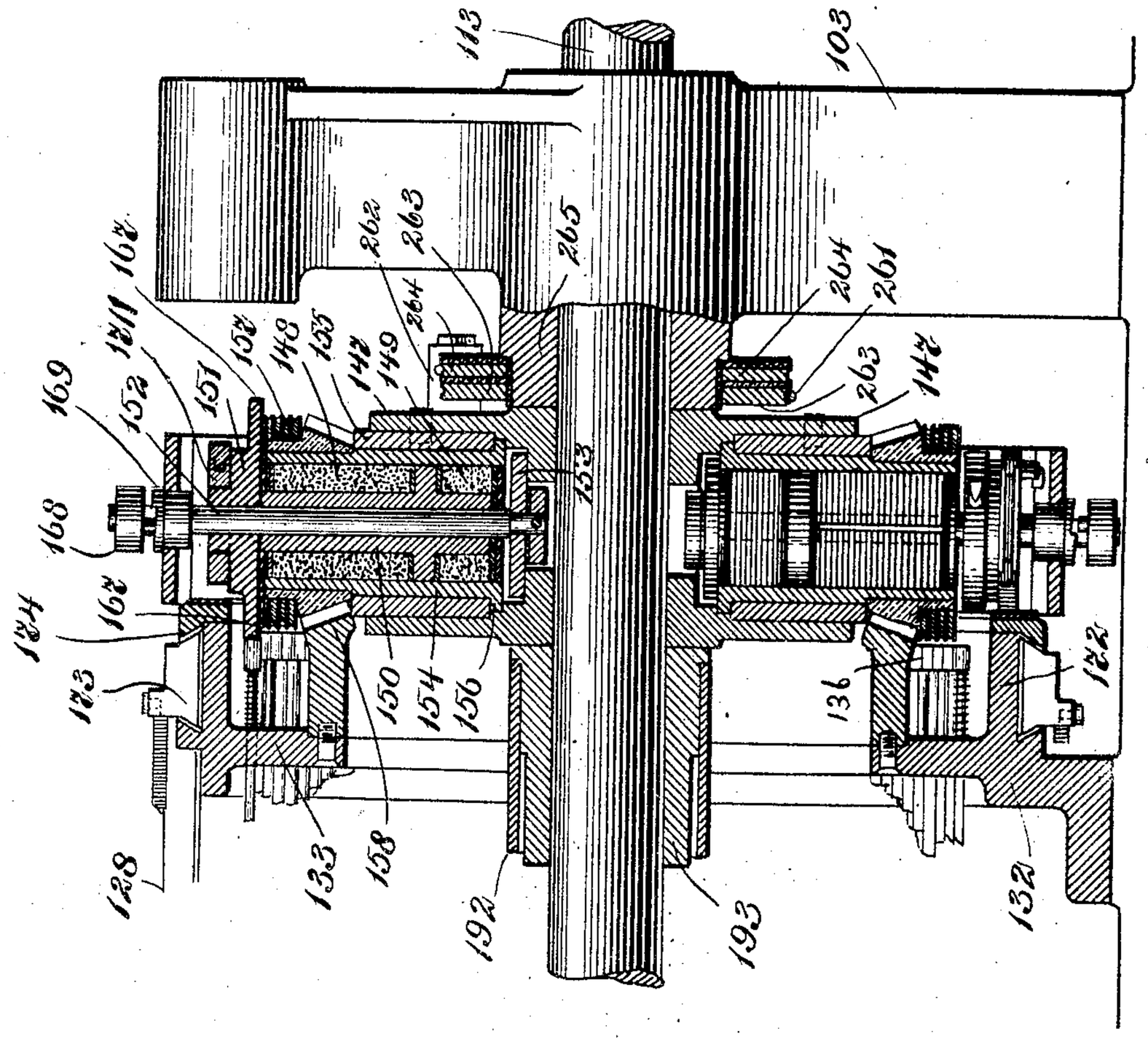
No. 812,542. PATENTED FEB. 13, 1906.

E. V. BEALS.

ATTACHMENT FOR KEYBOARD MACHINES.

APPLICATION FILED SEPT. 25, 1901.

14 SHEETS—SHEET 5.



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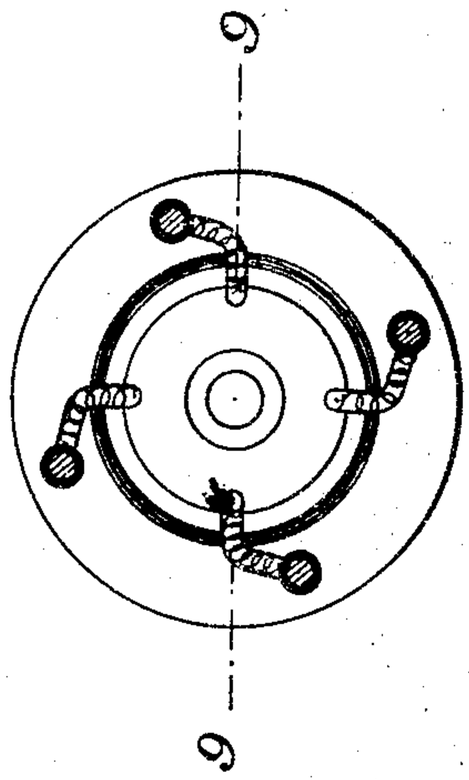

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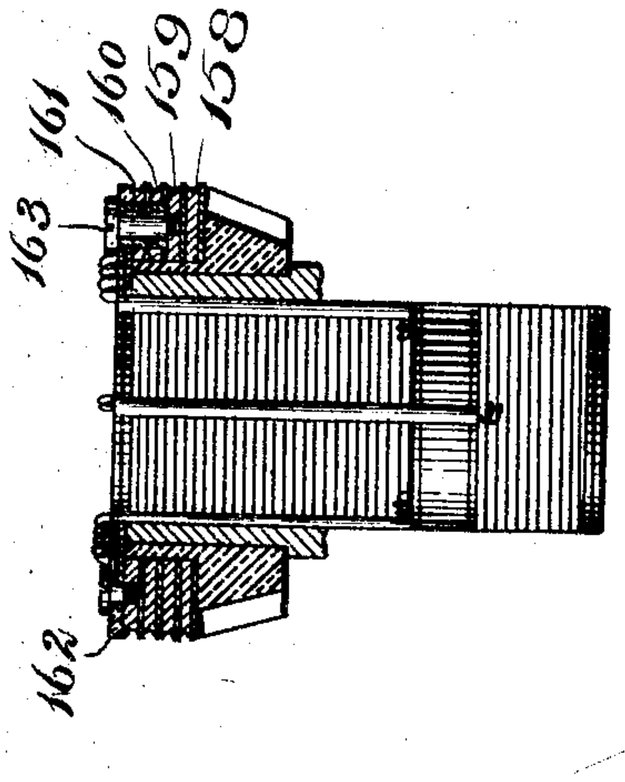

Fig. 9

Witnesses:
George Pezzetti
P. W. Pezzetti

Inventor:
Ed. V. Beals
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his Attys

No. 812,542. PATENTED FEB. 13, 1906.

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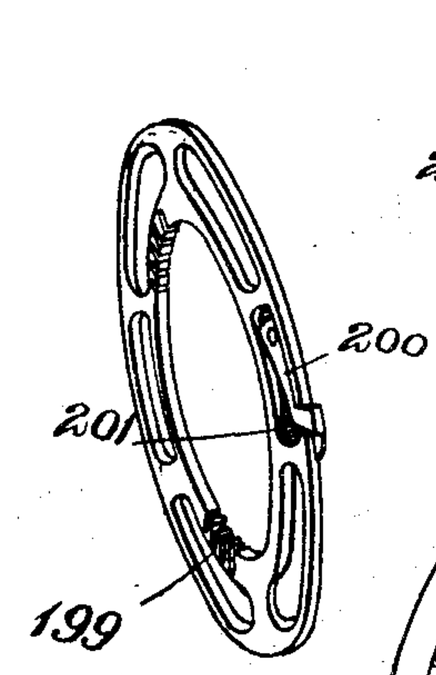
APPLICATION FILED SEPT. 25, 1901.

14 SHEETS—SHEET 6.



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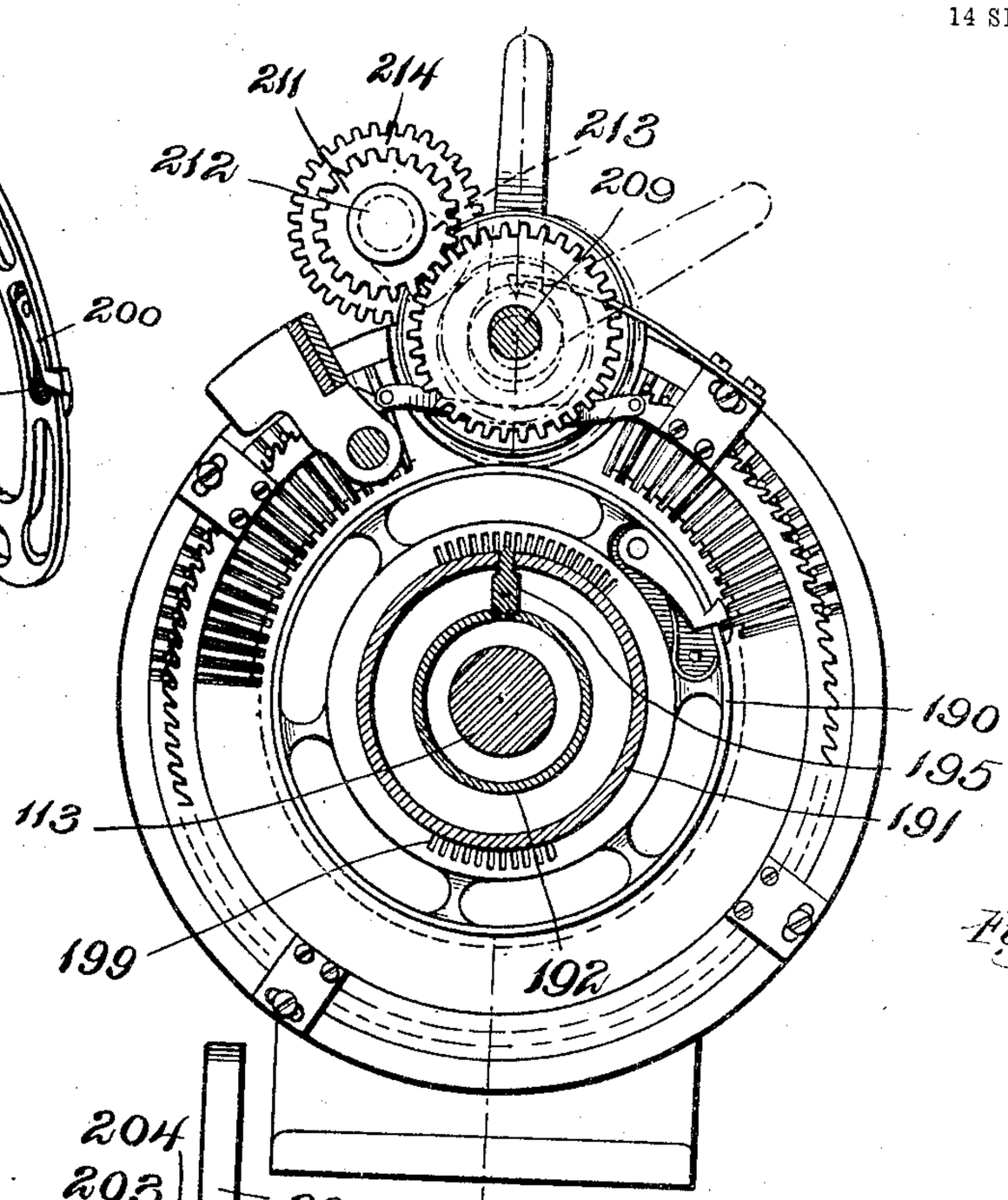

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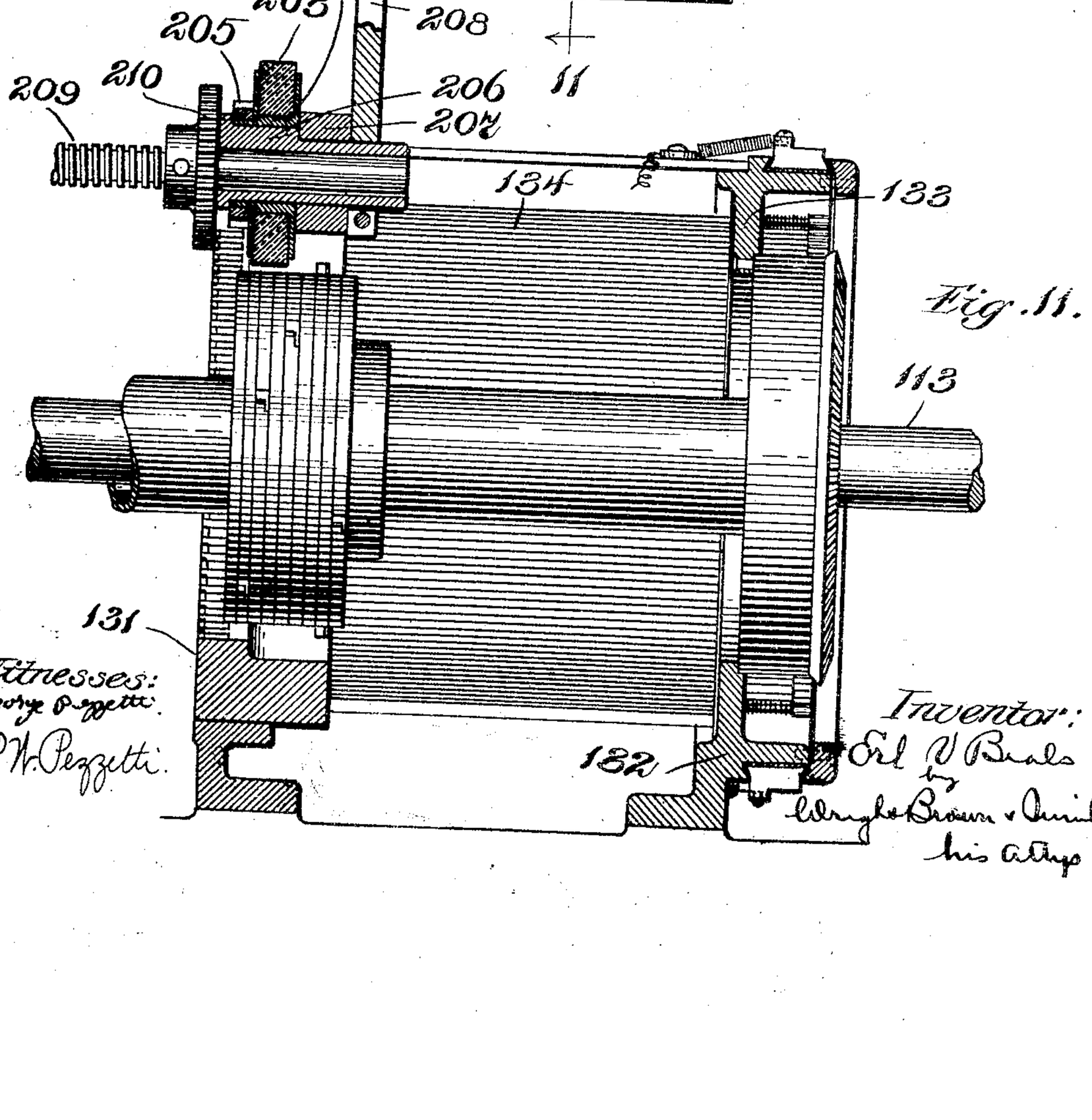

Fig. 11.

Witnesses:
George Pezzetti.
P. W. Pezzetti.

Inventor:
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by
Wright Brown & Quinby
his Attys

No. 812,542. PATENTED FEB. 13, 1906.

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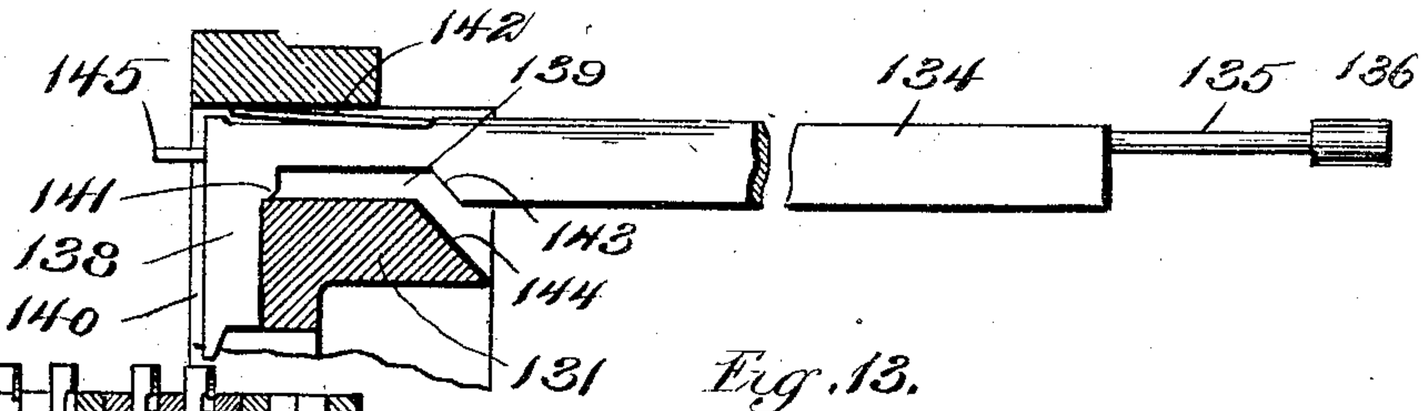
14 SHEETS—SHEET 7.



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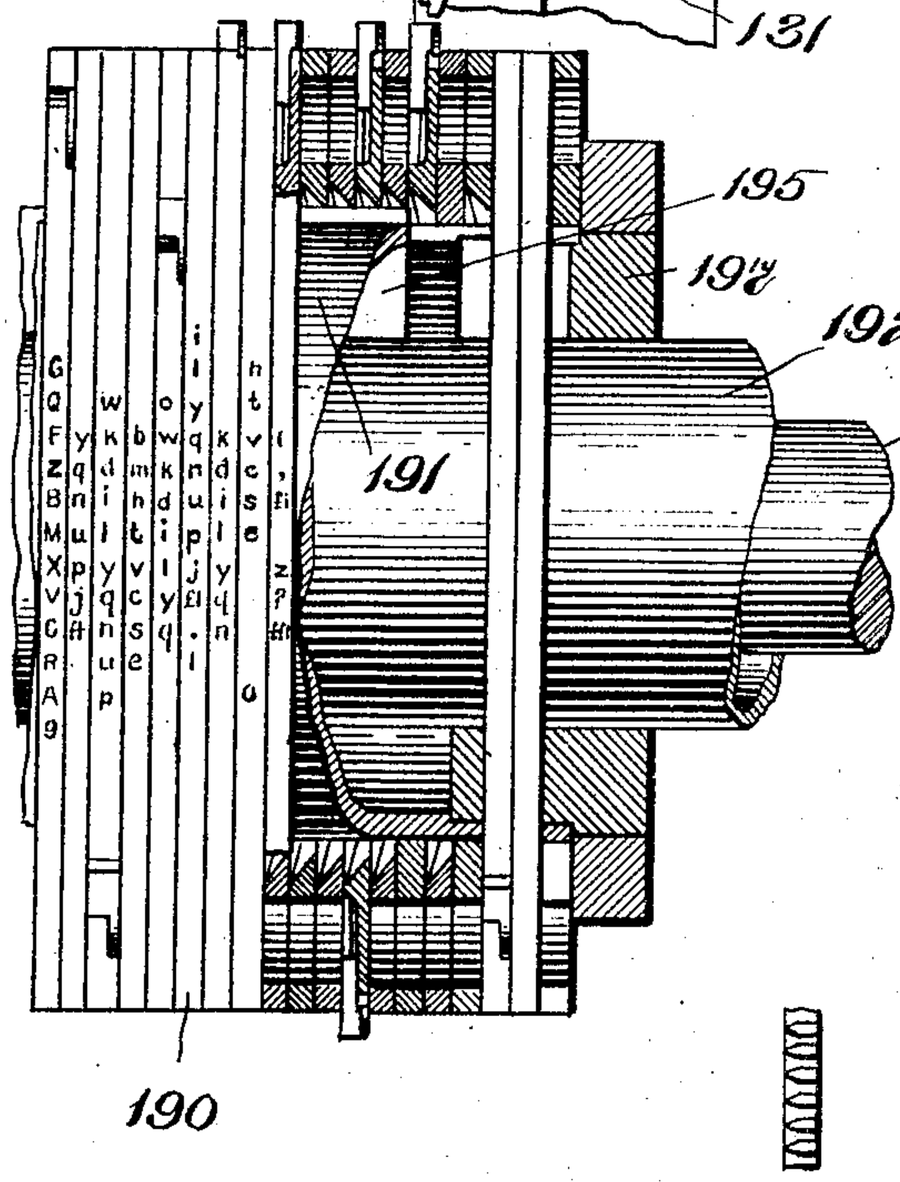

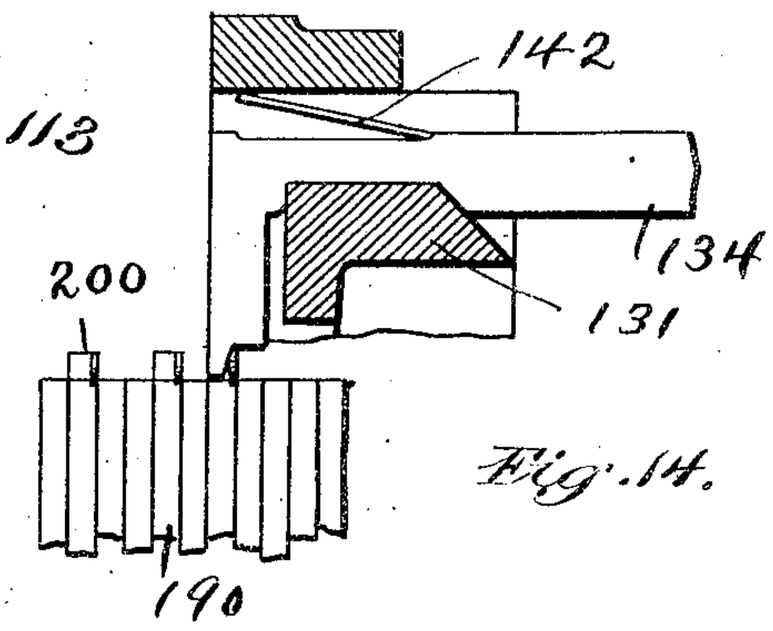

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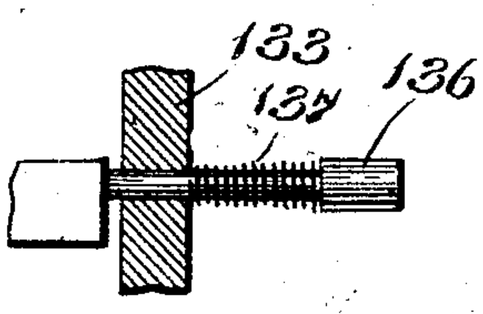

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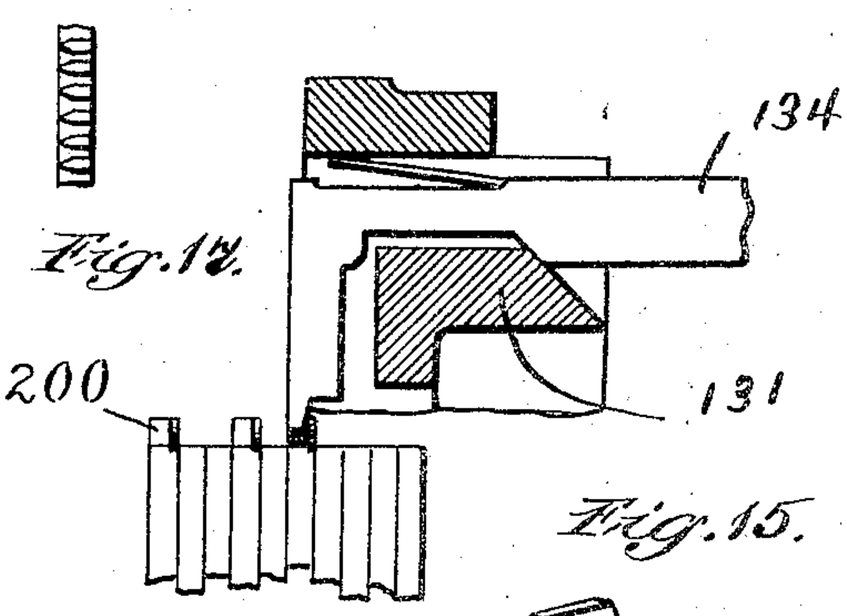

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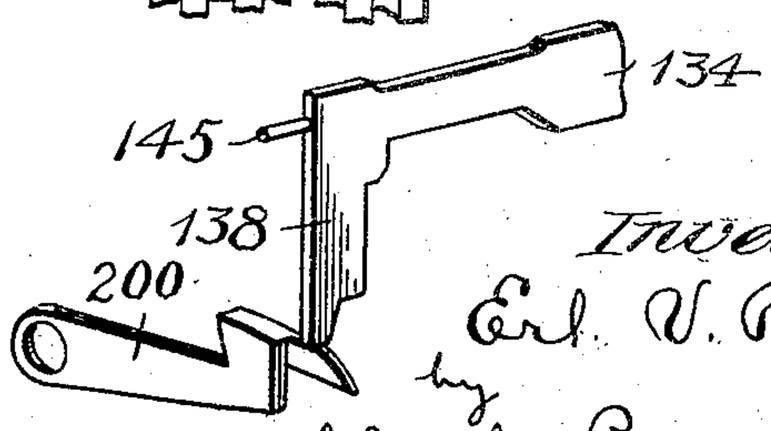

Fig. 16.

Witnesses:
George Pezzetti
P. N. Pezzetti.

Inventor:
Earl V. Beals
by
Wright Brown & Quinby
his attys

No. 812,542. PATENTED FEB. 13, 1906.

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APPLICATION FILED SEPT. 25, 1901.

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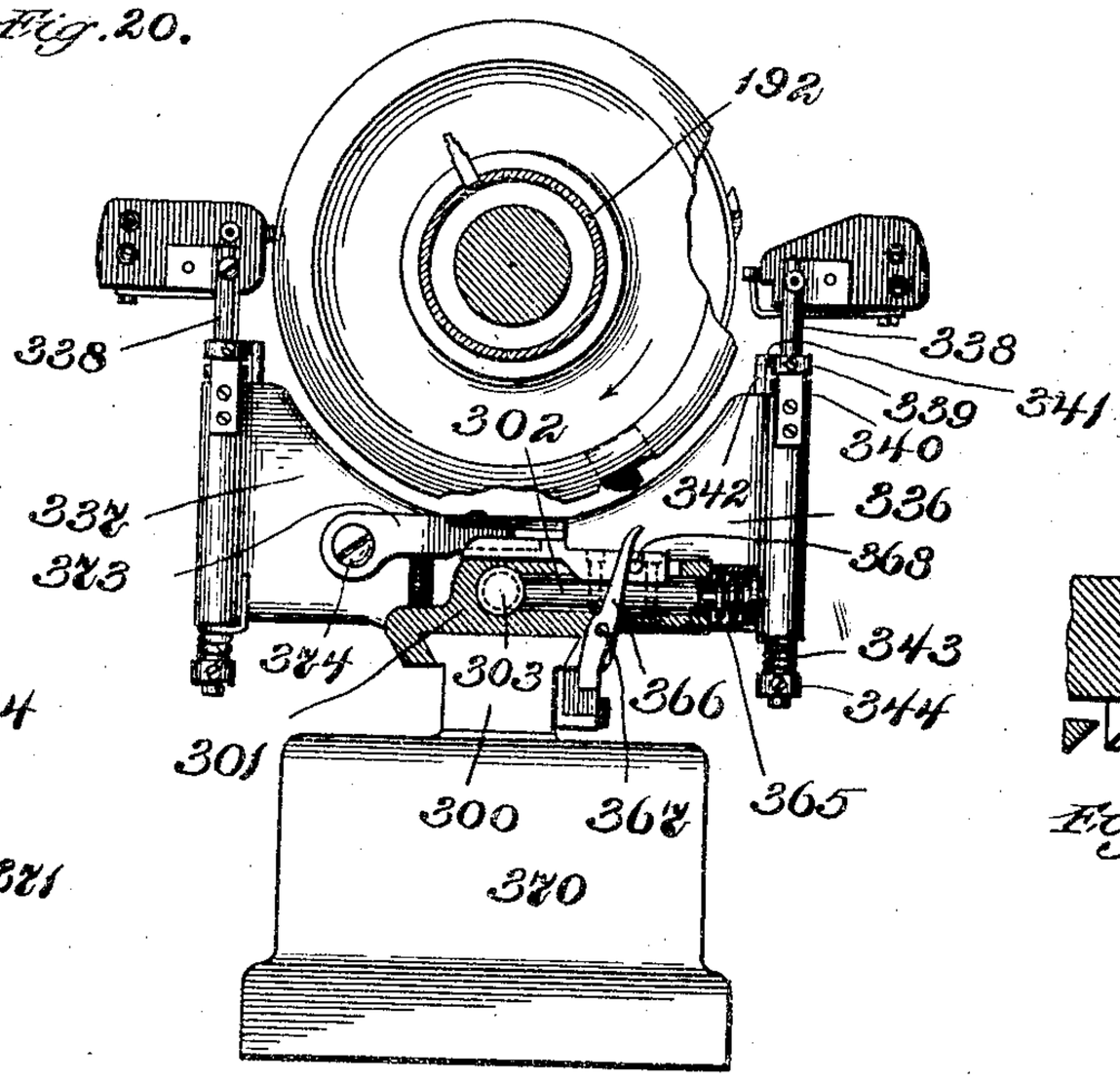
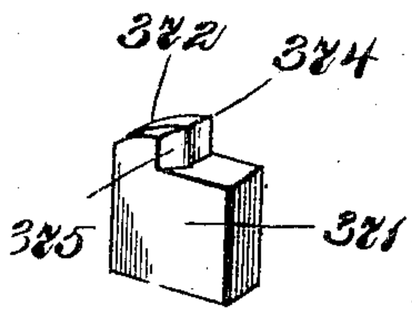
Fig. 20.





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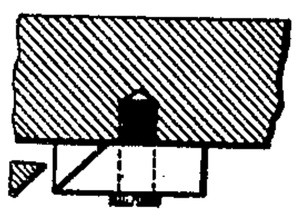

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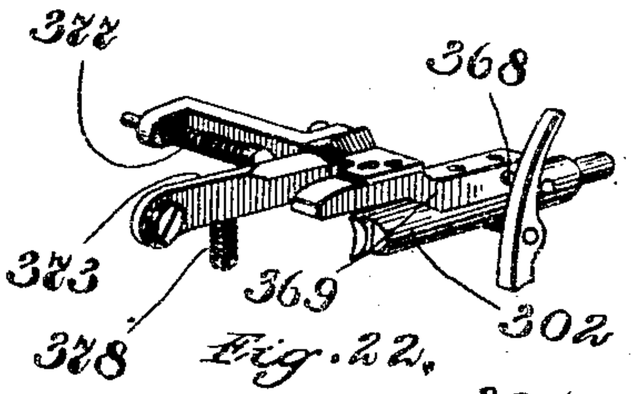

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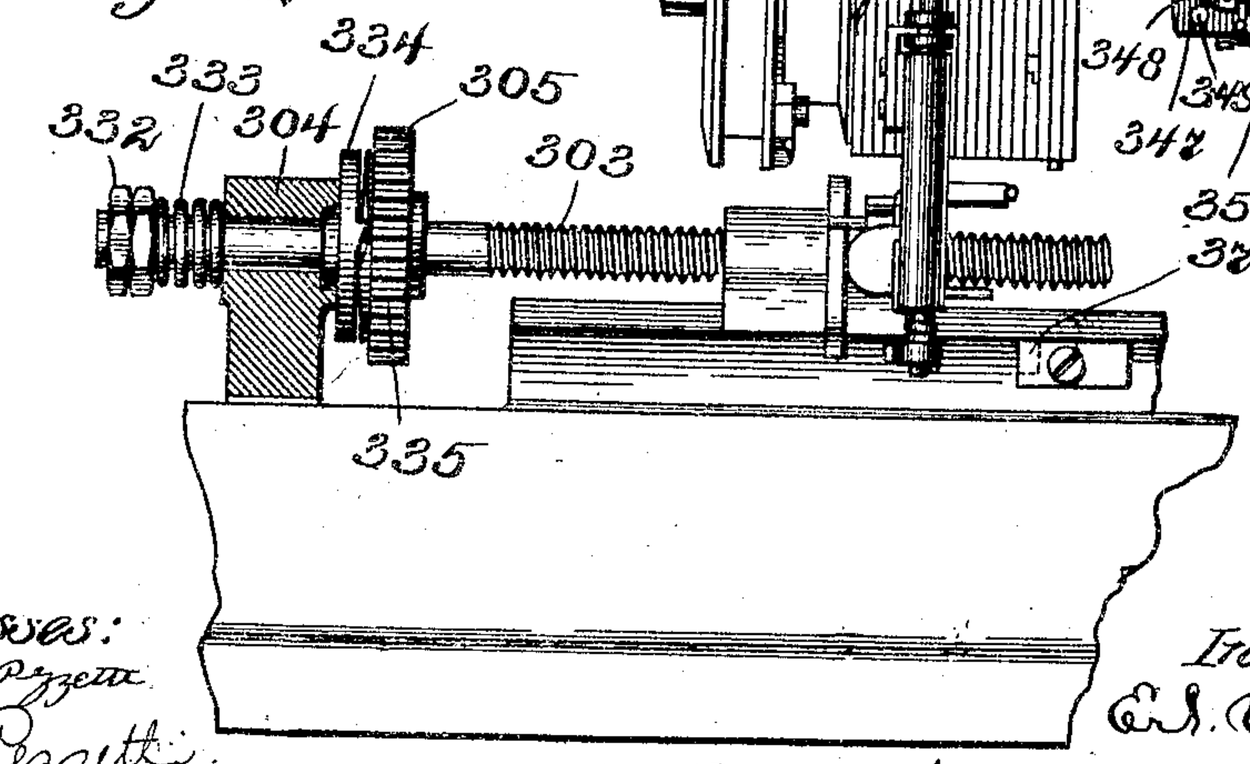

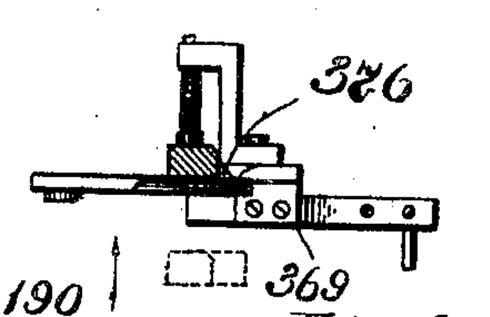

Fig. 23.

Fig. 21.

Fig. 19.

Witnesses:
George Rezzetti
P. W. Rezzetti.

Inventor:
E. V. Beals
by Albright Brown & Dunby
his attys

No. 812,542. PATENTED FEB. 13, 1906

E. V. BEALS.

ATTACHMENT FOR KEYBOARD MACHINES.

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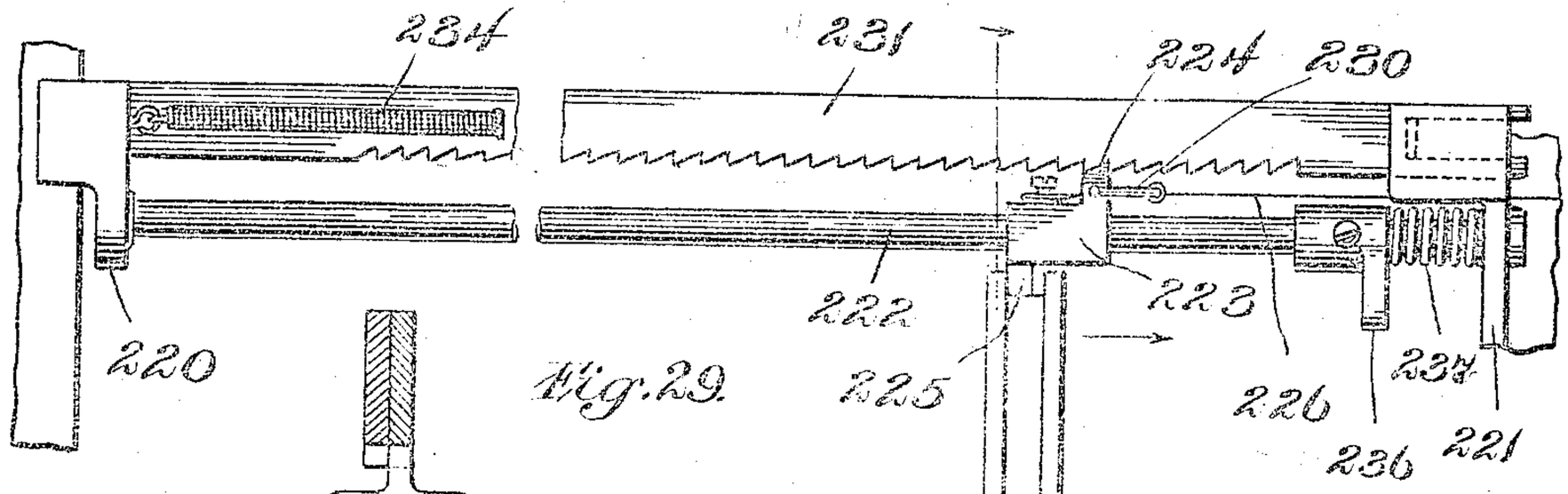

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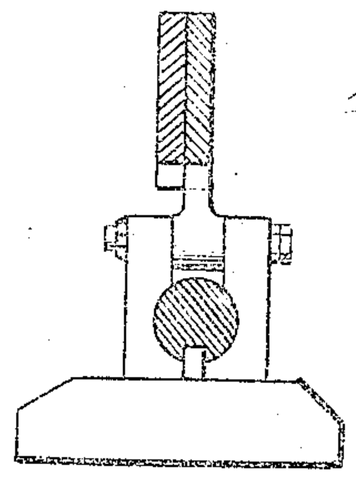

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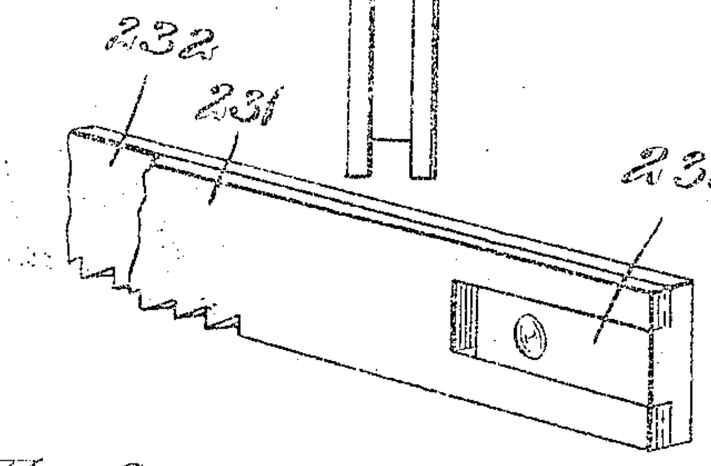
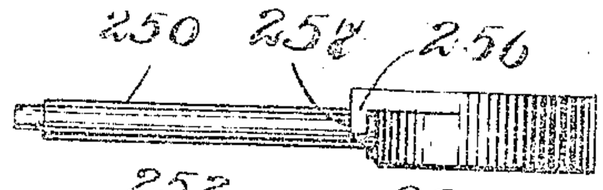


Fig. 31



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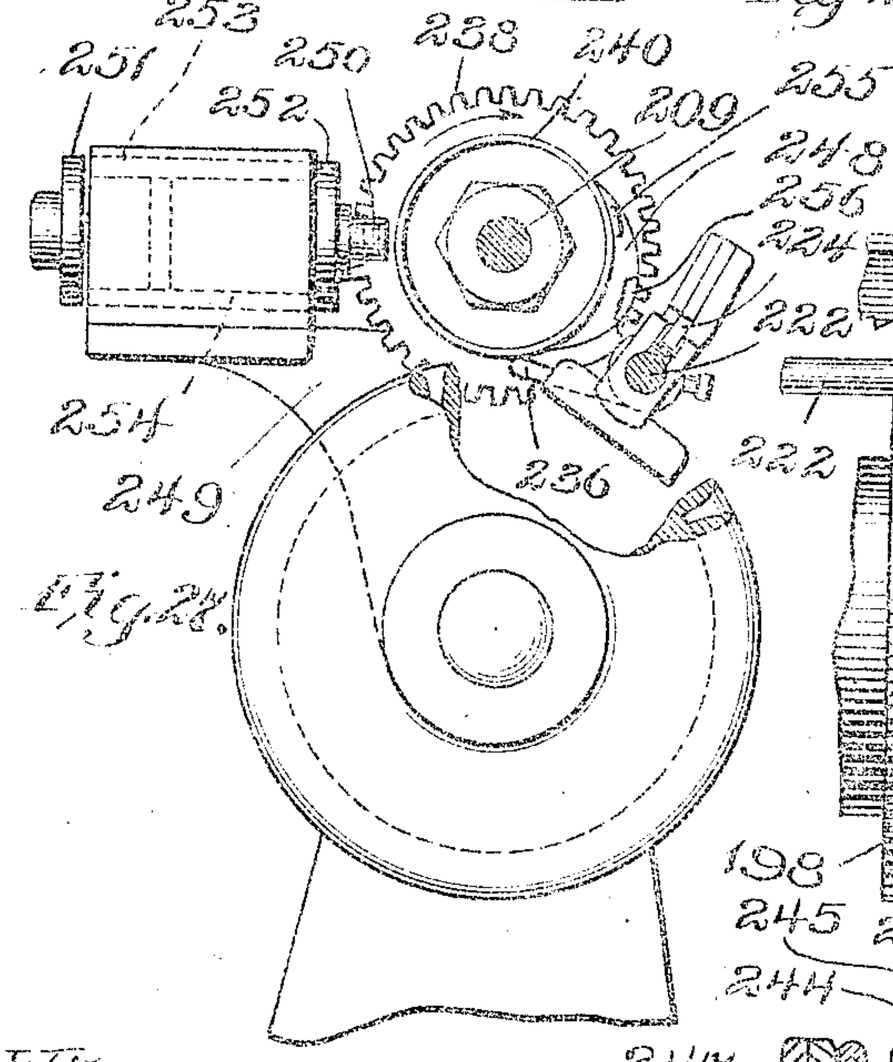

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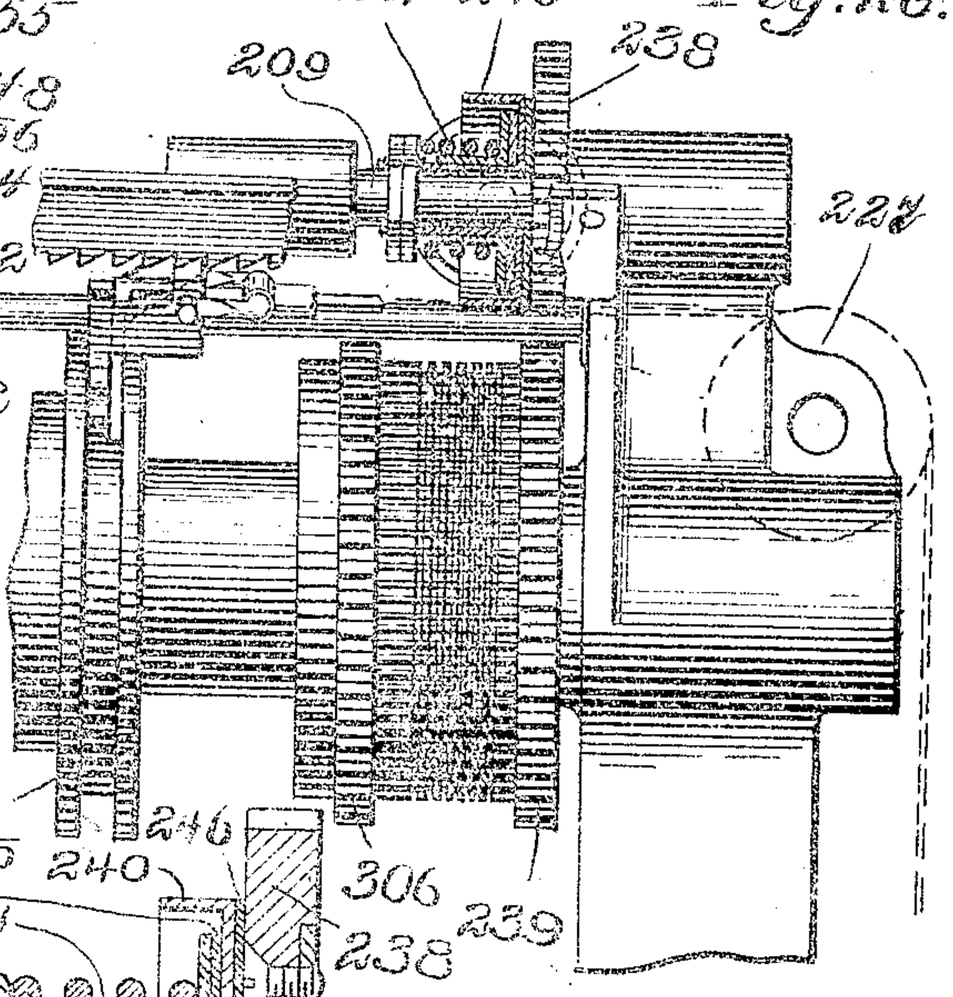

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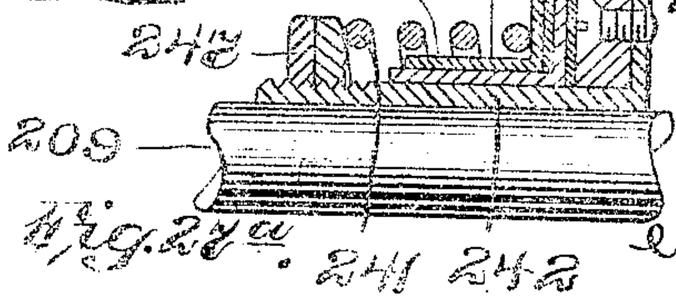

Fig. 27a.

Witnesses:
George Rizzetta
P. H. Rizzetta

Inventor:
Earl V. Beals
by
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his Attys

No. 812,542. PATENTED FEB. 13, 1906.

E. V. BEALS.

ATTACHMENT FOR KEYBOARD MACHINES.

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14 SHEETS—SHEET 10.

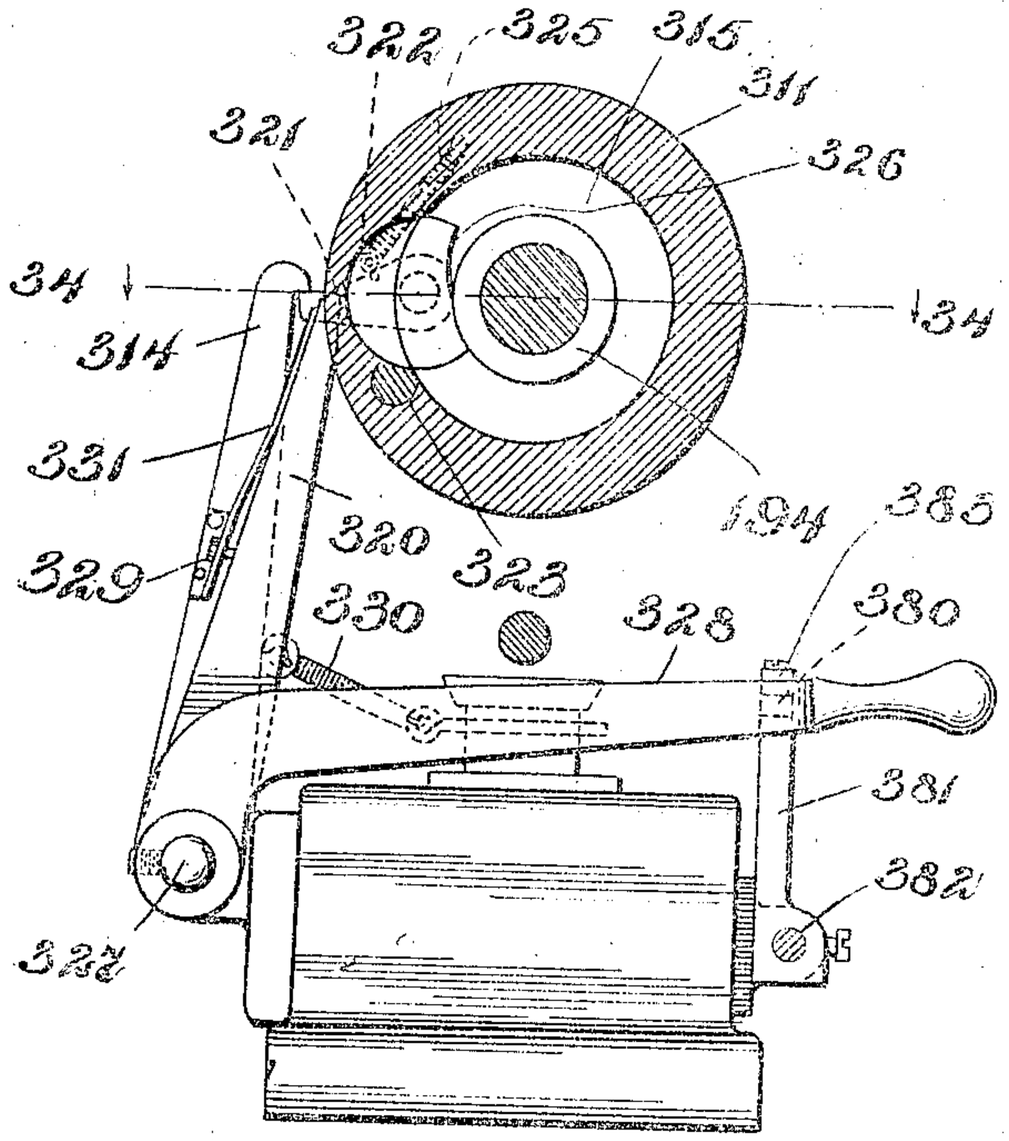
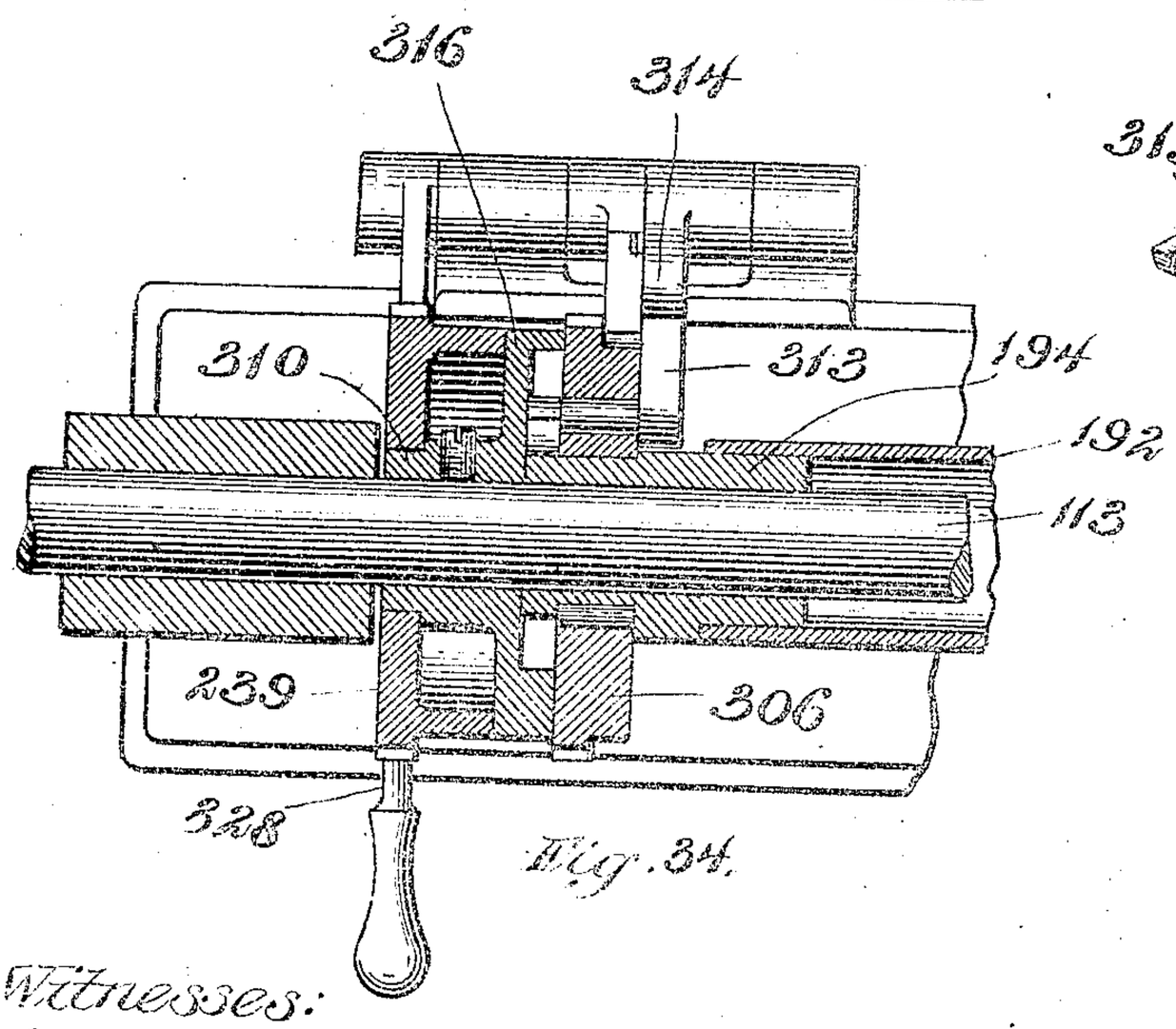


Fig. 33.



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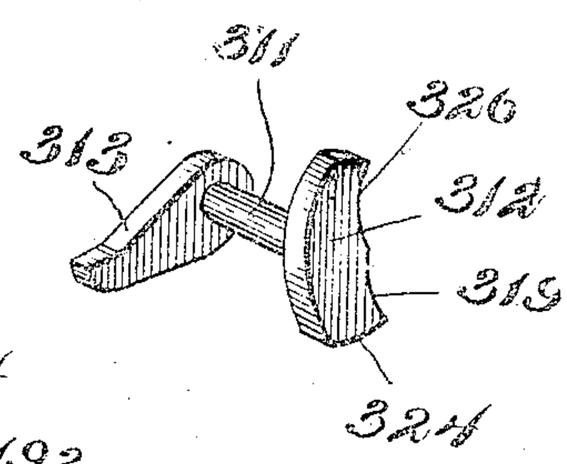


Fig. 35.

Witnesses:
George Pezzetti
P. W. Pezzetti

Inventor:
Erl. V. Beals
by Albright Brown & Quinby
his attys

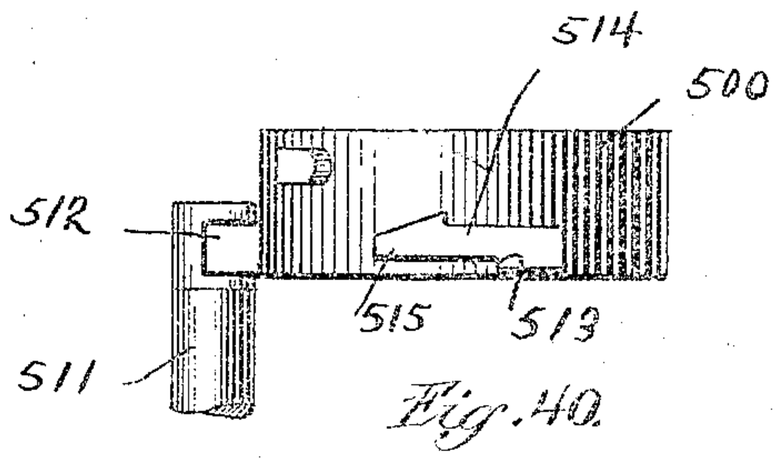
No. 812,542. PATENTED FEB. 13, 1906.

E. V. BEALS.

ATTACHMENT FOR KEYBOARD MACHINES.

APPLICATION FILED SEPT. 25, 1901.

14 SHEETS—SHEET 11.



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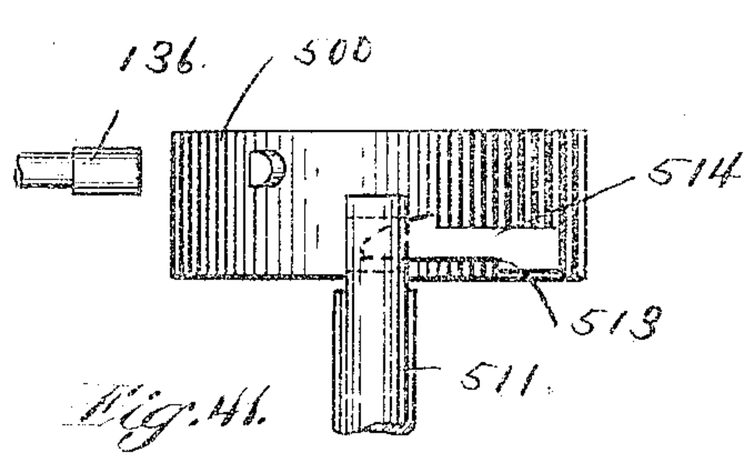

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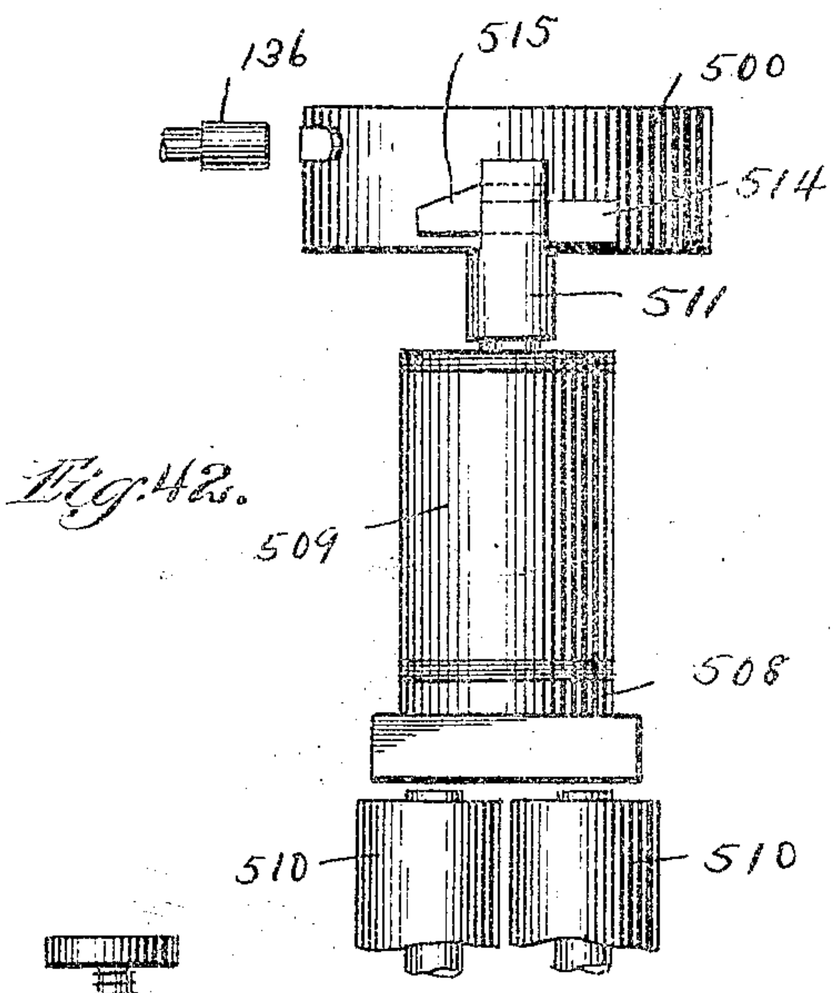

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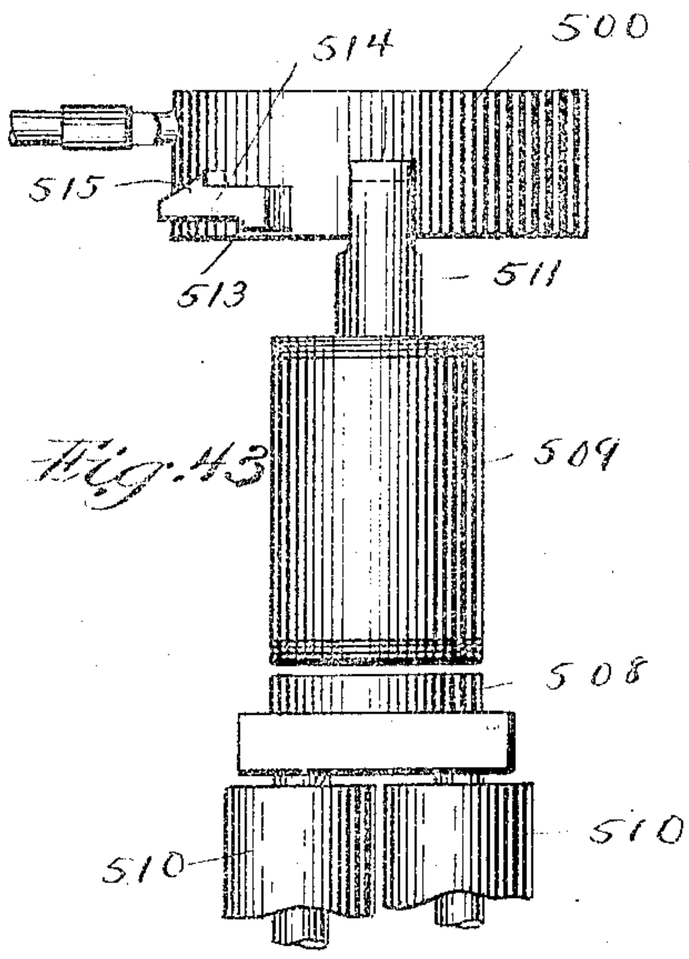

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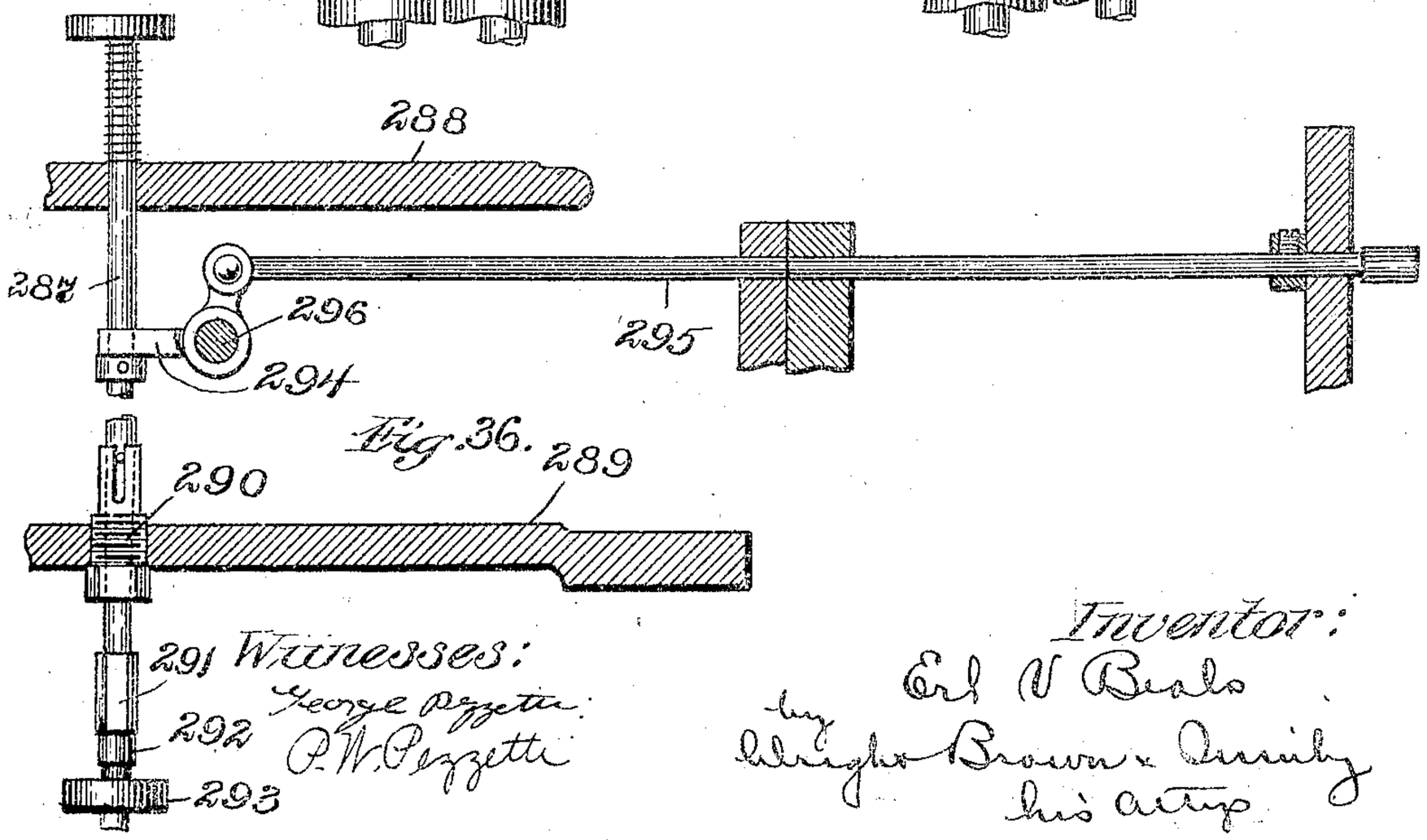

Fig. 36.

Witnesses:
George Pezzetti
P. W. Pezzetti

Inventor:
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by Wright Brown & Quinby
his attys

No. 812,542. PATENTED FEB. 13, 1906.

E. V. BEALS.

ATTACHMENT FOR KEYBOARD MACHINES.

APPLICATION FILED SEPT. 25, 1901. 14 SHEETS—SHEET 12.

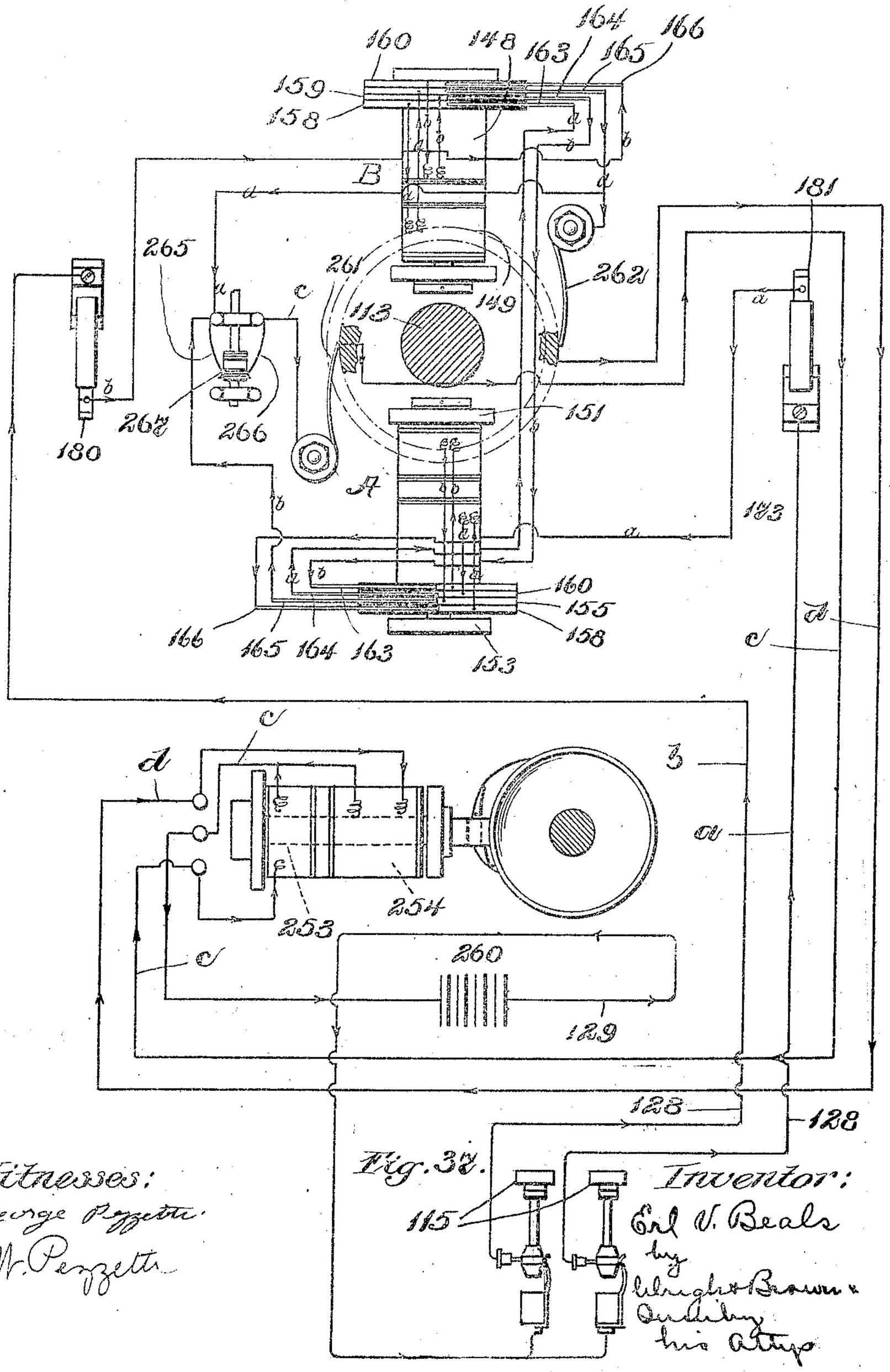

Fig. 32.

Witnesses:
George Pezzetti.
P. W. Pezzetti.

Inventor:
Earl V. Beals
by
Albright Brown &
Dunlevy
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No. 812,542. PATENTED FEB. 13, 1906.

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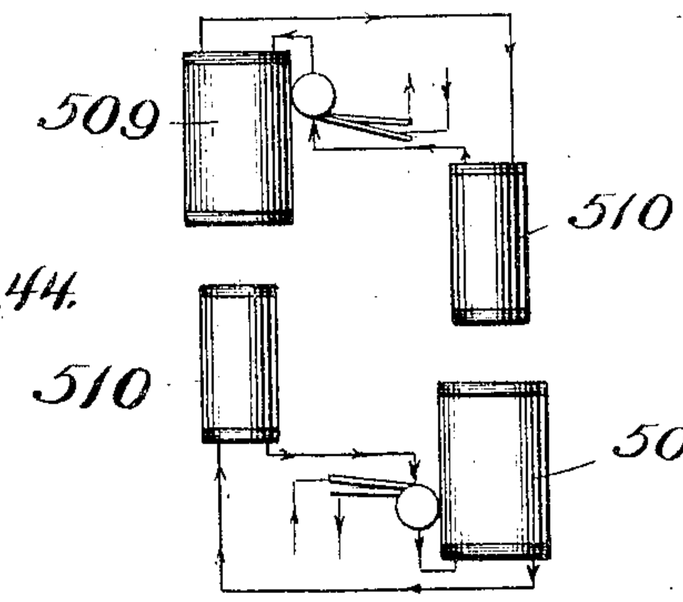
ATTACHMENT FOR KEYBOARD MACHINES.

APPLICATION FILED SEPT. 25, 1901.

14 SHEETS—SHEET 13.



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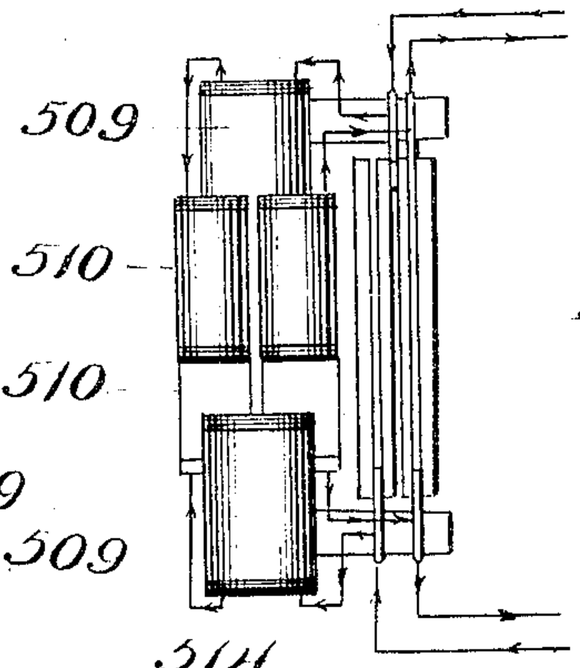

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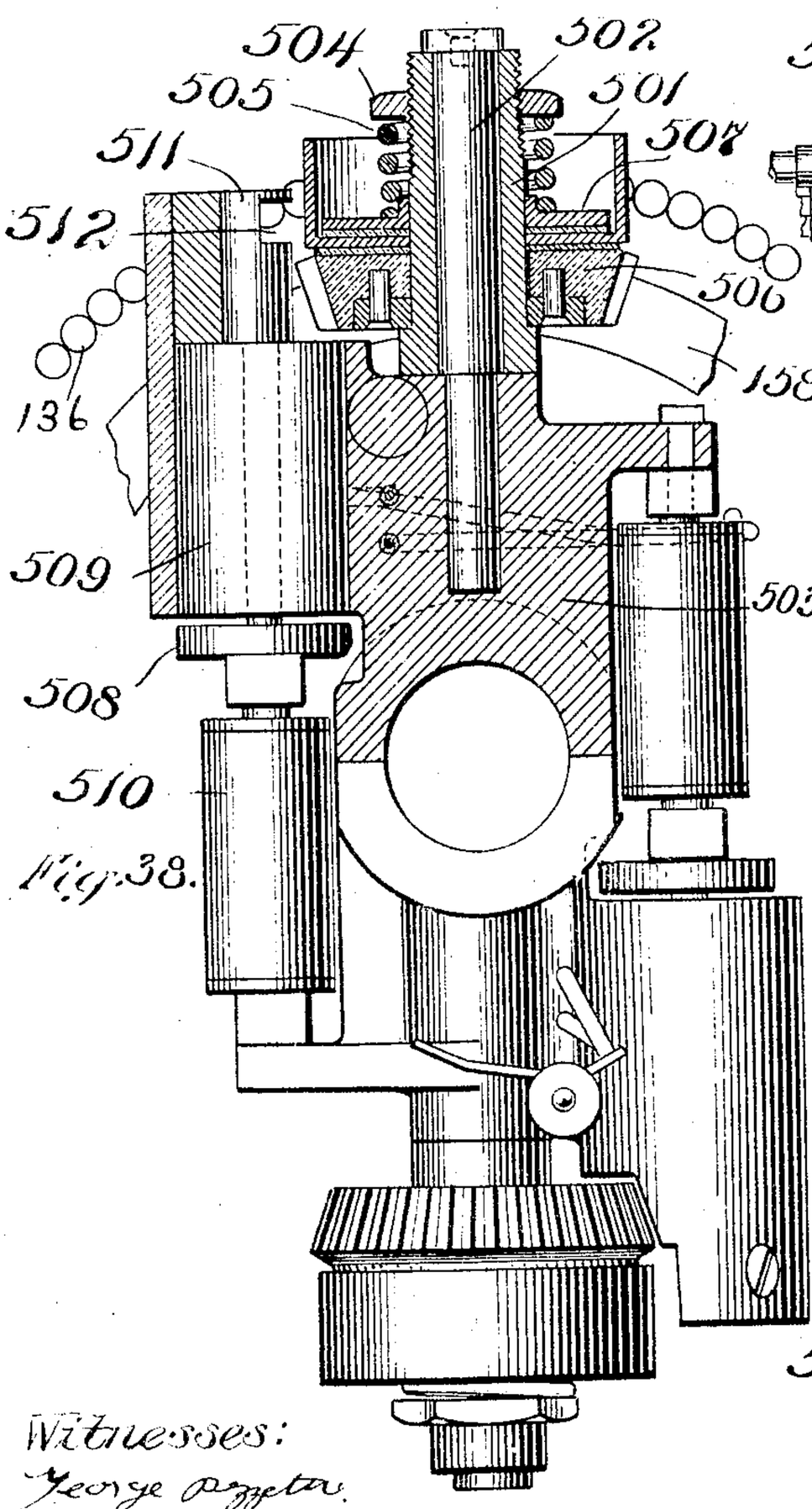

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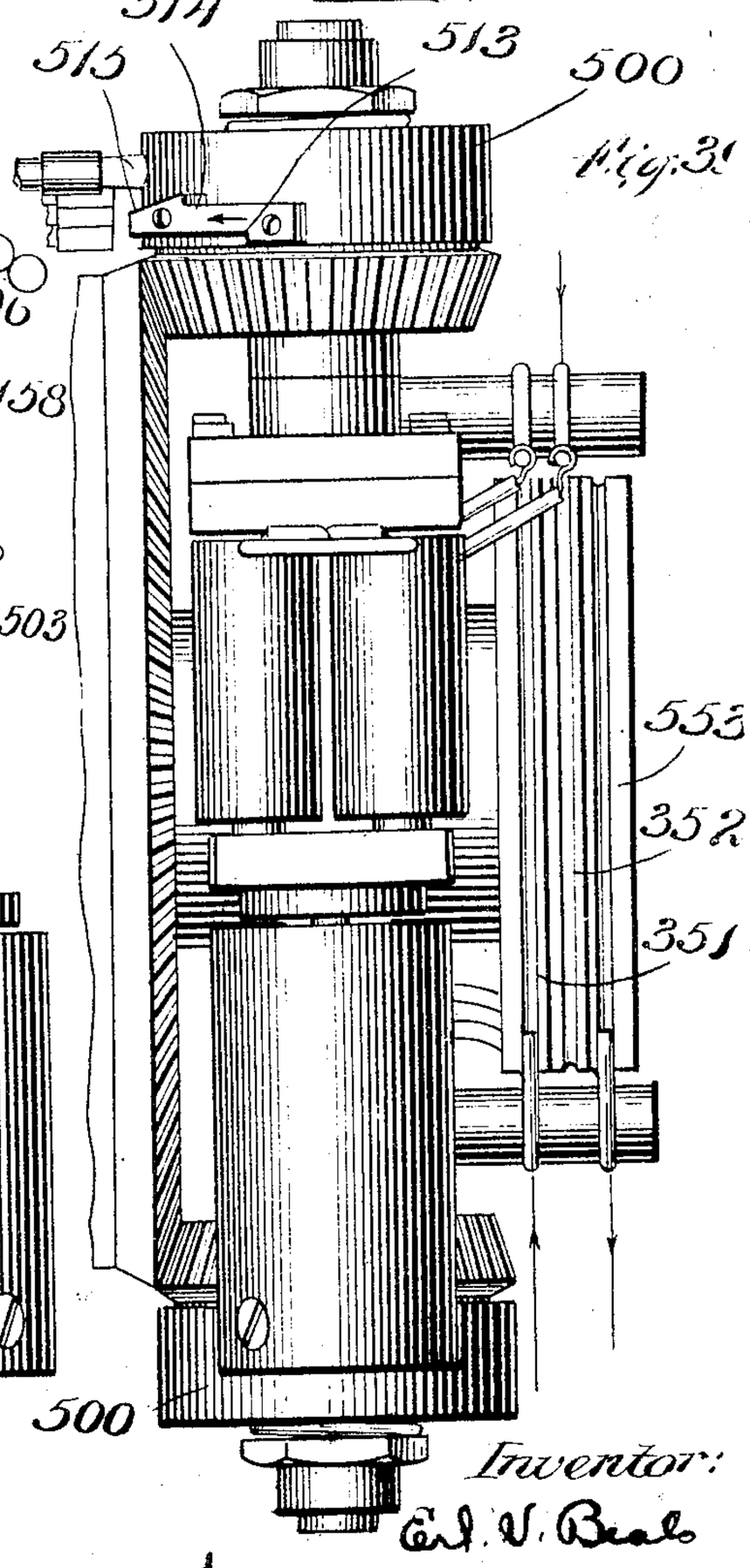

Fig. 31.

Witnesses:
George Pezzetti.
P. V. Pezzetti

Inventor:
Ed. V. Beals
by Wright Brown & Quinby
his Attys

No. 812,542. PATENTED FEB. 13, 1906.

E. V. BEALS.

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APPLICATION FILED SEPT. 25, 1901.

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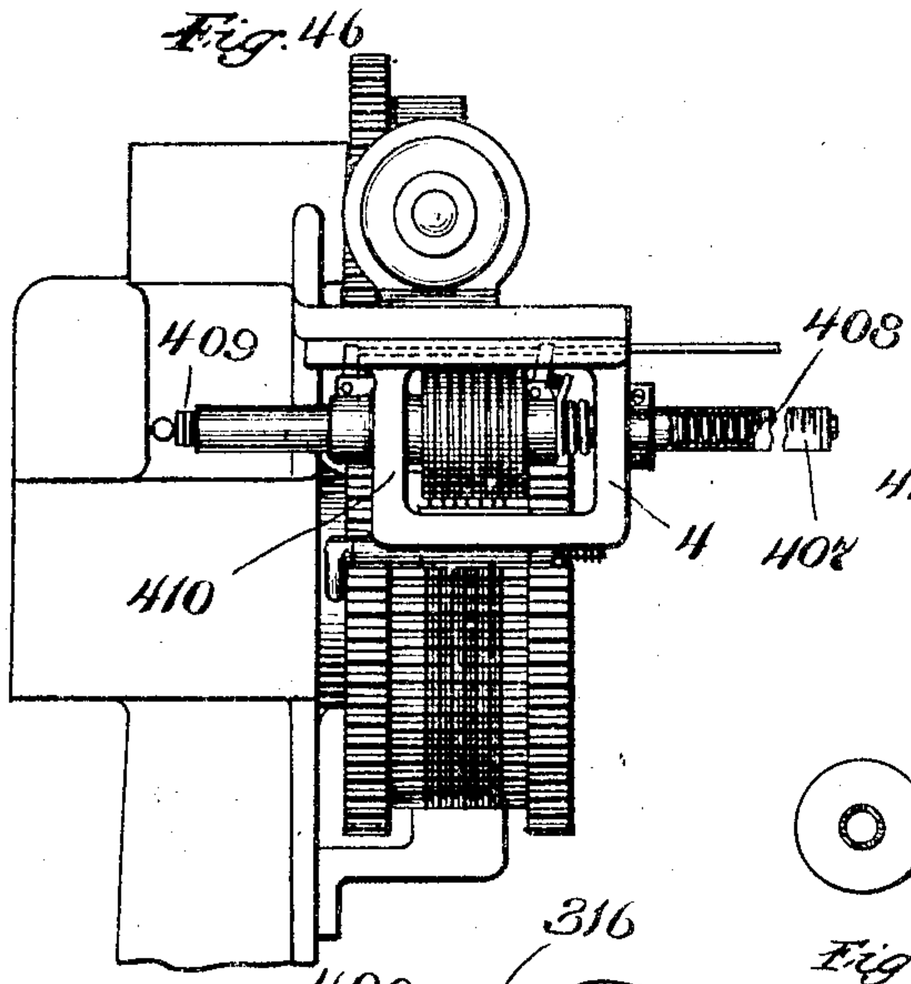
Fig. 46.



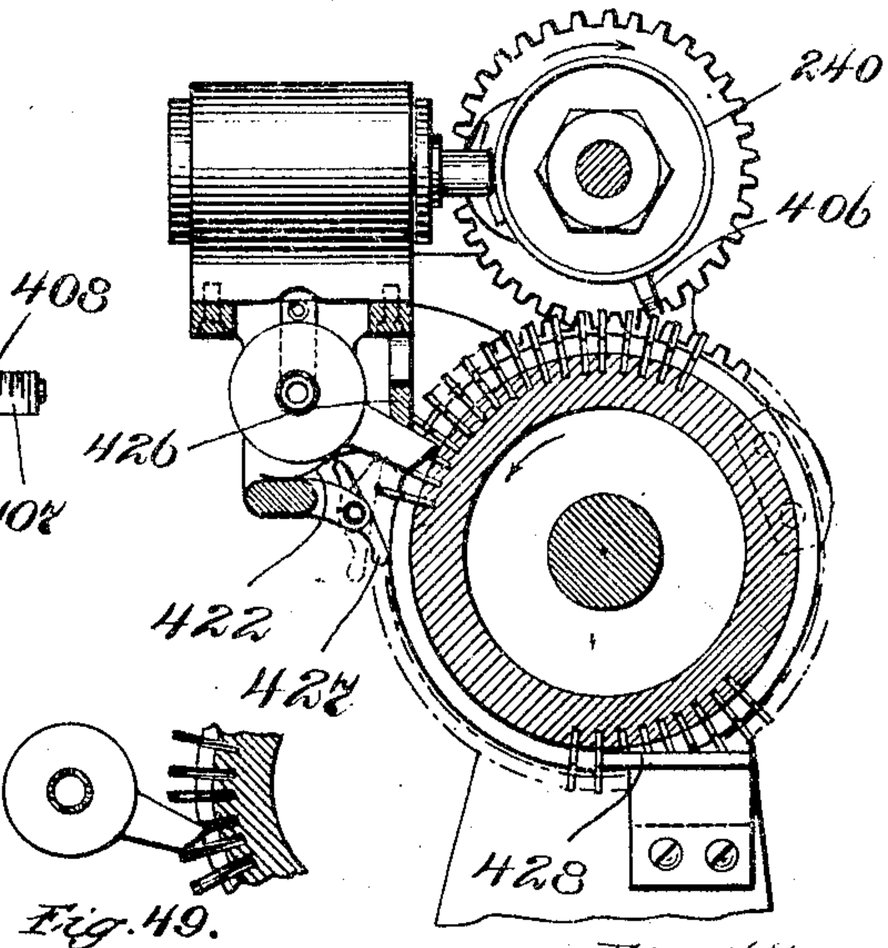
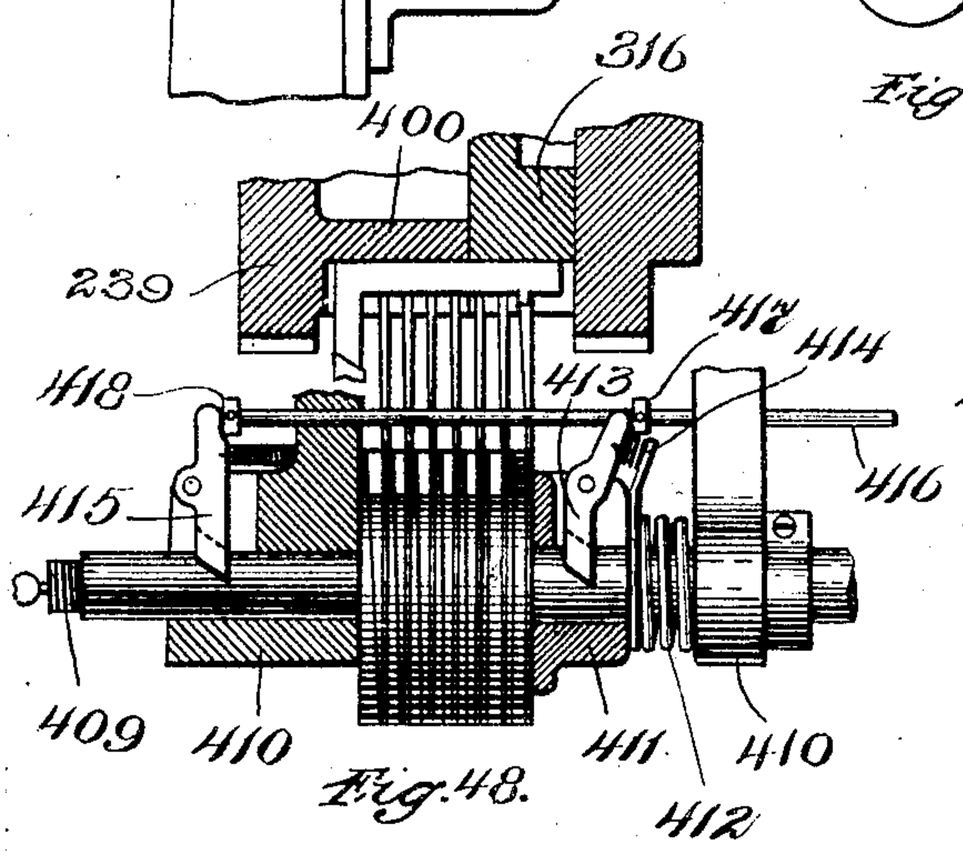


Fig. 49.

Fig. 47.



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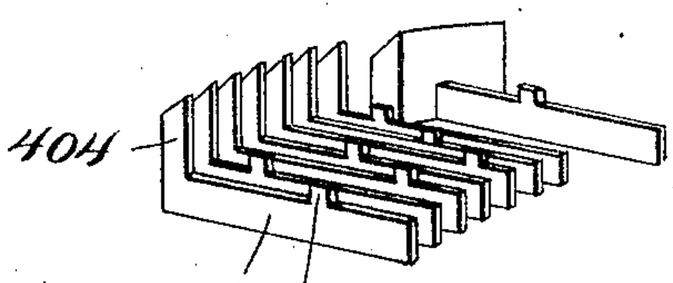

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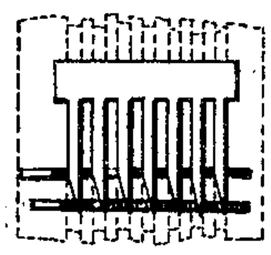


Fig. 50.

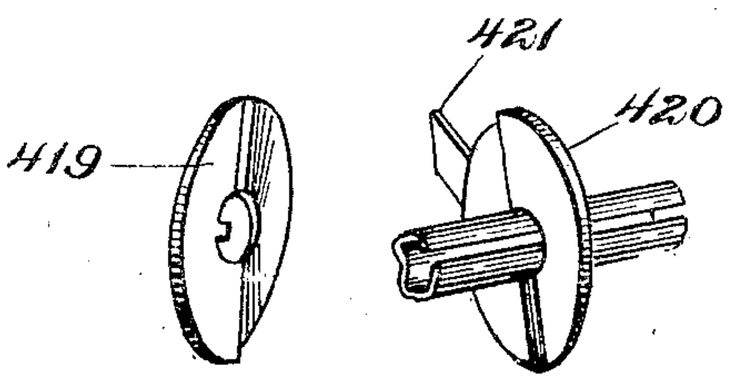
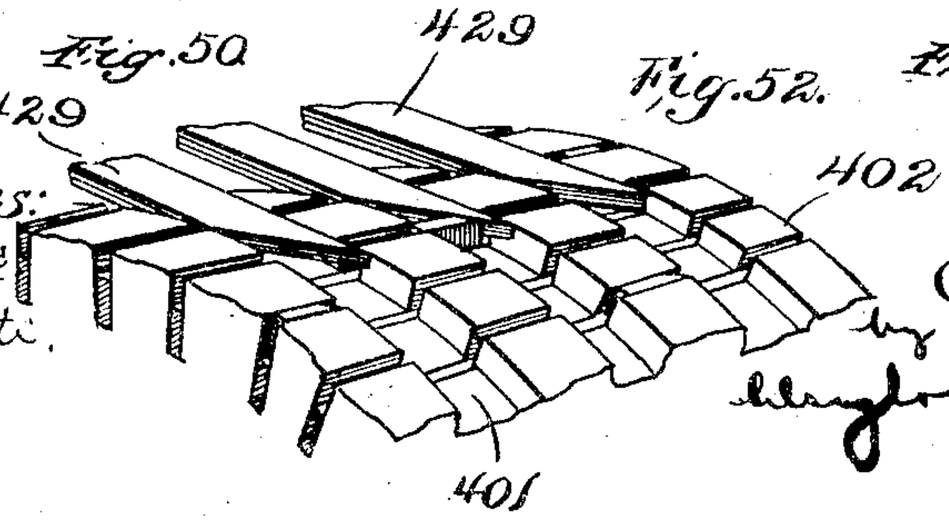


Fig. 52.

Fig. 53.



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UNITED STATES PATENT OFFICE.

ERL V. BEALS, OF BOSTON, MASSACHUSETTS.

ATTACHMENT FOR KEYBOARD-MACHINES.

No. 812,542. Specification of Letters Patent. Patented Feb. 13, 1906.

Application filed September 26, 1901. Serial No. 76,607.

To all whom it may concern:

Be it known that I, ERL V. BEALS, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Attachments for Keyboard-Machines, of which the following is a specification.

This invention has relation to linotype, matrix-making, or type-setting machines by means of which key-controlled matrices or type are alined in any predetermined order according to the will of the operator. In such machines the operation of selecting and alining the matrices or type can by reason of the construction of such machines be accomplished with the greatest rapidity, and, in fact, the matrices respond to the actuation of the keys much more rapidily than the ability of the operator to select and depress them successively—that is to say, the greatest speed at which the operator can work is not by any means the capacity of the machine, since the latter may be operated at a speed several times greater than that of the most rapid operator. Consequently I have found it possible to utilize a single linotype or type-setting machine under the control of a plurality of operators, whereby one machine may be used by said operators for several compositions.

The present invention therefore has for its object the provision of a mechanism under the control of a plurality of operators for actuating a single linotype, matrix-making, or type-setting machine whereby said operators may at their leisure simultaneously work upon separate compositions independently of each other, and while, as said, my invention is designed more particularly for linotype or type-setting machines at the same time it may be employed in connection with any machine controlled by a finger-key operation.

The invention consists of a single duplicating or key-actuating mechanism adapted to be arranged in operative relation to the keys of a linotype, type-setting, matrix-making, or other machine and a plurality of independent composing mechanisms by means of which the duplicating mechanism may be actuated to effect the operation of the last-mentioned machine. Each composing mechanism is under the control of a single operator and is provided with a plurality of keys similar in number to those of the linotype or type-setting machine, and the duplicating mechanism is likewise provided with corresponding actuating members to operate on the keyboard of the linotype-machine. Each composing mechanism includes in addition to the keys one or more selectors controlled thereby, a dummy or mechanical line consisting of a plurality of actuators under the control of the selecting instrumentalities, and transferring or repeating devices connected with the duplicating mechanism and controlled by the dummy for causing the actuation thereof. By depressing the keys of the composing mechanism in a predetermined order they cause the actuation of the selector and the selection of the actuators in said order, this being accomplished at any desired speed by the operator simultaneously with and independently of the work being accomplished by another operator on a similar selecting mechanism. When an operator has thus selected and arranged a plurality of actuators of the dummy in a certain order, each actuator representing a certain character or symbol, according to its set position, the transferring device is operated to cause the actuation of the duplicating mechanism and the consequent operation of the linotype, type-setting, or other machine equipped with a keyboard.

As will be readily understood, mechanism must be provided for preventing the simultaneous operation of two repeating or transferring devices, and hence the present invention includes means whereby when one of the transferring devices is operating the other is rendered inoperative.

I have not illustrated in the present patent the mechanism for separating the slugs or lines of type in the linotype or type-setting machine as said mechanism is fully illustrated and described and forms part of the subject-matter of my Letters Patent No. 696,360, dated March 25, 1902.

Referring to the drawings, which illustrate one embodiment of the invention, Figure 1 illustrates a plan view of the machine. Fig. 2 represents a front elevation of the same. Fig. 3 represents an end elevation of the machine. Fig. 4 represents in partial end section the keyboard and the depressible keys. Fig. 5 represents in section the rotating carrier and that portion of the selecting mechanism which is mounted thereon. Fig. 6 represents a partial plan view and partial sectional view of the same. Fig. 7 represents a section on line 7 7 of Fig. 5. Figs. 8 and 9 represent in detail one of the selector-

magnets. Fig. 10 represents the non-rotary portion of the selecting mechanism and one of the actuators therein contained. Fig. 11 represents a section on the line 11 11 of Fig. 10. Fig. 12 represents a perspective view of one of the actuators or rings of the dummy, whose position is selected by the selecting-devices. Fig. 13 represents in detail one of the selector-slides in operative relation to the actuators or rings. Figs. 14, 15, and 16 represent in detail the operation of the selector-slides. Fig. 17 represents the toothed portion of one of the rings or actuators. Fig. 18 represents the end of one of the selector-slides on which the coiled spring is mounted, by means of which said selector-slide is returned to operative position at the proper time. Fig. 19 represents a front elevation of a portion of the repeating mechanism. Fig. 20 represents an end elevation of the same, partially in section. Fig. 21 represents in detail one of the tripping-brushes forming a portion of the repeating mechanism. Figs. 22 and 23 represent mechanism for operatively engaging the sliding carriage which forms a portion of the repeating mechanism, with the worm by means of which it is moved. Figs. 24 and 25 show in detail portions of the tripping mechanism which stops the movement of the carriage. Figs. 26 to 31, inclusive, illustrate the escapement mechanism for causing the advance of the actuators or rings into operative position under control of the selecting instrumentalities. Fig. 32, Sheet 2, illustrates the nut which causes the withdrawal of the actuators or rings in the non-rotary portion of the selecting mechanism. Figs. 33 to 35, inclusive, illustrate clutch mechanism for causing the rotation of those actuators or rings in the selecting mechanism which have been set in a predetermined order. Fig. 36 illustrates one of the actuating members of the duplicating mechanism and the device by which it is operated. Fig. 37 shows in diagrammatic view the escapement-magnets, the selector-magnets, and the circuits including the same. Figs. 38 to 43, inclusive, illustrate a different form of duplicating mechanism so far as concerns the magnets and their arrangement. Figs. 44 and 45 represent diagrammatic views of the electric circuits forming a part of the said duplicating mechanism illustrated in the said last-mentioned figures. Figs. 46 to 53, inclusive, illustrate registering mechanism for indicating the thickness of each matrix or type as it is struck and the aggregate thickness of a line of matrices or type, so that the operator can see at a glance how nearly his line is completed.

Framework.—Referring to the drawings, which illustrate one embodiment of the invention, to the details of construction of which it will be understood, as previously stated, I am not limited, a machine is shown adapted for use by two operators. It is provided with the bed 100, supported by end standards 101. Rising from the bed are three bearing-brackets 102 103 104, which are utilized to receive and support a portion of the operative mechanism of the machine. As previously stated, said machine includes a duplicating mechanism, the transferring mechanisms, and the composing mechanisms. The composing mechanisms are placed in a line on the bed, with the keyboards separated far enough apart to prevent the operators from interfering with each other, and the duplicating mechanism is arranged for convenience at the rear of the machine.

Driving mechanism.—The driving mechanism includes an electromotor 105, suspended underneath the bed 100 and having on the armature-shaft a small pinion 106, intermeshing with and driving a gear 107. The latter is journaled on the stud-shaft 108, projecting from a bracket 109, depending from the bed. The said gear 107 has secured to it a pinion 110, intermeshing with and driving a large gear 111, journaled on a stud-shaft 1121, projecting from the bed 100. The gear 111 is connected with the gear 112, the latter being composed of a toothed rim adjustably secured to a hub, as shown in Fig. 3. The gear 112 is rigidly secured to a main shaft 113, which is journaled in the uprights or bearings 102 103 104.

Composing mechanism.—Each composing mechanism is similar to the others and includes a keyboard, selector-slides, and electromagnetic mechanism, a dummy formed of actuator-rings, mechanism for feeding the actuator-rings, resetting mechanism, and electric circuits.

Keyboard.—The keyboard of each composing mechanism is supported by brackets 114, extending downward and forwardly from the under side of the bed 100. The keys are arranged in banks and are each provided with a knob 115, on which is printed or indicated a letter, numeral, punctuation-mark, or other symbol, such as usually found in linotype, type-setting, type-writing, or other machines, a spindle 116, and a head 117. The keys are supported by a frame (indicated as a whole at 118) and having the inclined top plate 119, said keys being normally raised by a coiled spring 120. (See Fig. 4.) The frame 118 is provided with the intermediate plate 121, which, with the inclined plate 119, forms a guide for the reception of the spindles 116 of the keys, the heads 117 being located below the said plate 121. Each key normally closes an independent branch circuit, and when it is depressed the circuit is broken. The heads 117 are of the shape shown in Fig. 4, being constructed of wood, fiber, or other electrically-non-conducting material. Each head is provided, however, with a metallic cross-bar 122, by which the independent branch circuit is

closed, said head being in reality a switch operable at the will of the operator. Along each row of switches is a metallic bar 123, apertured to receive a contacting spring 124, which is held yieldingly in an operative position by a pin 125. Each bar 123 is insulated from the plate 121. Underneath each row of keys is a single cross-bar 126, of non-conducting material, such as wood. Said cross-bars operate to limit the downward movement of the keys, and to said cross-bars are secured spring-contacts 127, there being one contact for each head 117. Said contacts are arranged opposite to the ends of the pins 124, and when the keys are in an elevated position the circuit is closed between them; but when the key is depressed the said circuit is broken. Each one of the contacts 127 is in a separate branch circuit including a wire 128, the cross-bar 123 being connected in multiple with a return-wire 129. Connected to the last-mentioned wire there is a switch 130, located on the end of the keyboard for breaking the main circuit when the machine is not being used. From this description it will be seen that when the keys are all raised and in inoperative position all of the branch circuits are closed; but immediately upon one of the keys being depressed the branch circuit therefor is immediately broken, for a purpose to be subsequently explained. The heads 117 are beveled to permit the easy movement thereof past the contacts 124 and 127.

Selector mechanism.—The selector-magnets, of which any number may be employed, though I prefer two, for reasons to be explained, are controlled by the key-circuits, and they operate to select and actuate slides in the same order in which the keys are depressed. The selector-slides are equal in number to the key-circuits, and they are arranged in a circle about a common center. These slides control a plurality of actuators or rings (which constitute the dummy) rotating upon an axis coincident with said common center, and they stop the rings at predetermined points in their rotation, (causing them to remain fixed in the positions in which they are stopped,) upon a suitable support splined to receive them. Each time a selector-slide is actuated by the breaking of a key-circuit, as will be explained, it stops a rotating ring at a certain point in its rotation corresponding to the location of the slide.

Assuming for the sake of explanation that each rotating ring of the dummy bears upon its periphery all of the characters of the type-font, then by stopping said rings in succession with reference to a fixed line the characters in a certain line may be caused to indicate the word, phrase, or sentence. Instead of bearing alphabetical characters, however, each ring carries a finger or projection, and the location of that finger when the ring is stopped upon its support depends upon the composing-key which has been depressed and the location of the selector-slide which engages it, so that the location of the finger or projection with respect or relation to a certain line parallel to the axis of the ring indicates the character designated.

The duplicating mechanism includes a plurality of slides equal in number to and arranged similarly to the selector-slides, and each of them is connected with a rod or member located above a key of a linotype, type-setting, or matrix-making machine.

The slides of the duplicating mechanism are actuated by electromagnets similar to the selector-magnets to be described. In circuit with the said magnets are two interrupters, which may be moved along a line parallel to the axis of the cylindrical support upon which the rings are placed, being fed with a step-by-step movement. Hence when a line has been composed the cylindrical support for the dummy is set in motion, and as it rotates the interrupting devices are fed along and are engaged by the fingers upon the successive rings of said dummy. The duplicating-magnets rotate in unison with the rings and their support and in operative relation to the transferring-slides, so that the engagement of an interrupter by a finger on the ring causes the actuation of the slide in the duplicating mechanism corresponding to the selector-slide which caused the placing of that ring in that particular location upon said support.

Selector-slides.—As the composing mechanisms are similar, I shall describe only one of them. Secured upon the bed are two uprights or supports 131 132, each of which is in the shape of a ring. (See Figs. 7, 10, 11, and 15.) The shaft 113 passes through said standard, the apertures of which are relatively large. The annular upright 132 is provided with an internal flange 133, and supported by said flange and by the annular upright or support 131 are a plurality of actuator-slides 134, arranged at equal radial distances around the shaft 113 and lying parallel thereto. Said selector-slides are shown in detail in Figs. 13 to 16, inclusive, each being constructed of a long narrow metallic strip having at its rear a cylindrical pin 135 with a head 136, said pin passing through the flange 133. Coiled springs 137 surround the said pin and bear against the heads 136 and the flange 133 to hold said slides normally rearward. The front end of each slide is provided with a laterally-projecting finger 138, arranged radially of the shaft 113. The annular upright or support 131 is provided with apertures 139 to receive the slide and also with radial notches 140 in its front face to receive the fingers 138. Each finger is provided with a shoulder 141, by means of which the finger is held in an inoperative position, there being, however, a leaf-spring 142 formed

on or secured to said slide and bearing against the inner wall of the aperture 139 to force the finger radially inward when the slide is moved forward to disengage the shoulder 141 from the wall of the support 131. In order to position each slide as it is moved into operative position, it is provided with a beveled edge 143, which engages a bevel-wall 144 of the aperture 139, as best shown in Fig. 17. At its outer end each slide is provided w th a pin or projection 145 for a purpose to be subsequently explained.

The heads 136 and the slides form a circle, and they are in position to be engaged and thrust endwise by selectors, which I shall now describe. Rigidly secured on the shaft 113 is a carrier 146, (see Figs. 5 and 7,) which is rotated thereby at a high rate of speed—to wit, from two hundred to three hundred revolutions per minute. Said carrier is substantially in the shape of a disk or wheel except that it is provided with radial sockets 147 for the reception of electromagnetic devices. Each magnet comprises two coils 148 149, wound about the hollow core 150, arranged radially of a carrier. The coil 148 is considerably longer than that at 149, so that the magnetic strength thereof is much greater than that of the latter. The armature 151 for the attracting magnet or coil 148 is connected by a rod 152, passing through the hollow core 150, with the armature 153 for the holding or smaller magnetic coil 149. The two coils which thus compose the two-part magnet are secured within a cylindrical casing 154, which is journaled in a brass bushing or box 155, secured in the socket 147. The casing and the core are both made of Sweede's iron. The end of the casing is flanged at 156 and overlaps the end of the box or bushing 155 to prevent endwise movement of the compound magnet. Secured to the portion of the casing which projects beyond the bushing there is a bevel-gear 157, which intermeshes with a circular rack 158, attached to the flange 133 of the support 132, so that when the carrier 146 is rotated the magnets are revolved about the shaft 113 and also are rotated on axes radial of the said shaft.

Secured upon the head of the pinion 157 are four insulated collector-rings 158, 159, 160, and 161. (See Fig. 9.) On the end of the larger coil there are placed layers of insulating material 162, and through said layers and through the collector-rings are passed binding-screws 163, each binding-screw being attached to one of the collector-rings and being insulated from the other rings. The coils of the smaller magnet are connected with the rings 158 160 by wires passed inside of the casing and connected with the screw 163, and the collector-rings 159 and 161 are connected with the larger coil of the magnet. Brushes 163, 164, 165, and 166 are in electrical contact with the collector-rings 158, 159, 160, and 161, respectively, there being a set of collector-brushes for each compound magnet.

By means to be explained when the circuit is broken by one of the keys through the smaller end of the magnet the larger portion is energized to an increased extent and draws the armature 151 to it, causing it to rotate therewith, constituting, as it were, a magnetic clutch.

Normally the armature last referred to is out of alinement with the head of the selector-slide; but when it is moved toward the magnet it is brought into alinement therewith. The said armature is substantially circular in plan view except that it is provided with two oppositely-projecting fingers or selectors 167, either of which may engage the end of one of the selector-slides and move it longitudinally into operative position. The circuit is then almost instantly restored in the smaller end of the magnet, and as the armature rotates the cam 168 on the upper end of rod 152, which rests upon a stationary cam 169 on the perforated support, rides up on the latter and lifts the rod 152 radially outward to bring the armature 153 up against the smaller end of the magnet.

To insure the stopping of the rotary armature at the proper point, there is a stop-pin 170, (see Fig. 5,) against which a projection 171 on the armature engages just as said armature completes one half-rotation about its own axis, and to insure the full half-turn of the armature and the engagement of the two stops there is secured to the hub of the armature a friction-idler 1711, having shoes of yielding frictional material adapted to engage the end of the support 132 after the armature has left the magnet to such an extent as to weaken or break the magnet-driving power. These pins hold the rotating armature against further movement until the circuit through the smaller end of the magnet is again broken. The attraction of the armature 153 at the smaller portion of the rotating magnet tends to hold the two stop-pins 170 171 in firm and constant engagement, it being essential that the armature 151 when it begins its rotation should always start at a fixed point. In order to carry the current from each of the depressed keys in the keyboard to the magnets on the rotary carrier, I employ a stationary commutator, the sections of which are mounted upon the support 132, the latter being provided with an annular flange 172 for this purpose. The commutator-sections are indicated at 173 and are as many in number at least as there are keys in the keyboard and as there are selector-slides. Said sections are arranged in a groove formed by the flange and by a ring 174, which is secured thereto, the groove being dovetailed and the end portions of the sections being similar in shape, whereby they are held against movement. The sections are not only insulated from each

other, as ordinarily, but are also insulated from the support on which they are mounted. Each section is connected to one of the wires 128. On the flanged rim of the carrier there are adjustably mounted two brushes 180 and 181, arranged diametrically opposite each other. Each brush consists of a contact pivoted in an insulating-block 182 and having bearing against its free end a spring 183. There are two brushes, as stated, and two compound magnets, and hence as the sections of the commutator are placed very closely together the circuit through the smaller ends of the magnets will be practically continuous unless one of the keys be depressed to break it, and inasmuch as the carrier is rotated at a speed of about three hundred turns per minute it is impossible for an operator to depress a key and release it before one or another of the brushes will have swept across the section of the commutator with which the key is connected and will have caused the breaking of the circuit through the smaller end of one of the magnets.

I shall hereinafter describe the electric circuit more in detail, it sufficing for the present to state that each time a key is depressed to break the circuit through the commutator-sections connected therewith upon arrival of a brush on the carrier into juxtaposition to said section the circuit is immediately broken through the smaller end of one of the magnets and the rotating armature is immediately drawn into contact with the larger end of said magnet and rotated far enough to cause it to engage a selector-slide corresponding to the said key. At the same time that the circuit is broken through the smaller end of one compound magnet the magnetic energy of the larger end of said magnet and the smaller end of the other magnet is increased, as will be explained. The rotating armatures are always stopped by the stop-pin 170 171 in close proximity to the head of the selector-slide, so that but a slight rotative movement is necessary to cause the actuation of the latter.

The dummy.—The dummy consists of actuators, the position of each of which is determined by the selector-slides. Said actuators are indicated at 190 and are journaled or supported upon a large sleeve 191. At its ends the sleeve is supported upon a second sleeve or bushing 192. At one end the bushing 192 is supported loosely upon the shaft 113 by a collar 193, (see Fig. 7,) and at its other end it is rigidly secured to a bushing 194, loose on the shaft 113. (See Fig. 34.) Clutching mechanism, which I shall describe, is employed for connecting the bushing and sleeve 192 with the constantly-moving shaft at a certain time. The outer sleeve or support is free to slide relatively to the sleeve 192, but is held from rotative movement relatively thereto by a key 195, (see Fig. 10,) which is secured to the sleeve 192 and extends through a slot in the sleeve 191. The projecting edge of the key is narrow, and it projects but a short distance radially from the periphery of the sleeve 191. The cylindrical sleeve 191 is supported at one end by a collar 197 on the bushing or sleeve 192, as shown in Fig. 13, and at its other end it is provided with an inwardly-projecting flange supported by the said sleeve 192. The last-mentioned ends of the support 191 has a grooved external flange 198, with which is engaged the means for moving the support relatively to the sleeve 192.

By examination of Fig. 13 it will be observed that the key or spline 195 ends in the plane of the front face of the support, while the cylindrical support for the rings may slide considerably beyond the said face, so as to lie within the shell formed by the selector-slides.

Each of the rings 190 is journaled upon the cylindrical support 191 and is free to rotate thereon unless engaged with the spline 195, and to permit them to be engaged by said spline and held stationary each ring is formed with a plurality of internal notches 199, adequate to receive a projecting edge of the spline. There are as many notches at least in each ring as there are keys in the keyboard and as there are selector-slides, and the position at which any one of the rings is held determines the particular key in the linotype or type-setting machine which is depressed by a duplicating mechanism. Each ring is provided with a disappearing spring-pressed member or trigger 200, pivoted in a socket provided for it, as shown in Fig. 12, it being held so that its end projects beyond the periphery of the ring by a spring 201. The trigger is adapted to be engaged during the rotation of the ring while it is to the right of the spline in Fig. 13 by the finger 138 of any one of the selector-slides 134, and when it is thus held against rotation the cylindrical support 191 is moved longitudinally to engage the ring with the spline. As I have stated, the selector-slides are equal in number to the keys in the keyboard, and the notches are of the same number, so that when one of the keys is depressed the selector-slide which corresponds thereto is moved to operative position by the means previously described, whereby the ring is checked in its rotation and is engaged with the spline, the position of the ring and trigger upon the support being determined by that particular selector-slide which engages it.

The mechanism for rotating the rings consists of a roll 203 of yielding frictional material—such as rubber, leather, or the like—secured upon a hub 204, the latter being formed with the straight spur-pinion 205. (See Fig. 11.) The hub 204 is journaled in a bearing 207, formed on or secured to the upright 131. To the end of the bushing is attached a handle 208, by means of which it may be rocked

to adjust the roll 203 toward or from the rings on the cylindrical support 191. Journaled in the bushing is the smooth end of a screw-bar 209, whose other end is journaled in the upright 102. (See Fig. 2.) Upon said screw-bar is rigidly secured a large gear 210, intermeshing with and driving a smaller pinion 211, journaled on said shaft 212, supported by a bracket 213, projecting out from the bearing 207. The pinion 211 is connected to a larger gear 214, intermeshing with and driving the pinion 205. The screw-shaft 209 is provided on its opposite end with a gear 215, intermeshing with and driven by a gear 216 from the shaft 113. When the machine is in operation, the roll is rotated quite rapidly by the gearing described and rotates those rings with which it is engaged. It will be observed from Fig. 11 that the said roll is so located that it engages several of the rings which are in juxtaposition to the end of the spline, said roll being located so that its front face is in the plane of the front face of the annular support or upright 131. The cylindrical support 191 has a step-by-step longitudinal movement in one direction, said movement occurring immediately after one of the rings is held against rotation by a selector-slide engaging the trigger thereof, said step-by-step movement being controlled by an electromagnet arranged in circuit with the electromagnets which select and operate the selector-slides, and it is moved in the opposite direction with a continuous movement after the repeating mechanism has been actuated to return the rings to an inoperative position—that is to say, after an operator has composed a single line by depressing the keys, and thereby causing the rings or actuators to be located one by one on the spline and the transferring and duplicating mechanisms have been actuated to cause the operation of the linotype or type-setting machine—the operator returns the rings to their normal inoperative position inside of the shell formed by the selector-slides and between the two annular supports or uprights 131 132.

Mechanism for feeding the actuators and their support.—It is essential that actual movement of the support 191 should not take place until an appreciable time has expired after the depression of one of the keys in order to first permit the actuation of the selector-slide and the stopping of a rotating ring in position to slide upon the spline, and to accomplish this I employ an escapement somewhat similar to that used on a type-writer controlled, as aforesaid, by electromagnetic mechanism. Mounted in brackets 220 221, supported by the upright 102 and the annular upright or support 131, there is a grooved rock-shaft 222. (See Fig. 29.) Keyed on the rock-shaft so as to slide thereon is a carriage 223, having a pivoted pawl 224. Said carriage has a head 225, extending into the groove in the end 198 of the cylindrical support 191, and said carriage is likewise connected by steel ribbon 226, passing over an idler 227 with a powerful coiled spring 228, arranged in a suitable socket 229, secured to the end of the machine. (See Fig. 2.) The spring for the other selector mechanism is arranged horizontally behind the bed and is not shown except in Fig. 1. The ribbon 226 is connected with the carriage 223 by a shackle 230. The pawl 224 is adapted to be engaged successively with either of two ratchet-bars 231 or 232, one of which is stationary and the other of which is adapted to longitudinally move the distance of one tooth. The stationary ratchet-bar 232 is secured to the brackets 220 221, and it is provided with a lug 233 at each end extending into a slot in the end of the movable bar 231. The said movable bar 231 is connected with the bracket 220 by a coiled spring 234. The tooth of the pawl is just wide enough to engage either of the bars 231 or 232, and it is moved successively into engagement with them by the rock-shaft 222. Under normal conditions the pawl is engaged with the movable bar, the latter in such cases being drawn by the ribbon 226 to the end of its movement longitudinally, so that when the shaft 222 is rocked to move the pawl into engagement with the bar 232 the spring 234 draws the bar 231 back one tooth, and hence when the shaft is rocked in the opposite direction to return the pawl 224 into engagement with the ratchet-bar 231 it will engage the tooth next to the one previously engaged and the said bar 231 will yield the distance of one tooth, whereby the carriage 223 and the cylindrical support 191 will be advanced one step.

It is desirable to adjust the carriage with relation to the rack-bars, and this is done by means of an adjusting-screw 235, which is passed through the free end of the pawl 224 and is adapted to engage the bar 232 to limit the movement of the bar.

The mechanism for rocking the shaft includes an arm 236, secured to said shaft, and an electrically-controlled cam 240 for engaging the said arm. The rock-shaft 222 is normally held in position to cause the engagement of the pawl 224 with the movable ratchet-bar by a spring 237, coiled about said bar 232.

Rigidly secured upon the shaft 209 is a gear 238, which intermeshes with and is driven by a large gear 239 in the shaft 113. (See Fig. 26.) It will be remembered that the last-mentioned shaft rotates continuously, and hence the gear 238 is likewise driven continuously when the machine is in operation.

By mechanism which I will now describe the cam 240 is permitted to make a single rotation and is then stopped automatically, the stopping and starting of the cam being controlled by an electromagnetically-regulated

stop. Spring-tensioned friction mechanism is interposed between the gear and the cam, and hence when the stop is moved to proper position the cam is clutched frictionally to the shaft and rotates therewith until it is again stopped.

Referring to Figs. 26 and 28, it will be observed that the cam is indicated at 240 and consists of a shell loose upon the hub 242 of gear 238. The hub 242 may be in the nature of a bushing secured to the gear, as indicated. The cam 240 has a hub 243 journaled on the bushing 242, and sliding on said hub is a flanged sleeve 244, there being interposed between the flange on the sleeve and the cam a disk 245 of friction material. A similar disk of friction material 246 is inserted between the cam and the gear. One or more adjusting-nuts 247 are threaded upon the bushing 242, and between said nuts and the flange of the sleeve 244 is inserted a compression-spring 241. The cam has a single rise 248 to engage the lever 236 of the rock-shaft 222. On a bracket 249 is mounted a two-part or compound magnet C, which is similar to that previously described. It has a single plunger 250, upon which are rigidly secured armatures 251 252. Two coils are indicated at 253 and 254, respectively, the former being smaller and correspondingly weaker than the latter. The circuit through the larger coil is always closed, but is opened and closed through the smaller coil 253, as will be explained, whereby the core is normally held at its forward extreme of movement in position to engage a stop on the cam and prevent the cam from rotating, but is withdrawn when the circuit through the small coil is broken. The stop is shown at 255, and when the plunger or, as it may be termed, the "pawl" 250 is advanced the stop engages it and is held thereby from movement. When the circuit is broken through the smaller coil, however, the plunger is retracted by the larger coil and the cam is immediately clutched to the gear 238 to rotate therewith. The circuit is subsequently immediately restored, so that when the plunger is advanced it may be held in position to engage the stop by the weaker coil. To return the pawl or plunger, the cam is provided with a cam-lug 256, which enters a notch 257 in the plunger and draws the latter toward the shaft 209. Said cam-lug rotates a short distance in advance of the stop 255. In Fig. 27 the normal position of the pawl or plunger 250 and the cam and stop are shown. The closing and opening of the circuit through the smaller coil of the electromagnet last described is controlled by the electromagnetic mechanism which actuates the selector-slides, and the larger coil is in the main electric circuit, which is connected with a generator of electricity. From this description it will be seen that immediately upon the depression of the key and the actuation of one of the selector-slides by the action of one of the electromagnets having the coils 148 149 the stop 250 will be withdrawn from engagement with the cam and said cam will begin to rotate, and in this connection it will be noticed in Fig. 28 that the rocking arm 236 is so located with reference to the core 250 that the cam will have completed about three-fourths of its rotation before the shaft 222 is rocked to cause the feeding of the actuator-ring upon the spline, this giving sufficient time for the ring to be positioned with respect to said spline before it is fed thereon. Each time, therefore, that a key on the finger-board is depressed a corresponding selector-slide is actuated and one of the rotary rings is stopped at a particular point in its rotation to properly position its trigger or member and is fed upon the stationary cylindrical support when the escapement mechanism is actuated. The composing is continued until the operator has fed upon the cylindrical support rings equal in number to the type and spaces necessary to complete a single printed line of matter, and by the characters or symbols which are upon the rings or actuators he is able to see what he has set up. This dummy or mechanical line corresponds exactly to the line which is to be cast upon the linotype, type-setting, or matrix-making machine, except for the justification, which is completed by another operation, which I shall not describe, as it is not included in the present invention. At the completion of the single line the composing operation is at an end, and the duplicating and transferring mechanisms may be then set in operation to cause the actuation of the keyboard of the linotype, type-setting, or matrix-making machine.

The electric circuits for the composing or selecting mechanism.—Reference may now be had to Fig. 37. The generator is indicated conventionally at 260, and it is connected by the wire 129 with the keys 115. I have shown but two keys for the sake of convenience. Two commutator-sections 173 are illustrated conventionally, and against them are the two brushes 180 181. The current is carried through the rotary magnetic selecting mechanism by rings and brushes. The brushes 261 and 262 are carried by the rotating support 146, and they rest upon insulated rings 263 264, mounted upon the annular boss 265 on the standard 103. (See Fig. 7.) The circuit for one key is indicated as *a*, the other as *b*. Each main circuit is therefore divided into branch circuits, arranged in parallel, and the current is obliged to traverse at least all but one of them.

Following the circuit *a*, it will be observed that it passes through the commutator-section 173, the brush 181, to the brush 166, and the collector-ring 158 of the revolving magnet A. It passes through the larger coil of said magnet, thence out through the ring 160

and the brush 164 to the brush 163 and ring 158, which are connected with the smaller coil of the opposing revolving magnet B, thence out through the ring 160 and brush 165 through the ring and brush 262 264 to the larger coil 254 of the feeding-magnet C, and thence back to the generator 260. The circuit *b* follows a similar course, except that it passes through the larger coil of magnet B and the smaller coil of magnet A.

It will be remembered that the key-circuits are normally closed, and hence the series of branch circuits *a* and *b* are also at all times practically normally closed as the brushes 180 181 move over the diametrically opposite sections of the commutator, and hence if one of the circuits *a* be broken the entire current will be caused to traverse the other or others. The branch circuits *a b* are thus arranged in pairs, and the circuits for the electromagnets A and B are connected with successive pairs as the brushes revolve.

Interposed between the selector-magnets and the stop-magnet C is a circuit-breaking mechanism for controlling the feeding of the rings on the cylindrical support. The larger coil 254 of said magnet C is always in the closed main circuit. On the revolving head 146 (see Fig. 5) there is a circuit-breaker, which consists of the two spring-contacts 265 266 and a movable contact 267. The latter consists of a spindle having the metallic portion 268, which is adapted to close the circuit between the two spring-contacts 265 266, and on both sides of the metallic part of the spindle there is an insulating-collar. The spindle moves in insulating-guides supported by an insulated block 269, as shown. The two spring-contacts are insulated from each other by the guide 270, having binding-screws for the wires, said binding-screws being indicated at 271 272. A spring 273 normally holds the spindle 267 in position to close the circuit between the two spring-contacts. The binding-screw 271 is connected by a circuit *a' a'* with the circuit *a*, being, in fact, connected with the screw which adjusts the brush 165 in place. Said binding-screw has likewise secured to it a wire which forms a part of the circuit *b*. The binding-screw 272 is in the circuit *c*, being connected with the binding-screw which holds the brush 261 against the ring 263. The circuit *c* includes a portion of the circuit *d* and also the smaller coil 263 of the stop-magnet C.

To operate the circuit-breaker, I employ two coacting levers 275 276. Each has an end extending into proximity to the adjacent armature 153 of the compound revoluble selector-magnet A or B. The lever 275 is fulcrumed at 277 and has a nut to engage a flange or collar 278 on the spindle 267, said last-mentioned lever having likewise an arm 279, adapted to be engaged by the free end of lever 276, the last-mentioned lever being shaped as a bell-crank.

When the parts are in normal position, the circuit is established through the smaller coil of armature C, there being also a circuit through the larger coil of said magnet, the last-mentioned circuit being indicated in part by *d* and *c*. When one of the circuits *a* or *b* is broken and the larger coil 148 of the magnet A or B is energized, to move the armature therefor one or the other of the levers 275 and 276 is actuated to move the circuit-breaker into inoperative position to break the circuit between the spring-contacts 265 and 266, and the circuit *c* through the smaller coil 253 of stop-magnet C is therefore broken to permit the larger coil to move the plunger to allow the rotation of the stop-cam. Assuming now, for example, that the key 115 of circuit *a* is depressed, the circuit is consequently broken through the larger coil 148 of magnet A and through the smaller coil of magnet B. Immediately thereafter the armatures of the compound magnet A are shifted, and the circuit-breaker is actuated to break circuit *c* through the smaller coil 153 of magnet *c*, this breaking taking place as soon as the brush 181 reaches the proper section 173 in the commutator with which said key was connected electrically. The result of this is that as soon as the brush reaches that section the armature 153 of the larger coil 148 of magnet A is moved into contact with the magnet and begins to rotate to cause the actuation of one of the selector-slides, as previously described. As this is done the circuit through the smaller coil in magnet B is broken, and there is no opportunity for the larger coil of that magnet to operate and move a selector-slide, and, moreover, the entire current must pass through circuit *b*, which adds additional energy to the smaller coil 149 on said magnet A and causes it to grip its armature 151 with additional force. The breaking of circuit *c* through the smaller coils 253 of magnet C permits the actuation of the stop-magnet, as previously described; but before said cam completes one rotation the circuit *a* is again closed, and circuit *c* is therefore closed as soon as armature 153 of coil 148 of magnet A is restored to normal position. It is deemed unnecessary to further trace in detail the circuits shown on Fig. 37, as they are clearly illustrated diagrammatically.

The action of the electromagnetic mechanism is so rapid, the head which carries the magnets A B moving so rapidly, (not less than two hundred rotations per minute,) that the selector-slides are actuated one by one to cause the placing of the actuators or rings upon the rotating spline-support more rapidly than an operator can depress the keys in the finger-board. The continued depres-

sion of any one of the keys will cause a continuous placing of selector-rings upon the cylindrical support, with the stops carried by said rings in similar corresponding positions.

I have illustrated and described two separate magnets for actuating the selector-slides; but it will be understood that I may, if desired, employ but one. The only purpose of employing more than one is that I am thereby enabled to lessen the speed at which the magnet-carrier is rotated. For instance, if but one magnet were employed it would be necessary to rotate the carrier at twice the speed necessary for the carrier having the two magnets.

The breaking of any one of the circuits through the commutator-sections will cause the operation of the first magnet, whose corresponding brush comes in contact with the said commutator-section. If I were to employ, on the contrary, four magnets, it would be necessary to rotate the carrier at only one-half the speed. I have found, however, that for practical purposes two magnets are all that are necessary for a proper actuation of the machine. Another reason for employing the two magnets is that I am enabled to arrange the key-circuits in pairs, as previously described, and connect them with diametrically opposite commutator-sections, so that when the circuit is broken through the larger coil of one of the compound magnets the strength of the smaller coil of the magnet is increased for the time being.

Actuators' resetting mechanism. — The mechanism for resetting the actuators is manually regulated, and the operation takes place after the actuation of the duplicating and transferring mechanisms and is for the purpose of returning the actuators or rings to normal inoperative position, whereby the operator may compose a second line. I shall describe this mechanism at this time, although, as stated, it is not called into play until after the operation of the transferring or duplicatng mechanism, because it includes parts already referred to.

On the screw-shaft 209 is placed a sleeve 280, carrying an arm 281, which projects into a groove in the flanged head 198 of the cylindrical support. (See Fig. 32.) Said sleeve carries a manually-operable lever 282, normally held in inoperative position by a spring 283. Affixed to said lever is a nut-section 284, which is adapted to be engaged with a screw-shaft 209 by the depression of said lever. An arm 285 projects outwardly from said sleeve and has a spring-pressed pin 286, which is adapted to engage a notch (not shown) in the lever 282 and hold it in an operative position. When a line of actuators has been set up or composed and the duplicating and transferring mechanisms have been actuated to transfer the matter to the linotype, type-setting, or matrix-making machine the operator depresses the lever 282 and the rotation of the screw-shaft 209 causes the cylindrical support to be fed to the right in Fig. 2 to reset or return all of the rings or actuators into operative position. For the purpose of automatically throwing the nut-sections out of gear with the screw-shaft a pointed pin or cam 287, Fig. 1, is located in position to engage the lever 282 and throw it upward, whereupon the cylindrical support will immediately cease to move.

Duplicating mechanism.—The duplicating mechanism for the entire machine includes a single actuating mechanism adapted to operate upon the keyboard of a linotype, type-setting, or matrix-making machine, with independent connections whereby it is adapted to be operated or controlled by any one of the composing mechanisms. The actuating mechanism includes a plurality of key members adapted to be set over the keyboard of one of the machines last mentioned, with a member above each key, so that by the depression of any one of them the key therebeneath will be likewise depressed. The members correspond in position and arrangement to the keys of any one of the keyboards of the composing mechanisms, and they are actuated by electromagnetic mechanisms or devices similar to the selecting electromagnetic mechanisms. A plurality of slides similar in disposition and arrangement to the selector-slides are arranged to actuate the trackers, and the actuation of the transferring-slides is controlled by the position of the actuator-rings upon their cylindrical support.

A key member is shown in Fig. 36, consisting of a vertical rod 287, mounted to slide in a stationary frame which is supported upon the rear of the machine. Said frame is formed with the top and bottom plates 288 289 connected by uprights. (Not shown.) Each rod passes loosely through the plate 288 and through a screw-bushing 290 set in the lower plate 289. On the lower end of the rod there is an adjustable ferrule 291 with a rubber tip 292 to engage the key 293 of a linotype, typesetting, or matrix-making machine. Each rod is connected by a bell-crank 294 with a slide 295. These slides are equal in number to the selector-slides, and they are arranged in a circle about a common axis similarly to the selector-slides. The bell-cranks 294 are journaled upon cross-shafts 296, secured in the frame previously referred to.

An electromagnetic mechanism similar to that employed for the selector-slides is used for actuating the duplicating-slides, and this electromagnetic mechanism is governed in its actuation by the positions of the rings 180 upon the cylindrical support 191. As the said support rotates, the interrupters in circuit with the electromagnetic mechanism are fed with a step-by-step movement into oper-

ative engagement with the rings, so that each time the circuit is broken by the projection on one of the rings the said electromagnetic mechanism is actuated to operate the key member which will depress a key corresponding to the key that was depressed to set the ring in that particular position upon the cylindrical support.

The transferring-selectors which operate the transferring-slides are, as stated, substantially similar to those illustrated in Figs. 5, 6, and 7. The shaft upon which the selectors and their coöperating mechanism are mounted is indicated at 297, and it is provided with a pinion 298 intermeshing with a gear-wheel 111. Said pinion 298 is equal in size and number of teeth to the pinion 112.

Inasmuch as there is absolutely no difference in construction, arrangement, and operation between the electromagnetic mechanism for the selector-slides and that for the duplicating slide, I have not illustrated the latter in detail, it being shown sufficiently in Figs. 1 and 3, which are respectively a plan and an end elevation of the same. The only difference between the two electromagnetic mechanisms is that in lieu of the traveling brushes 180 and 181 and the commutator-sections 173 I employ interrupters or circuit-changers which, as stated, are arranged to move step by step into operative relation with the rings on the cylindrical support, during which time the rings and their support are continuously rotated. These interrupters for the several sets of composing mechanism are in pairs and arranged to be connected one pair at a time to collector-rings on the bearing for the shaft 297, there being brushes on the rotatable electromagnetic mechanism which engage said rings. In Fig. 37 I have shown a diagrammatic view of the electric circuit, including said interrupters and the magnets of the electromagnetic mechanisms.

The interrupters.—The interrupters are shown in Figs. 19 to 24, inclusive. Sliding upon a guide 300 upon the base of the machine is a carriage 301. This carriage is provided with a nut-section 302, which is adapted to be moved into operative engagement with a rotatable screw 303, journaled in a bearing 304 upon the bed of the machine. This screw 303 has a continuous rotary movement so long as the rings 190 are rotating, and likewise a longitudinally-reciprocating movement, the effect of which is to advance the carriage with a step-by-step movement relatively to the rotary rings 190. The screw 303 is parallel to and directly underneath the shaft 113, and it receives its rotation from the latter. I shall subsequently describe the mechanism by which this reciprocating action is imparted to the screw.

Under the head of "The actuators" I have referred to the fact that the bushing 194 is loose upon the shaft 13 and that the clutching mechanism is employed for connecting the bushing with the sleeve at 192. I shall now proceed to describe said clutching mechanism by means of which the cylindrical support for the rings is caused to rotate during the operations of transferring the lines of composition to the linotype or other finger-key-actuated machine.

Upon the screw-shaft is a gear 305, which intermeshes with a gear 306 (see Fig. 34) upon the hub 194, hereinbefore referred to as being imposed between the shaft 113 and the cylindrical support 192. The gear 239 (see Fig. 26) is rigid upon a hub 310, fast upon the shaft 113, and in this connection it will be remembered that the gear 239 imparts a rotary movement to the screw by which the ring-supports move longitudinally. The hub 310 is formed with a recessed flange 311, which abuts against the collar or bushing 194. The gear 306 is keyed upon the bushing or collar 194, and it is apertured to receive a pin 311, carrying on one end a clutching-pawl 312 and upon its other end a finger 313, to be engaged by a latch 314. The clutching-pawl 312 enters the annular recess 315 in the flange 316 of the hub 310 and when in one position permits the hub to rotate freely, while the gear 306 is stationary, and it will be observed in this connection that the outer edge of the pawl 312 is in a curve corresponding to the curved face of the recess 315 in the flange 311. (See Fig. 33.) When the finger 313 is engaged by the latch 314, the pawl 312 is held in position to permit the hub 310 to rotate freely without affecting the movement of the gear 306 or bushing 194. In order to at once check the rotation of the gear and bushing immediately upon the engagement of the finger 313 with the latch 314, the pawl 312 is formed with a curved portion 319 to engage the bushing 194. At the same time there is a stop-lever 320, which enters a notch 321 in the gear 306 and holds it against rebounding or reverse rotation. The effect of the engagement of the latch 314 with the finger 313 and the engagement of the finger 320 with the stop-lever 321 is to instantly check the rotation of the gear 306 on the cylindrical support 192 and to lock it positively against movement. In order to connect the gear 306 with the hub 310, and therefore with the rotating shaft 113, the flange 311 is cut away at 322 and is formed with a hardened pin 323 in position to be engaged by the curved end 324 of the clutch 312. The said recess 322 is semicylindrical, its radius being equal to the distance between the center of the pin 311 and the curved end 324 of the pawl 312, the said curved end 324 being struck from the same center with the said radius. A spring 325 is fastened at one end to the finger 313 and its other end to the gear 306, the function of the spring being to swing the finger and rock the pin 311, so as to throw the end

324 of the locking-pawl into the recess 322 when the gear is rotated in position to bring the pawl into position to enter the recess. The curved end 324 enters the recess 322 until the curved side 326 of the other end of the pawl bears against the bushing 194. This clutching mechanism is controlled by the operator, devices being provided whereby only one of the clutches can be operated at a time to start the rotation of the rings and their cylindrical support 192. The latch 314 is fast upon a small shaft 327, journaled in brackets at the back of the bed, there being a handle 328 connected to said shaft, which projects forward in position to be actuated by the operator. The stop-lever 320 is loose upon the shaft 327; but it is connected to the latch 314 by a spring 331, having a loose connection with said latch. This loose connection consists of a headed screw 329, passed into the lever 320 through a hole in the spring 331, said spring being secured to the latch 314 and tending to force the stop-lever away from the latch toward the shaft 113. A strong spring 330 draws the latch forward and tends to cause the latch to engage the finger 313 and the stop-lever 320 to engage the notch 321 in the gear 326. When the handle 328 is raised, the latch is thrown rearward into inoperative position and the stop-lever is held away from the gear, so as to prevent it from "clicking" as the notch passes under it, the spring engaging the head of the screw 329 and drawing said stop-lever rearwardly. From this description it will be apparent that in order to cause the actuation of the cylindrical support and the rings or actuators thereon all that is necessary is to raise the proper lever 328, and means which I shall subsequently describe, automatically engaging the said lever, not only hold it raised to permit the continued rotation of the cylindrical support, but all prevent the actuation of the other of said levers. When the cylindrical support is set in motion, the screw which actuates the interrupter slide or carriage is likewise set in motion.

Referring now once more to the interrupter mechanism, I will describe the means whereby the carriage which carries said interrupters is given a step-by-step movement through the medium of the screw 303.

In Fig. 19 it will be observed that the smooth end of the screw, which passes through the bearing 304, is provided with check-nuts 332, between which and the bearing there is a compression-spring 333, tending to move the shaft axially to the left. Rigidly secured to the bearing 304 is a stationary cam-plate 334, with which a cam 335 on the gear 305 is adapted to engage. The engaging cam-faces are so formed that the shaft is moved during one rotation rapidly to the right and then slowly to the left. The pitch of the cams is such with relation to the pitch of the threads upon the screw 303 that the slow movement of the screw to the left exactly compensates for the movement that would be transmitted to the carriage to the right, and consequently the carriage remains stationary during the time that the screw is moving to the left. When, however, the sharp rises on the cam-faces come in contact, the screw is given a quick movement to the right. The effect of this is to move the carriage with a step-by-step movement for each semirotation of the shaft 113, the relation of the gear 305 to the gear 306 being as one to two. The main purpose of this step-by-step movement of the screw is to hold the interrupters in perfect operative position with relation to the rings 190 and to move said interrupters into operative relation to the said rings in succession. Said carriage 201 is provided with two wings or extensions 336 337, in which are formed vertical bearings for rods 338. These rods are vertically adjustable, being provided with collars 339, adjustably secured thereto, said collars being engaged by clips 340, secured to the bearings. By loosening the screw in the collar, as shown in Fig. 20, the rod 338 may be adjusted vertically with relation thereto, after which the screw is again driven home. The collar is provided with a pin 341, adapted to be held yieldingly against a stop 342 by a torsional spring 343, encircling the lower end of the rod 338 and having one end attached to a collar 334, rigidly secured to the rod, and the other end bearing against the lateral extension 336 of the carriage. This permits a horizontal yielding rotary motion of the rod 338 to allow the rings and their projections to be moved laterally with relation thereto at any time. Upon the upper end of each rod 338 there is a make-and-break device, the movable part of which is actuated by the projecting members or triggers 200 of the rings. The said movable member is indicated at 345 and is pivoted upon a screw 346, passed into a plate 347 of insulating material, secured upon the top of each rod 338. The movable member 345 is itself preferably formed of insulating material, and it has two contacts 348, which normally register with stationary contacts 349 349 on the plate 347. Projecting out from the movable member 345 is a finger 350, with which a spring 351 engages to hold the movable contact yieldingly in position to close the circuit between the contacts 349 349. This finger 350, however, is in juxtaposition to the periphery of an adjacent ring 190 and is adapted to be engaged by the projection 200 thereon, whereby the movable member will be shifted and the contact broken for an instant, the spring 351 immediately returning the movable member to closing position as soon as the projection 200 moves out of engagement with the pin 350.

Each pair of contacts 349 is in electrical con-

nection with one of the electromagnets of the tracker-slide-operating mechanism, and each time a circuit is broken through the smaller coils of one of said magnets the larger coils attract the armature to operate a selector, and thereby operate the rod 287, connected thereto.

The purpose of employing two interrupting devices and their corresponding magnets is the same as that for employing the two electromagnets in the selecting mechanism and the two brushes heretofore described.

A single interrupting device may be employed, in which event I would use but one electromagnet in the tracker-slide-actuating mechanism, and the number of interrupters may be increased to three or more, there being always, however, an equal number of electromagnets. By increasing the number of interrupters the speed of rotation of the rings may be correspondingly decreased.

The two interrupters which I employ are arranged diametrically opposite each other, and their engaging fingers lie in a plane coincident with the axis of the shaft 113, and it is for this purpose of accurately positioning the interrupters that the rods 338 are made vertically adjustable. The carriage for the interrupters receives two impulses for each single rotation of the ring-carrying support, and if the number of interrupters were increased the number of impulses received by the carriage would be similarly increased. By thus placing the interrupters so that they occupy similar relative positions each interrupter will cause the actuation of any one of the trackers according to the set location of the ring upon the cylindrical support.

As has been stated many times herein, the particular location of the rings with respect to the spline is determined by the particular key upon the keyboard which has been depressed, and therefore the particular location of that ring causes the depression of the corresponding key-depressing rod 287 and the actuation of the corresponding key in the typesetting, matrix-making, or linotype machine.

When the rings are rotating, the duplicating-slide-actuating magnets are rotating synchronously therewith and the selectors which are operated by said magnets are sweeping around in front of the slides of the duplicating mechanism. Consequently when the projection upon one of the rings breaks a circuit a selector is set in motion which engages the proper slide and actuates it. The position of the selector or the magnet is exactly the same as the ring, and it rotates, as stated, in unison with the ring, so that the breaking of the circuit through either of the interrupters will effect the actuation of a key-depressing rod corresponding to the character indicated by the position of the ring upon its cylindrical support.

The selector-magnets and the selectors sweep around so rapidly that it is impossible for an operator to break two circuits during a half-revolution of a magnet, and in the present construction of my machine this is an essential requirement. If any one of the composing-keys in the keyboard be held depressed for a certain number of revolutions of the selector-magnets, the corresponding key-depressing rods 287 will be depressed once for each half-revolution of the magnets, and, conversely, the selector-magnets move so rapidly that it will be practically impossible for an operator to break a circuit by the depression of a key without the selector-brush sweeping the section of the commutator with which the key is electrically connected.

As previously stated, the construction of the electromagnetic mechanism for actuating the rods 295 is precisely similar to that shown in Fig. 7, to which reference may be had for the details of construction. The selector which engages the end of the rod 295 is similar to that indicated at 151, and it has fingers like that at 167. Consequently the breaking of one of the circuits through the smaller coil of the magnet causes the larger coil to attract the armature or selector and bring it into alinement with the ends of the rods 295. The rotation of the selector with the magnet causes the actuation of the proper rod. The magnets are mounted upon a disk-like support and they rotate about the axis of the shaft 297.

Instead of employing commutator-sections with brushes sweeping over them I employ collector-rings 351, 352, and 353. The two interrupters are in circuit, respectively, by wires 354 355 with the rings 352 353, which are mounted stationarily upon insulated material secured to the bearing for the shaft 297. To the ring 351 is attached the return-wire 355. The revolving carrier for the magnet carries four brushes, there being two for each magnet. One of the brushes of each pair for the two magnets bears against the ring 351. The other brushes of the two pairs bear against rings 352 353, respectively. The current normally flows through both of the magnets, passing in from the brushes which bear upon rings 352 353 and leaving through the brushes which bear against ring 351. Each interrupter is in series with one of the rings, and therefore one of the magnets; but said interrupters are arranged, however, in multiple in the main circuit.

The interrupters break the circuits to cause the actuation of the magnetic selectors and the operation of the rods 295, which are arranged in proper relation thereto. The machine shown upon the drawings has two composing mechanisms and two transferring mechanisms, each of the latter controlling the single duplicating mechanism, and consequently each pair of interrupters must be

electrically connected with the magnets. The circuits for the transferring mechanism and the duplicating mechanism are indicated diagrammatically in Fig. 1, there being switches at 360 361 for connecting each pair of interrupters with the circuits through the electromagnets of the duplicating mechanism. These switches may be located at any convenient part of the machine where they are accessible to the operators, and in practice I arrange them so that they are controlled by the handle 328, so that when said handle is operated to permit the rotation of the cylindrical support carrying the actuator-rings the circuit is automatically closed through the interrupters corresponding to that set of rings. From this description it will be seen that when the carrier which supports the interrupters is moved longitudinally, so as to bring the interrupters with a step-by-step movement successively into operative relation with the rotating rings, each time one of the projections on the ring engages one or the other of the interrupters the circuit through one or the other of the electromagnets of the transferring mechanism will be broken and the magnetically operated actuator corresponding to the magnet will be caused to operate one of the rods 295 and cause the depression of one of the tracker-rods and a key of the linotype or type-setting machine.

It should be remembered that the rings are automatically set on a cylindrical support in predetermined relation to the commutator-sections of the selector mechanism, and therefore since the electromagnets of the transferring mechanism and the selector mechanism occupy a predetermined relation and rotate in unison when the rings are rotated they move or rotate synchronously with the rotation of the transferring-magnets, starting with a fixed point, and must occupy the same positions relatively to the duplicating-magnets as they did when at rest to the commutator-sections. Therefore the interrupters and the projections on the rings perform substantially the same function in causing the actuation of the duplicating-magnets as do the commutator-sections and the brushes which sweep therearound in the selector mechanism, the only difference being that in the latter the brushes move relatively to the commutator-sections, whereas in the former the rings move relatively to the stationary brushes or interrupters.

I have arranged mechanism to stop the travel of the interrupter-carrier when it has reached the limit of its movement by disengaging the nut-section from the screw, said nut-section, as shown in Fig. 20, being indicated at 302. It is mounted in the carrier 301 and is adapted to be pressed inward by a spring 365. To disengage it from the screw, I employ a small lever 366, which is fulcrumed at 367 and has an upwardly-projecting handle adapted to engage a pin 368 on an angular bar 369, attached to the nut-section 302. (See Fig. 22.) The upper part of the handle or lever may be grasped manually to disengage the nut-section from the screw-bar, so as to slide the carrier relatively thereto in either direction. The lower end of the lever 366 projects downwardly and is beveled to be engaged by the beveled end of a stop 370, attached to the front of the way 300. When the interrupter-carrier reaches the extreme of its movement to the right in Fig. 19, the lever 366 is engaged at its lower end and said lower end is moved inwardly, with the result that the nut-section 302 is forced outwardly to free it from the screw-bar. In order to permit of the locking of the interrupter-carrier with the cylindrical support and the rings, so that the said carrier will be moved to the left as said cylindrical support is fed to the left by its screw bar and nut, I provide the said cylindrical support with a cam catch member 371. (See Figs. 19, 23, and 25.) The end of this catch is curved or beveled upon its end, as indicated at 372, to engage the latch 373. It is pivoted at 374 to the interrupter-carrier 301. When the cylindrical support reaches the extreme of its movement to the right after disengaging all of the rings from the spline, the catch 372 forces downwardly the latch until the said latch is adapted to move upwardly behind the shoulder 374 of the catch, so that when the cylindrical support moves forward the catch through its engagement with the latch will force the interrupter-carrier along with it. This movement, however, of the carrier would be prevented were the nut-sections not moved into disengagement with the screw-bar 303, and hence the catch is beveled at 375 to engage the similarly beveled or inclined surface 376 upon the angular bar 369 to thrust it outward and disengage and thereby move the nut-sections into inoperative position. In order to hold the face of the shoulder 374 of the catch in engagement with the face of the latch, I employ a spring-pressed plunger 377, which is adapted to engage the catch after it has depressed the latch and permitted the latter to spring up under the shoulder. The latch is tensioned by the spring 378, as shown in Figs. 20 and 22. When it is desired that the interrupter-carrier should be moved relatively to the ring, the first rotary movement of the cylindrical support to which the catch is connected disengages the catch from the latch, and consequently the latch and the spring-plunger 377 are moved from the nut-section, so that the carrier is moved by a screw-bar a sufficient distance before the completion of one rotation of the cylindrical support, whereby said parts are out of the way of the catch, and the carrier is therefore free to be moved relatively to the rings. From this description it will be seen that the interrupter-carrier is.

first moved with the cylindrical support to the left in Fig. 19, as the rings are set one by one upon the cylindrical support in predetermined relation to the spline and to the commutator-sections until the cylindrical support reaches the end of its movement, which is variable, of course, according to the number of characters in the line of composition or the number of rings which are set. The number of rings is, however, determined according to a registering mechanism, which I shall hereinafter describe in detail, by which the operator is able to determine when the line is filled. The operator then by lifting the lever 328 starts in motion the transferring mechanism, during which time it will be remembered the cylindrical support and the screw-bar 303 are rotated. The cylindrical support during its rotation is held from axial movement, whereas the interrupter-carrier is moved into operative engagement with the successive rings on the support, starting with the first ring that was set, until the interrupters have been successively caused to register with all of the set rings. When the interrupter has engaged the projection on the last ring, the nut-section is disengaged from the screw-bar 303 by the mechanism which I have just described.

Controlling mechanism—In order to stop the rotation of the cylindrical support and the rings at exactly the desired time after the interrupter has engaged the projection on the last-set ring, I provide the following devices, which are also utilized to prevent the actuation of more than one of the transferring devices at any time. Each lever 328 is provided with a lug 380, projecting laterally from one side, and when the said lever is raised to permit the rotation of the cylindrical support a finger 381 on a movable bar 382 is adapted to slip under the lug and hold the said lever away. This bar or rod 382 is mounted in supports or bearings to permit it to slide in a limited degree, said supports or bearings being attached to the front of the bed. The upper end of each finger is bent or is provided with a small projection, which when the lever is in its lowest position is adapted to slip over the lug and prevent the lever from being raised. The fingers 381 when the levers 328 are all depressed are in inoperative position; but I provide means whereby when one of the levers is raised a bar 382 is moved longitudinally to cause the projections 383 to engage the lugs on the other levers and prevent said lugs from being raised until the lug on the raised lever is disengaged from the projection 383 by the actuation of the machine. Directly beneath each lever there is fulcrumed another lever 385, which is cam-shaped or beveled at its upper end. It bears against a pin 386, projecting rearwardly from the bar 382. A spring 387 tends to move the small lever and the bar or rod 382 to the left. When the levers 328, however, are all depressed, they swing the small levers in a direction to permit the free movement of the bar 382 to the right in Fig. 1 to release the said levers 328. As soon as any one of the handles 328 is raised it relieves the spring-tensioned lever therebeneath, which immediately moves the bar 382 to the left to cause the engagement of the projection 383 with the other handles, and the latter are prevented from being raised. The elevated handle is prevented from dropping by the projection 383 passing under the lug 380 and sustaining it. In order therefore to release the elevated handle, I provide each of the interrupter-carriers with an angular stop 389, adapted to engage with a finger or stop 390 on the rod 382. This stop engages the finger when the interrupter-carrier reaches the end of its movement across the rings, and it moves the bar sufficiently to disengage the projection 383 from the lug 380 and permit the handle 328 to drop, whereupon the cylindrical support is stopped at a fixed point in its motion by the clutch mechanism previously explained. This description makes it clear that as many operators as there are composing mechanisms may work simultaneously in setting up independent lines by selecting the actuator-rings and placing them upon the cylindrical supports. As soon as one of the operators has completed one of his lines he raises the lever 328, which starts the cylindrical support to rotating and sets in motion the interrupter-carrier. The raising of this lever immediately locks all of the other levers 328 against movement, so that the other operators are prevented from using their transferring mechanisms until the first-mentioned operator has duplicated his line upon the linotype-machine. The time taken for the duplication is so short that in actual practice no one operator is compelled to wait more than a few seconds or so before he is able to duplicate his line.

Indicator.—In order that each operator may determine the number and width of characters in the line, so as to divide the words or sentences in a line, I provide a graduated indicator which is automatically operated as the actuators or rings are placed upon the cylindrical support. This mechanism is shown in Figs. 28 and 46 to 52, as well as in Figs. 1 and 2. The flange 316 and the flange 400 of the gear 239 form, as it were, a drum, as shown in Figs. 34, 46, and 48. This drum is provided on its periphery with grooves, part of which are circumferential, as shown in Fig. 52. The circumferential grooves are as many in number as there are different thicknesses of type and spaces and are indicated at 401. The longitudinal grooves may be as many in number as there are keys in each keyboard, although in practice, as will be explained, this number is not necessary. The said longitudinal grooves

are indicated at 402. In each of the grooves 402 there is placed a right-angle slide 403, having a beveled projection 404 at one end and a lug 405 between its ends, said lugs 405 being placed at predetermined distances from the projection 404. Normally the slides are so embedded in the grooves and are so located that the lugs 405 are between the grooves 401; but by moving any one of the said slides longitudinally the lug 405 thereon may be brought to lie in a circumferential groove 401. The projections or heads of the slides are located near the cam 240, which is permitted to rotate once by the electromagnetic escapement mechanism to permit the feeding of the rings into set position upon the longitudinal support. Consequently on said cam 240 is placed a projecting finger 406, which when the cam is held against movement by the stop is in the position shown in Fig. 47 and when the cam is permitted to rotate the said finger, which is beveled, is adapted to engage the head 404 of the slide 403, which happens to be therebeneath, for it will be remembered that the gear 239 rotates continuously. This engagement of the finger with the head 404 cams the slide to bring the lug 405 into one of the grooves 401. Arranged in opposite relation to the drum is the indicator having a graduated scale, and said indicator is fed forward step by step by said lugs 405 as they are moved, respectively, into operative position in the grooves 401. The said indicator is shown at 407, and it consists of a hollow tube, which is graduated, as at 408. A spring 409 is inserted in said tube and tends to draw it to the left in Fig. 46. The said tube is journaled in a bracket 410, attached to the support of the escapement-magnet, as shown in Fig. 47, and it is adapted to be moved in one direction by step-by-step mechanism and in the other direction by the spring 409. To this end it is provided with a loose collar 411, against which and one of the arms of the bracket is placed a spring 412. This collar is provided with a bifurcated pawl 413, having a biting edge which engages the tube when the cam is moved in one direction and slides over it when the collar is moved in the other direction, a spring 414 being utilized to normally hold the biting edge of the pawl against the tube. To prevent the retrograde movement of the tube, there is another similar pawl 415, pivoted upon the bracket 410. In order to disengage both pawls simultaneously to permit the return of the graduated indicator or tube to operative position, I provide a rod 416, having adjustable collars 417 418 to engage fingers on the pawls and simultaneously move them from engagement with the indicator. Between the loose collar 411 and one of the bracket-arms are placed a plurality of cam-couples. Each couple comprises two cams 419 420, the former of which is splined upon the tube and the latter of which is loose thereon. By rotating one of the cams of each couple relatively to the other they will be moved to the right in Fig. 48. Each couple corresponds to one thickness of the type, and if there are, for instance, fifteen different widths of type—such as "L," "A," "M," &c.—there will be just as many couples. The rotary member of each couple is provided with an arm 421, projecting into the groove 401 of the drum and held in that position by a spring 422. (See Fig. 47.) Consequently each time one of the slides 403 is actuated to move its lug 405 in one of the grooves 401 the said lug will when the drum is rotated sufficiently engage one of the arms 421 and rotate the cam connected thereto to force the collar 411 longitudinally of the axis of the indicator-tube, carrying said tube with it one step. The tube is prevented from returning by the pawl 415. In order to return the arm 421 to initial position against a stop-bar 426, I pivot below each arm a lever 427, which is adapted to be engaged by the lug 405 and swinging about its axis force the arm 421 to initial position, as shown in dotted lines in said last-mentioned figure. The slides 403 are returned to normal inoperative position by a comb (indicated as a whole at 428) and attached to the upright 103. This comb is provided with a plurality of teeth 429, lying in the circumferential grooves 401 and having cam-shaped or beveled ends to engage the lugs 405, as clearly shown in Fig. 52. From this description it will be apparent that inasmuch as the drum is rotating in unison with the selector-magnets of the composing mechanism the actuation of the escapement-magnet to permit the feeding of a ring upon the spline will cause the actuation of one of the slides 403 corresponding to the width of the character upon the key which was depressed to actuate the selector-magnet, and consequently the indicator will be advanced one step, the length of the step corresponding to the width of the type or the character referred to. Thus the indicator has a variable movement, and it is advanced step by step to indicate to the operator the length of the line being composed, so that he is able to determine at a glance the number of spaces in the line which have been filled and the number which remain unfilled.

I have stated that I may employ as many slides 403 as there are keys in the keyboard; but to reduce the number of slides I may vary the width of as many of the heads 404 as represent the same thickness of letters coming together side by side, as indicated in Fig. 51, in which event each head 404 would cover a certain number of the longitudinal grooves 402, and of course the keys and the selector-slides for the various characters would have to be grouped according to the thicknesses of the different characters.

It is unnecessary to relate the operation of the machine, as a description of the operation has been given in detail hereinbefore.

It will be understood that many of the parts which I have shown and described may be replaced by mechanical or electrical equivalents without departing from the spirit and scope of the invention, for many of the features of the machine may be varied without materially affecting its operation one way or the other. For instance, in Figs. 38, 39, 44, and 45 I have illustrated another form of selector-magnets, which may be employed with equal facility. In this case the selectors 500 are journaled upon bushings 501, mounted to rotate upon radial shafts 502 on the rotary support 503. The bushing 501 is threaded to receive an adjustable nut 504, between which and the selector there is placed a spring 505. The bevel-gear 506 is mounted to rotate upon the bushing 501, being in engagement with the stationary bevel-gear 158, heretofore referred to. The selector is frictionally engaged with the gear 506 by a spring 505 and a friction-disk 507, so that unless the said selector is held against movement it will rotate with the bevel-gear 506. The two compound magnets, however, operate to hold their respective selectors against rotation, except when the circuit is broken through the larger coils of said magnets. Said magnets are not radially disposed, as shown in Fig. 7, but are arranged in parallelism and tangentially to a circle inscribed about the axis of a shaft 113. The said magnets have a common armature 508 placed between the larger coils 509 and the smaller coils 510. The said armature is on a plunger 511, which is formed with a notch 512. When the armature 508 is engaged with the larger magnet, the lower wall of the notch engages the shoulder 513 on a projection 514, secured to the actuator 500; but when the circuit through the larger coil 509 is broken and the plunger is withdrawn the shoulder 513 is freed and the selector is permitted to make one rotation. The current is restored through the larger coil, as previously described, almost instantly after it is broken. In order, therefore to restore the plunger to operative position, the projection 514 has a bevel end 515, which engages the upper wall of the notch 512, raising said plunger and bringing the lower wall of the notch into position to engage the shoulder 513. This arrangement provides a relatively simple wiring or arrangement of circuits, as indicated in Figs. 44 and 45, in which the smaller coils of one magnet are connected with the larger coils of the other magnet. Many other modifications and changes will suggest themselves to those skilled in the art to which this invention broadly relates.

Having thus explained the nature of the invention and described a way of constructing and using the same, although without attempting to set forth all of the forms in which it may be made or all of the modes of its use, I declare that what I claim is—

1. A machine of the character described comprising a plurality of key-actuated composing mechanisms, and mechanism adapted to coact with any one of said composing mechanisms to operate the keys of a keyboard.

2. A machine of the character described, comprising key-actuating mechanism, a plurality of sets of actuators, selecting mechanism for each set of actuators, and means whereby each set of actuators when selected causes the actuation of said key-actuating mechanism.

3. In combination, a machine having a keyboard and a machine of the character described comprising a composing mechanism for composing a line of matter by successive selections, and mechanism for actuating the keys of said keyboard-machine to reproduce said line of matter after said line has been completed.

4. A machine of the character described comprising mechanism for selecting a line of actuators successively, and side by side and mechanism controlled by said actuators when the line thereof is complete for actuating the keyboard of a finger-key-actuated machine.

5. A machine of the character described comprising a keyboard, a plurality of actuators successively selected by the keys on said board, means for arranging said actuators side by side and mechanism coacting with said actuators after the selection of a line is completed for operating the keys of a finger-key-actuated machine.

6. A machine of the character described comprising mechanism for actuating the keys of a keyboard, manually-selected actuators for controlling said actuating mechanism, to cause the actuation of said keys in the order of the selection of the actuators, and provisions whereby a line or group of successively-selected actuators arranged side by side is complete before the key-actuating mechanism is operated.

7. A machine of the character described comprising mechanism for actuating the keys of a keyboard, a plurality of actuators for controlling said mechanism, and means including a plurality of keys and mechanism controlled thereby for selecting and positioning said actuators side by side in a line to represent a line of printed matter.

8. A machine of the character described comprising mechanism for actuating the keys of a keyboard, and a plurality of sets of actuators, each set having an independent control over said mechanism.

9. A machine of the character described comprising mechanism for actuating the keys

of a keyboard, and a plurality of independent composing mechanisms for independently coacting with said actuating mechanism to cause the actuation of said keys in predetermined order.

10. A machine of the character described comprising a plurality of composing mechanisms, each including a plurality of manually-selected actuators, and a duplicating or key-actuating mechanism adapted to coact singly with the actuators of each composing mechanism.

11. A machine of the character described comprising a plurality of independent key-actuated selectors, a series of actuators adapted to be selected by each of the selectors, and a key-actuating mechanism adapted to coact with each series of actuators independently.

12. A machine of the character described comprising a mechanical line composed of a plurality of successively-selected actuators arrangeable into side-by-side alinement in predetermined relation, and key-actuating mechanism controlled by said actuators.

13. A machine of the character described comprising a composing mechanism including a plurality of keys, and a mechanical line of actuators arrangeable successively into a line and side by side according to the order of selection of said keys, and a key-actuating mechanism controlled by said line of actuators.

14. A machine of the character described comprising a composing mechanism including a plurality of keys, and a line of actuators each of which is under the domination of all of said keys, and key-actuating mechanism whereby said actuators may select the keys of a keyboard according to their own selection and arrangement.

15. A machine of the character described comprising a composing mechanism including a plurality of keys, and a line of rotary actuators successively positioned in order to represent a line of printed matter by said keys and key-actuating mechanism by which the keys of a keyboard may be subsequently selected according to the order of selection of said actuators.

16. A machine of the character described comprising a plurality of keys, a series of rotary actuators which are adapted to be successively positioned in order in predetermined relation to a fixed line by any one of said keys, and mechanism whereby said actuators cause the actuation of other keys in a keyboard.

17. A machine of the character described comprising a line of actuators normally free to rotate on a common axis, selecting mechanism for positioning said actuators in succession; whereby when said actuators are positioned they constitute a dummy line of matter and key-actuating mechanism controlled by said line.

18. A machine of the character described comprising a mechanical line of actuators successively prearrangeable side by side according to the will of the operator to indicate or represent a line of printed matter, and automatic mechanism whereby said actuators cause the actuation of those keys of a keyboard which correspond to the characters in said line of printed matter.

19. A machine of the character described comprising a mechanical line of actuators, an electromagnetic selector for said actuators, keys and key-circuits for effecting the actuation of said selector, and means for holding said actuators in their selected positions until the selection of any predetermined number thereof is complete.

20. A machine of the character described, comprising a series of rotatable actuators, stops arranged about the axis of said actuators so as to stop said actuators at any predetermined position, a series of keys, and a selector controlled by said keys to operate any one of the stops.

21. A machine of the character described comprising a series of rotatable actuators, stops arranged to arrest said actuators at any desired position, a selector to actuate said stops and electromagnetic mechanism for controlling said selector.

22. A machine of the character described comprising a series of actuators in circular form, a series of stops arranged in a circle, and a key-governed selector rotatable in proximity to said stops and adapted to operate them in any predetermined order.

23. A machine of the character described comprising a series of actuators, a series of setting-stops having their ends arranged in a circle, a rotatable carrier in proximity to said stop ends, and a key-controlled selector on said carrier for said stops.

24. A machine of the character described, comprising a plurality of independent composing mechanisms each including a dummy line adapted to be set up according to the will of the operator, a single key-actuating mechanism adapted to coact with said dummy lines, and means whereby said dummy lines can be placed in operative relation to said key-actuating mechanism only one at a time.

25. A machine of the character described, comprising a single key-actuating mechanism, a plurality of composing mechanisms, and intervening mechanisms adapted to coact with said composing mechanism for effecting the actuation of the key-actuating mechanism.

26. A machine of the character described, comprising a plurality of series of actuators adapted to be set in any predetermined relation, and a key-actuating mechanism adapted to coact with and be controlled by each of said series of actuators.

27. A machine of the character described,

comprising a plurality of keys adapted to be selected and actuated in succession, by an operator, a series of actuators adapted to be selected and set in succession by said keys until a line is formed, and key-actuating mechanism controlled by said actuators in succession to depress a series of keys, whereby the last-mentioned keys are automatically actuated in the same order that the first-mentioned keys were actuated.

28. An attachment for a linotype, typesetting, matrix-making or analogous keyboard machine having mechanism including a plurality of separate sets of actuators and separate keyboards whereby a series of operators may independently and simultaneously set up dummy lines of matter, and one at a time cause the actuation of the keys of said machine, thereby permitting several operators to be working at a single keyboard-machine.

29. A machine of the character described, comprising an electromagnetic key-actuating mechanism, in combination with a selective line of actuators, and electrical transferring mechanism coacting with said actuators and said key-actuating mechanism.

30. A machine of the character described, comprising an electromagnetic composing mechanism, including a keyboard, and electromagnetic selectors controlled thereby an electromagnetic key-actuating mechanism and electrical connections between said mechanisms.

31. A machine of the character described, comprising a composing mechanism including a selective line of actuators arranged side by side, means for successively selecting said actuators to represent a line of printed matter, and a key-duplicating mechanism including a plurality of key-operating members whose selection and operation is controlled by the said actuators.

32. A machine of the character described, comprising a composing mechanism including a selective line of actuators adapted to be arranged side by side, means for successively selecting said actuators to represent a line of printed matter, and a mechanism including a plurality of key-operating members, and a selector for selecting and operating said members controlled by the actuators.

33. A machine of the character described comprising a composing mechanism including a plurality of actuators, each having an operative member, and means for successively selecting and controlling the positions of the members in a line to represent a line of printed matter whereby each actuator represents one character according to its position, and a mechanism including a plurality of key-operating members, and intervening mechanism controlled by the operative members of said actuators for operating said last-mentioned key-actuating members.

34. A machine of the character described comprising a composing mechanism including a line of actuators and selecting means therefor, and a key-actuating mechanism including a plurality of key-operating members, a carriage movable along the line of actuators and provisions of which a part is on said carriage, for actuating said members.

35. A machine of the character described comprising a dummy having stops as described, key-actuating members, and mechanism coacting with said stops successively to actuate said members.

36. A machine of the character described comprising a dummy having stops, as described, and selecting mechanism for positioning said stops, key-actuating members, and electromagnetic selecting mechanism for said members controlled by said dummy.

37. A machine of the character described comprising a plurality of dummies whose parts are prearrangeable, and a plurality of selecting mechanisms for said dummies, in combination with a set of key-actuating members controlled by each of said dummies.

38. A machine of the character described comprising a plurality of dummies whose parts are prearrangeable, and an independent selecting mechanism for each dummy, in combination with a series of key-actuating members, and electromagnetic mechanism controlled by each dummy for actuating said members.

39. A machine of the character described comprising a plurality of selectors, a dummy whose parts are prearrangeable, a set of key-actuating members, a set of keys corresponding to said member, and provisions whereby one of the selectors controls the parts of the dummy and the other selector is controlled by the dummy to actuate the said members, said instrumentalities being arranged and related whereby the actuation of the keys in a predetermined order effects, through the said instrumentalities, the actuation of said members in the same order.

40. A machine of the character described comprising a plurality of prearrangeable parts or members and selecting mechanism therefor including a plurality of keys, a series of electric circuits one for each key, and an electromagnetic selector governed by each circuit.

41. A machine of the character described comprising a plurality of circuits, a stationary commutator whose sections are respectively arranged in said circuits, and a rotary electromagnetic clutch having a brush which contacts with said sections respectively.

42. A machine of the character described comprising a dummy consisting of a plurality of rotary members, each having a stop; a series of stop members equal in number to said keys and arranged to engage the stops on the rotary members successively, a stationary

commutator whose sections are arranged in said circuits respectively, and a rotary magnetic clutch having provisions whereby a change in any one of said circuits causes said clutch to operate a corresponding stop member and position a rotary member of the dummy.

43. A machine of the character described comprising a plurality of rotary members each having an external stop, and a series of internal notches, a stationary support provided with a spline, and means for stopping said members one by one in predetermined positions and feeding them on said spline whereby they are subsequently held against rotary motion relatively thereto.

44. A machine of the character described comprising a plurality of rotary members, a plurality of selector-slides, means for actuating said slides in any predetermined order, and means for resetting said slides.

45. A machine of the character described comprising a plurality of rotary members, means for feeding said members axially with a step-by-step movement, devices for stopping said members against rotation one by one, and selector mechanism controlling said stopping devices and said feeding means.

46. A machine of the character described comprising a plurality of rotary members, means for feeding said members axially with a step-by-step movement, devices for stopping said members against rotation one by one, selector mechanism controlling said stopping devices and said feeding means, and means for returning said members to initial position.

47. A machine of the character described comprising a plurality of rotary members, devices for stopping said members one by one against rotation, means for feeding said members in one direction including a pawl and ratchet-bar, and a screw-driven carriage for feeding said members in the opposite direction.

48. A machine of the character described comprising two synchronously-moving selectors, a series of keys controlling the operation of one selector, a series of key-actuating members for operating on the keys of a keyboard and under the control of the other selector, and operative mechanism between said selectors, said instrumentalities being arranged and combined whereby the actuation of the keys effects the operation of the key-actuating members.

49. A machine of the character described comprising a line of prearrangeable actuators, a series of key-operating members, and intervening mechanism including an operative part movable longitudinally of said line of actuators.

50. A machine of the character described having a carriage, a nut on said carriage, a rotary screw-bar, and means for longitudinally reciprocating said bar, with the effect that the carriage receives an intermittent step-by-step movement.

51. A machine of the character described comprising a carriage having a nut, a rotary screw-bar engaged with said nut, a stationary cam, a coacting cam on the screw-bar, and means for rotating said screw-bar with the effect that the coaction of the cams and the rotation of the screw-bar cause the carriage to be actuated with a step-by-step movement.

52. A machine of the character described comprising a cylindrical support, a plurality of rotary members adapted to be set in order on said support, and means for rotating said support when said members are set thereon.

53. A series of elements to be actuated selectively, a selector movable in a cycle into potential coacting relation with each of said elements in succession, and electromagnetic means to cause the coaction of said selector with any of said elements when in such coacting relation.

54. A series of movable elements to be actuated selectively, a selector adapted to mechanically move said elements and movable in a cycle into potential coacting relation with each of said elements in succession, and electromagnetic means to cause the coaction of said selector with any of said elements when in such coacting relation.

55. A series of movable elements, a selector moving in potential coacting relation with said elements for effecting the actuation of said elements in any predetermined order, and electromagnetic means to cause the coaction of said selector with any of said members.

56. A series of members, a selector movable into coacting relation with each of said members in succession, and electromagnetic mechanism including a clutch adapted to produce the coacting relation of said selector with any of said members.

57. A circularly-disposed series of members to be actuated selectively, a selector mounted to revolve into potential coacting relation with each of said elements in succession, and means to cause the coaction of said selector with any of said elements when in such coacting relation.

58. A circularly-disposed series of selective elements, a selector revoluble into potential coacting relation with said elements in succession, an electromagnetic clutch revoluble with said selector to cause the actuation thereof and the consequent operation of an element, an electric circuit for said clutch, and a circuit-controller.

59. A circularly-disposed series of selective elements, a selector revoluble into potential coacting relation with said elements successively and also rotatable into coaction with said elements, and means for causing the ro-

tation of said selector into such coaction with any of said elements.

60. A circularly-disposed series of selective elements, a selector revoluble into potential coacting relation with said elements successively and also rotatable into coaction with said elements, a rotatable revoluble clutch normally disconnected from said selector, and means whereby said clutch causes the rotation of said selector into coaction with any of said elements.

61. A circularly-disposed series of selective elements, a concentric gear, a pinion mounted to revolve and rotate in mesh with said gear, a selector mounted to revolve with said pinion into potential coacting relation with each of said elements, and means for clutching said selector with said pinion to cause said selector to rotate with said pinion and actuate an element.

62. A circularly-disposed series of selective elements, a concentric gear, a pinion mounted to revolve and rotate in mesh with said gear, a selector mounted to revolve with said pinion into potential coacting relation with each of said elements, and electromagnetic mechanism including an electromagnetic clutch for clutching said selector to said pinion at will.

63. A series of selective elements, a selector movable in a cycle into potential coacting relation with said elements in succession, a series of controlled electric circuits for effecting the coaction of the selector, with any of said elements, a circuit-controller synchronized with said selector for rendering each of said circuits in succession, and means for operating said circuits.

64. A series of selective elements, a selector movable in a cycle into potential coacting relation with said elements in succession, a series of controlled electric circuits for effecting the coaction of the selector, with any of said elements, means for operating the circuits, and a controller comprising a fixed commutator whose segments are included in the respective circuits, and a revolving brush synchronized with the selector and adapted to render each of said circuits operative in succession.

65. A series of selective elements, a selector movable in a cycle into potential coacting relation with said elements in succession, a series of controlled electric circuits for effecting the coaction of the selector, with any of said elements, means for operating the circuits, and a controller comprising a fixed commutator whose segments are included in the respective circuits, a revolving brush for rendering said circuits successively operative, and gearing for effecting a synchronous revolution of the selector and the brush.

66. A series of elements to be actuated selectively, a mechanical selector movable in a cycle into potential coacting relation with said elements in succession, electromagnetic means to produce the coaction of said selector with any of the elements, a series of circuits for operating said means, and a controller for said circuits synchronized with the selector by a positive mechanical connection.

67. A circularly-disposed series of elements to be actuated selectively, a selector mounted to revolve concentrically therewith and to rotate into coaction with any of said elements, clutch parts adapted to have a frictional engagement and a relative sliding movement when frictionally engaged, one of said parts being continuously rotated, and the other connected to the selector, means to connect and disconnect said clutch parts, and an automatic stop acting to position the selector while the clutch parts are engaged.

68. A circularly-disposed series of elements to be actuated selectively, a concentric gear, a pinion to revolve and rotate in mesh with said gear and having a clutch part, a selector mounted to revolve with said pinion into potential coacting relation with each of said elements in succession, and having a complemental clutch part, the said clutch parts when connected causing the selector to reproduce the rotary movement of the pinion, whereby the said elements are actuated, and means to connect and disconnect the clutch parts.

69. A circularly-disposed series of elements to be actuated selectively, a concentric gear, a pinion mounted to revolve and rotate in mesh with said gear and having a clutch part, a selector mounted to revolve with said pinion into potential coacting relation with each of said elements in succession, and having a complemental clutch part, the said clutch parts when connected causing the selector to reproduce the rotary movement of the pinion, whereby the said elements are actuated, means to normally disconnect the clutch parts, and an electromagnet mounted to revolve with the selector and pinion and adapted to connect the clutch parts.

70. A machine of the character referred to, comprising a mechanical line whose parts are selectively prearrangeable side by side, selecting mechanism for said line, a register controlled by said selecting mechanism for denoting aggregate thicknesses of the characters represented by the parts in said line, and means for effecting a variable movement of said register.

71. A machine of the character referred to, comprising a mechanical line of selective rotary members, and an indicator for automatically indicating the presence of said members as they are added to the line.

72. A machine of the character referred to comprising a mechanical line of selective members representing the characters in a font of type, means for selecting and placing

said members side by side in a line, and an indicator mechanism controlled by said selector and including a scale and means for indicating on said scale the width of each character as the member corresponding thereto is added to the line.

73. A machine of the character referred to comprising a mechanical line of selective members representing the characters in a font of type, means for selecting and placing said members in a line, an indicator, and a plurality of devices controlled by said selecting means and each adapted to operate said indicator.

74. A machine of the character referred to comprising a mechanical line of selective members representing the characters in a font of type, means for selecting and placing said members in a line, an indicator, a plurality of devices corresponding to the characters of different widths, and means for actuating said devices and thereby operating said indicator, as the said members are selected and added to the line.

75. A machine of the character referred to comprising a mechanical line of selective members representing the characters in a font of type, means for selecting said members, means for placing said members side by side in a line, and a line-indicator controlled by said selecting means and operated by said placing means.

76. A machine of the character referred to comprising a mechanical line of selective members representing the characters in a font of type, means for selecting and placing said members in a line, an indicator, a plurality of independent cam-couplers for operating said indicator, and means for actuating said cam-couplers as said members are added to the line.

77. A machine of the character described comprising a mechanical line of selective elements adapted to be placed one by one into set position side by side in a single row, selector mechanism for said elements, and an escapement mechanism for said elements controlled by said selector mechanism.

78. A machine of the character described comprising a mechanical line of selective rotary elements, selector mechanism and an electromagnetic mechanism for feeding said elements into set position.

79. A machine of the character described comprising a mechanical line of selective elements, selector mechanism and an escapement mechanism for locating said elements in the selected positions.

80. A machine of the character described comprising a mechanical line of rotary selective elements, selector mechanism for selecting the positions of said elements, and escapement mechanism including an electromagnetically-controlled clutch.

81. A machine of the character described comprising a support, a series of selective elements on said support, a selector mechanism for said elements, and an escapement mechanism for feeding said elements, including a rotary member, an operating member, and means for permitting said operating member to rotate with said rotary member upon the operation of the selector mechanism.

82. A machine of the character described comprising a support, a series of selective elements on said support, a selector mechanism for said elements, and an escapement mechanism for feeding said elements, including a cam, a wheel frictionally clutched thereto, and an electromagnetic stop for said cam controlled by the selector mechanism.

83. A machine of the character described comprising a series of rotary selective elements, electromagnetic selector mechanism for selecting the position of each element, and mechanism for feeding said elements when selected, including an escapement, an electromagnetic stop under control of the selector mechanism for controlling said escapement, and means whereby said escapement mechanism is operated after the element is selected.

84. A machine of the character described comprising a cam, a rotary member clutched thereto, and an electromagnetic stop for said cam, said stop including a compound electromagnet having its armatures operatively connected together.

85. A machine of the character described having an escapement including an electromagnetic stop consisting of oppositely-arranged magnets of different strengths, armatures connected together to be attracted in opposite directions, means for temporarily closing the circuit through the stronger magnet, and means for mechanically moving the armature of said weaker magnet to operative position.

86. A machine of the character described comprising a series of rotary selective elements, adapted to be set in a line, an escapement therefor including a rotary member, an electromagnetic stop, and a plurality of key-controlled circuits each of which controls said electromagnetic stop.

87. A plurality of rotary members prearrangeable selectively, a cylindrical support on which said members are rotatively mounted, and an inner cylinder on which said support is longitudinally movable, said inner cylinder having means for holding said members against independent rotation.

88. A plurality of rotary members prearrangeable selectively, a cylindrical support on which said members are free to rotate, an inner cylinder on which said support is longitudinally movable, said cylinder having means for holding said members against in-

dependent rotation, means for feeding said support, and means for rotating said cylinder and support.

89. A plurality of rotary members prearrangeable selectively, a cylindrical support on which said members are free to rotate, an inner cylinder on which said support is longitudinally movable, said cylinder having means for holding said members against independent rotation, a rotary shift on which said cylinder is mounted, and a clutch between said shift and said cylinder.

90. A plurality of selectively prearrangeable rotary members, each having a stop, a series of slides arranged in a cycle, a selector movable in potential coacting relation with said slides in succession, and means for effecting the coaction of said selector with any one of slides to cause it to engage the stop of a rotary member to position the latter.

91. A plurality of selectively prearrangeable rotary members, each having a stop, a series of slides arranged in a cycle, a selector movable in potential coacting relation with said slides in succession, means for effecting the coaction of said selector with any one of slides to cause it to engage the stop of a rotary member to position the latter, and means for resetting said slides.

92. The combination with a support, of a selector-slide having a shoulder resting on one wall of said support, and a spring bearing against another wall of said support, whereby a longitudinal movement of said slide disengages said shoulder and permits the spring to act.

93. A selective element adapted to form a part of a variable mechanical line and consisting of a ring having a disappearing or movable stop.

94. A selective element adapted to form a part of a variable mechanical line and consisting of a ring having a spring-pressed stop which may be depressed substantially flush with the periphery of said ring.

In testimony whereof I have affixed my signature in presence of two witnesses.

ERL V. BEALS.

Witnesses:
MARCUS B. MAY,
E. BATCHELDER.