

No. 633,309.

Patented Sept. 19, 1899.

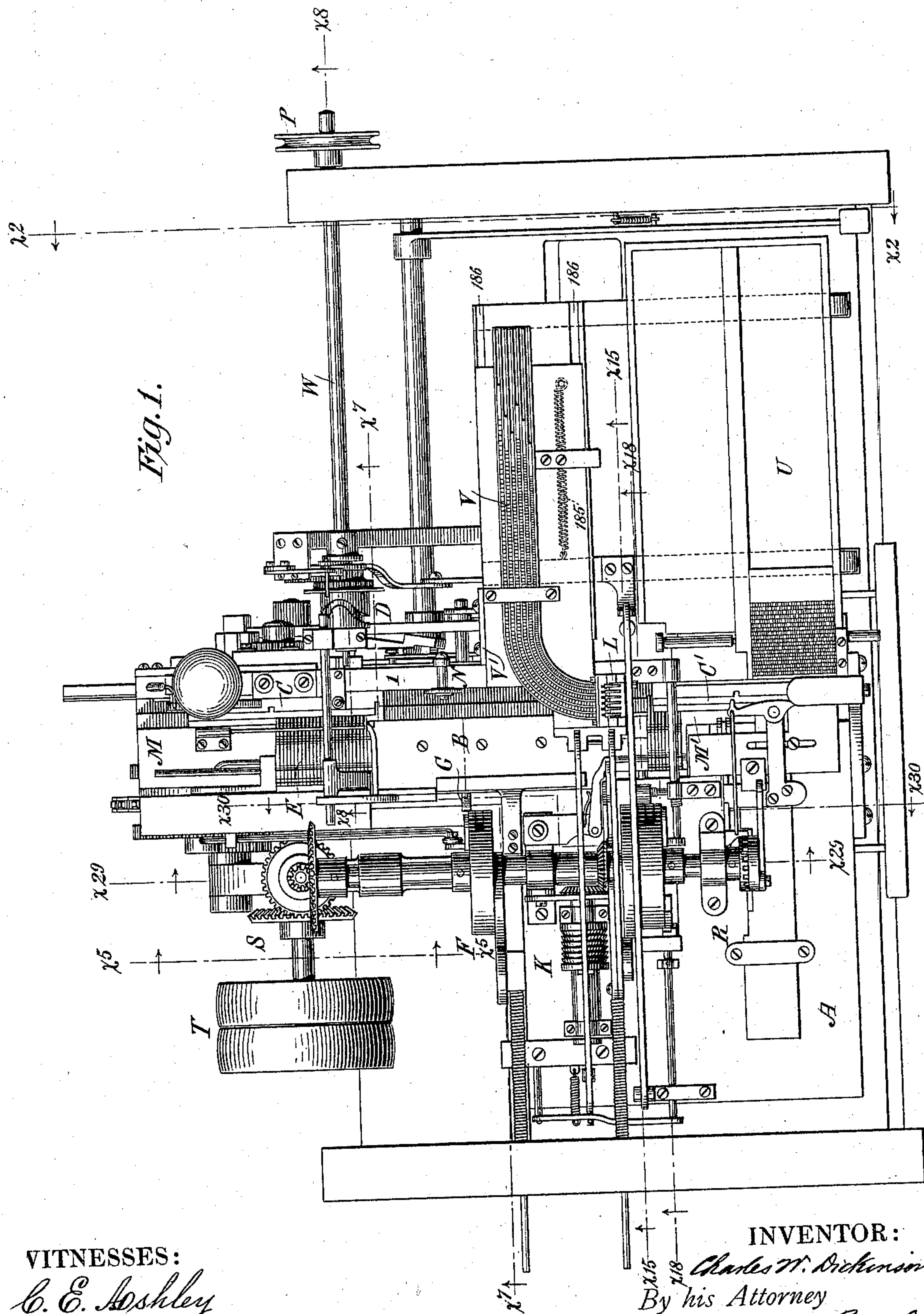
C. W. DICKINSON.

MACHINE FOR JUSTIFYING AND SPACING TYPE.

(Application filed June 15, 1898.)

27 Sheets—Sheet 1.

(No Model.)



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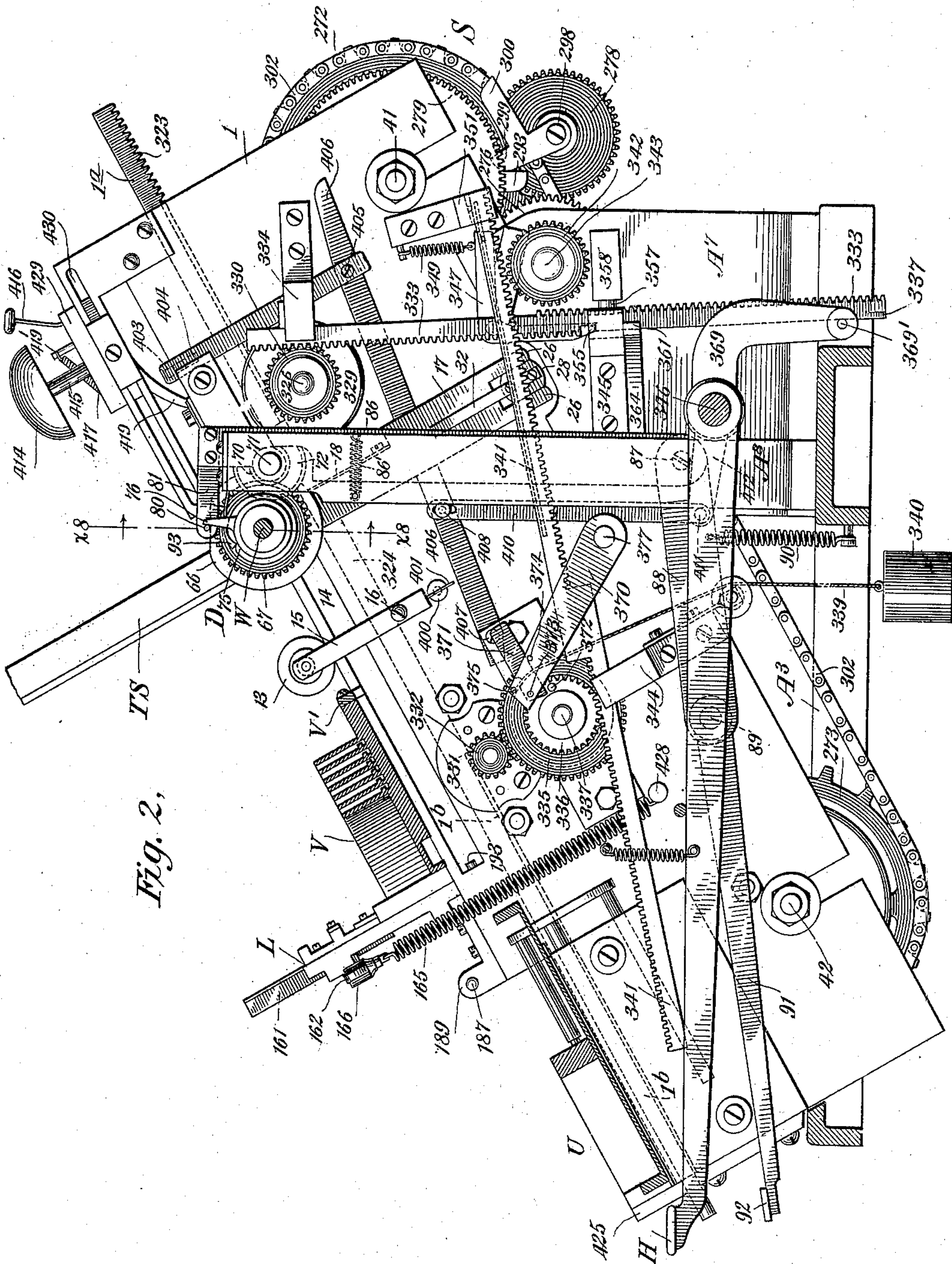


Fig. 2.

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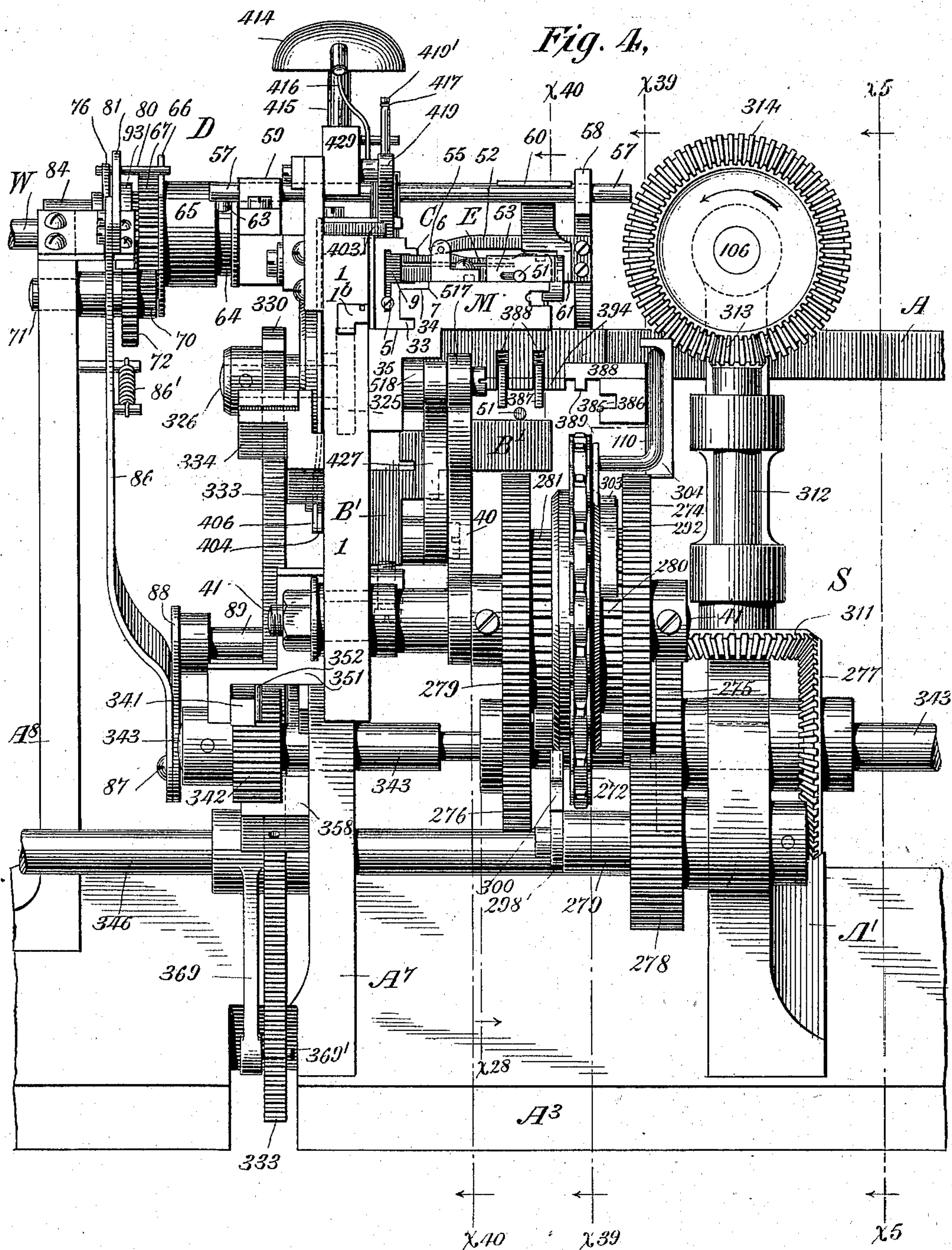
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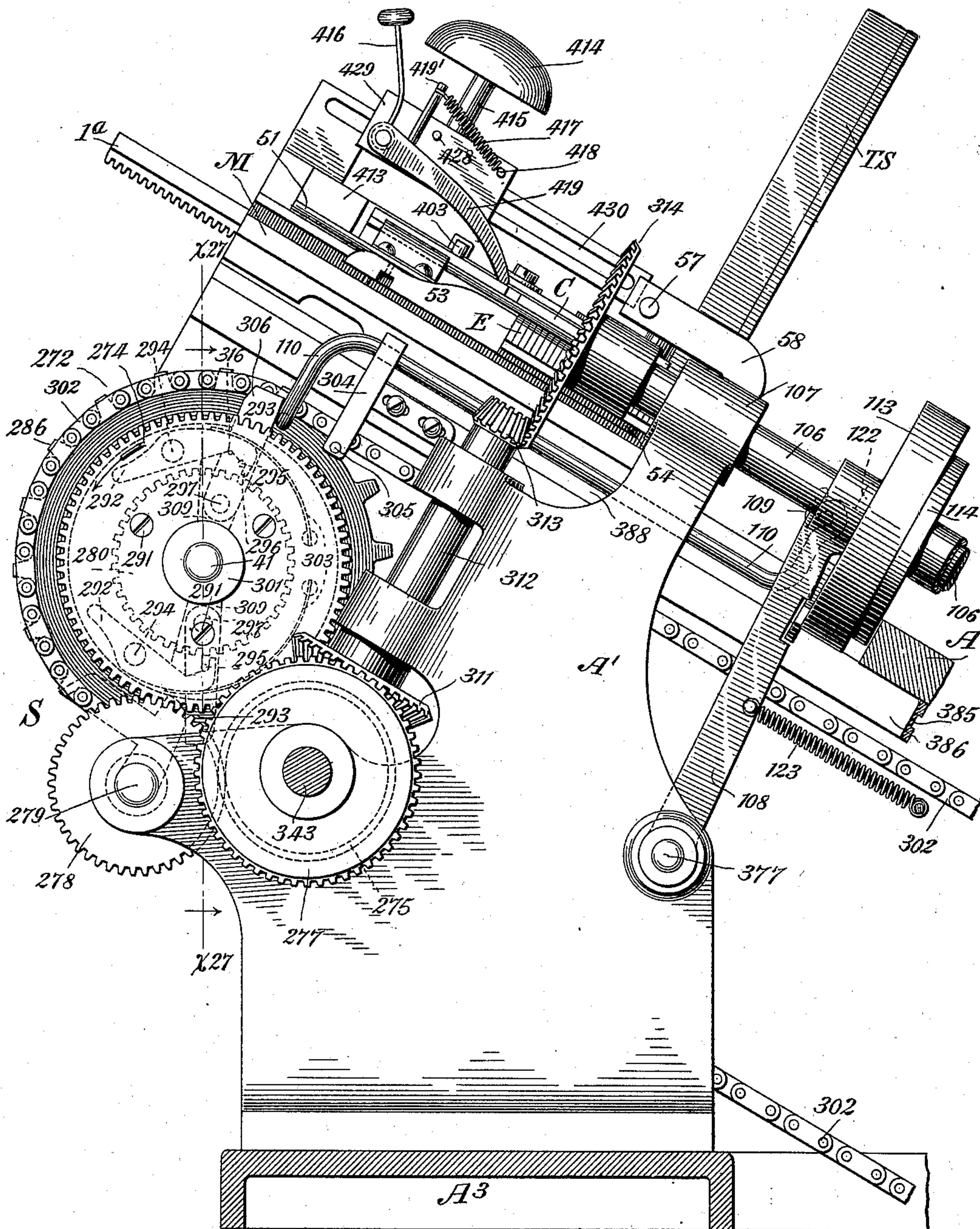
MACHINE FOR JUSTIFYING AND SPACING TYPE.

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(No Model.)

27 Sheets—Sheet 5.

Fig. 5.



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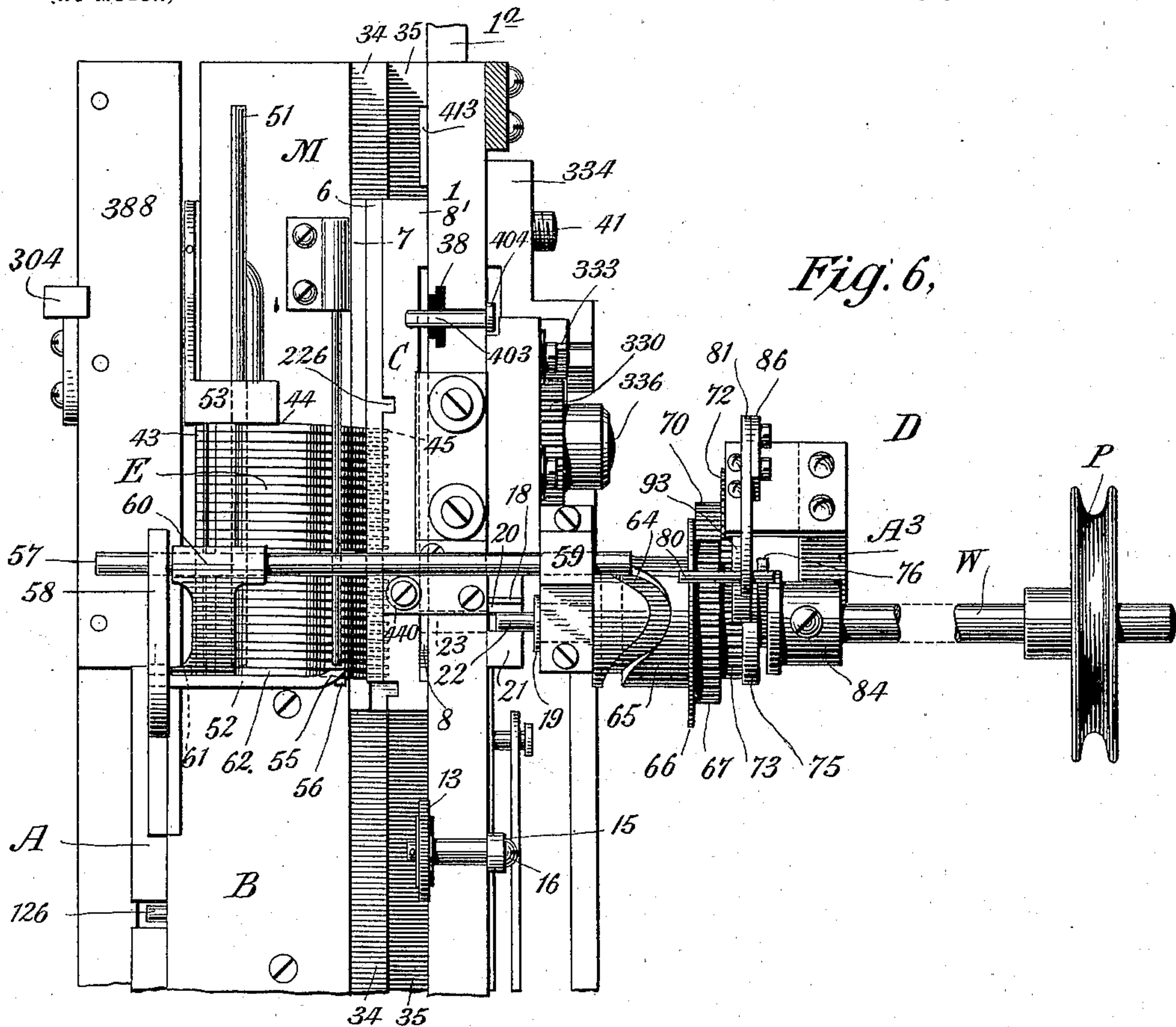


Fig. 8,

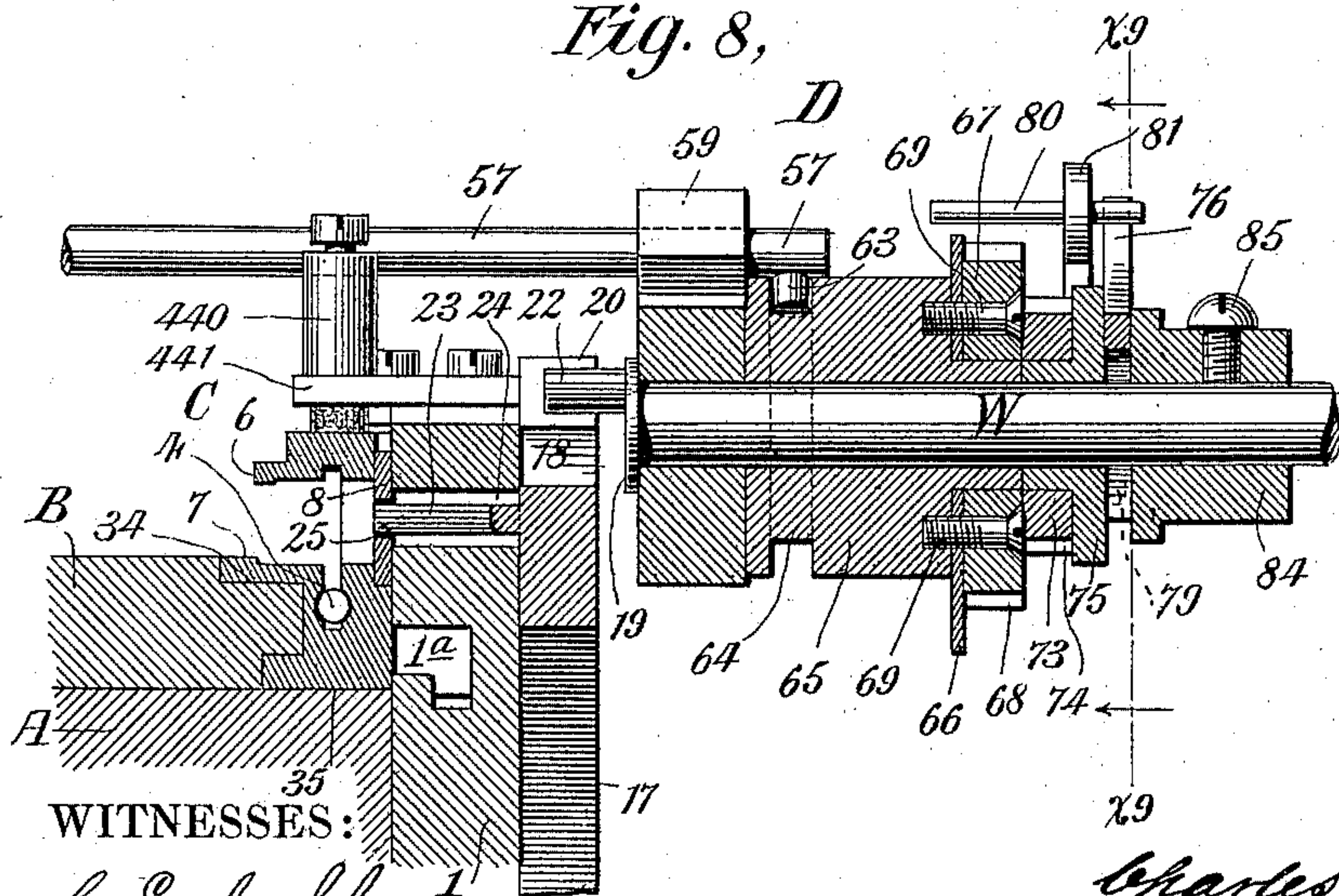
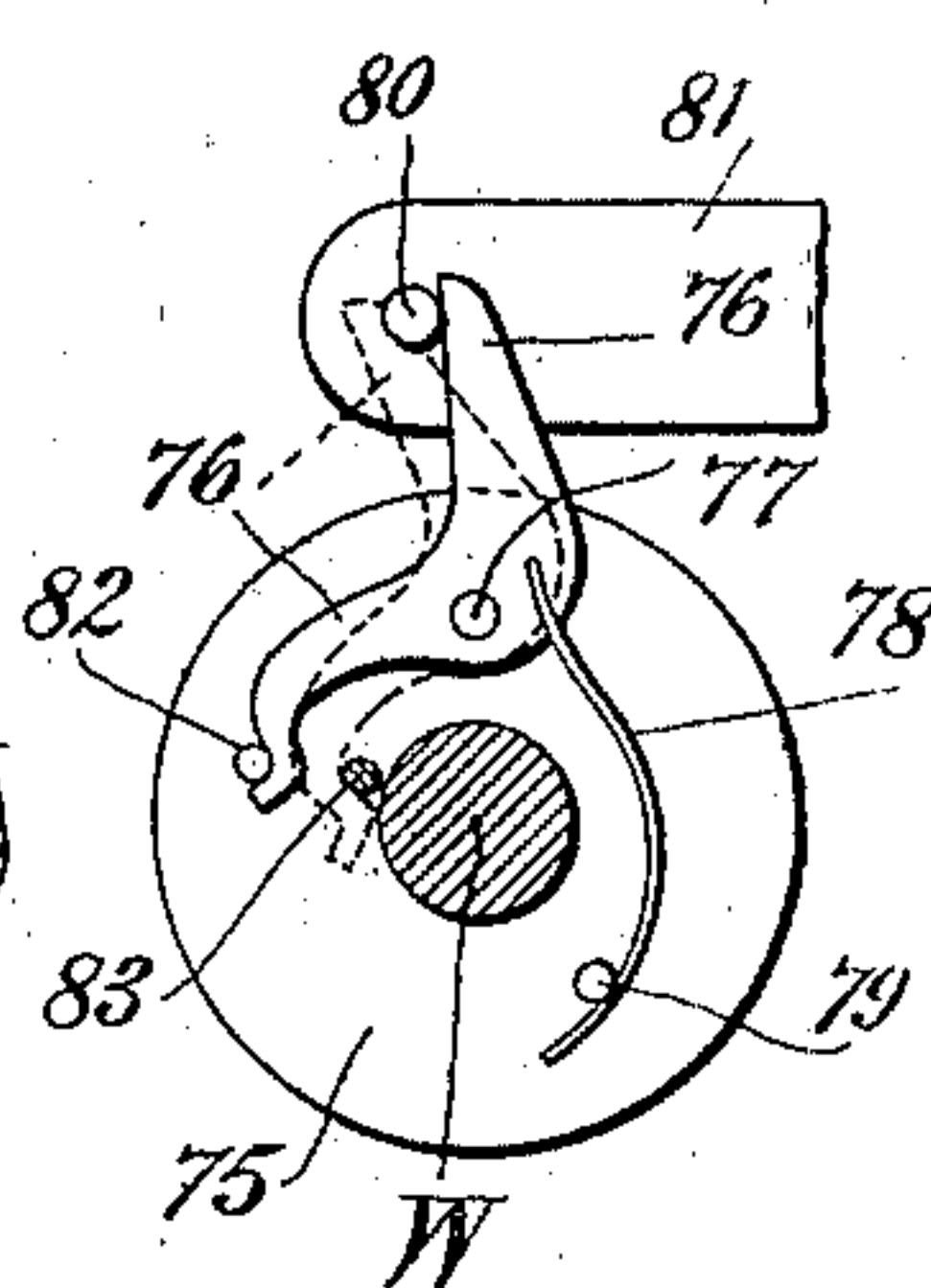


Fig. 9,



WITNESSES:

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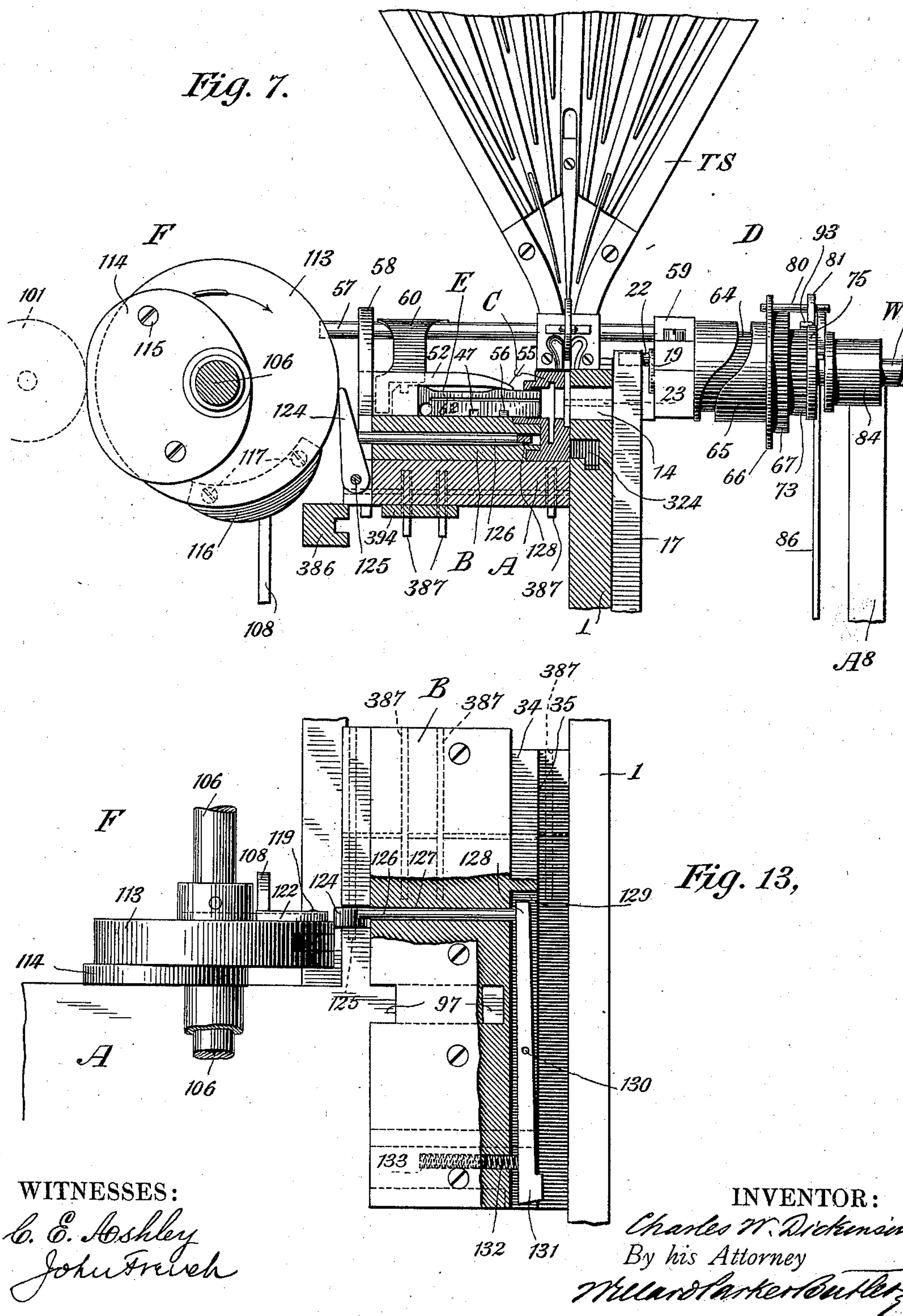
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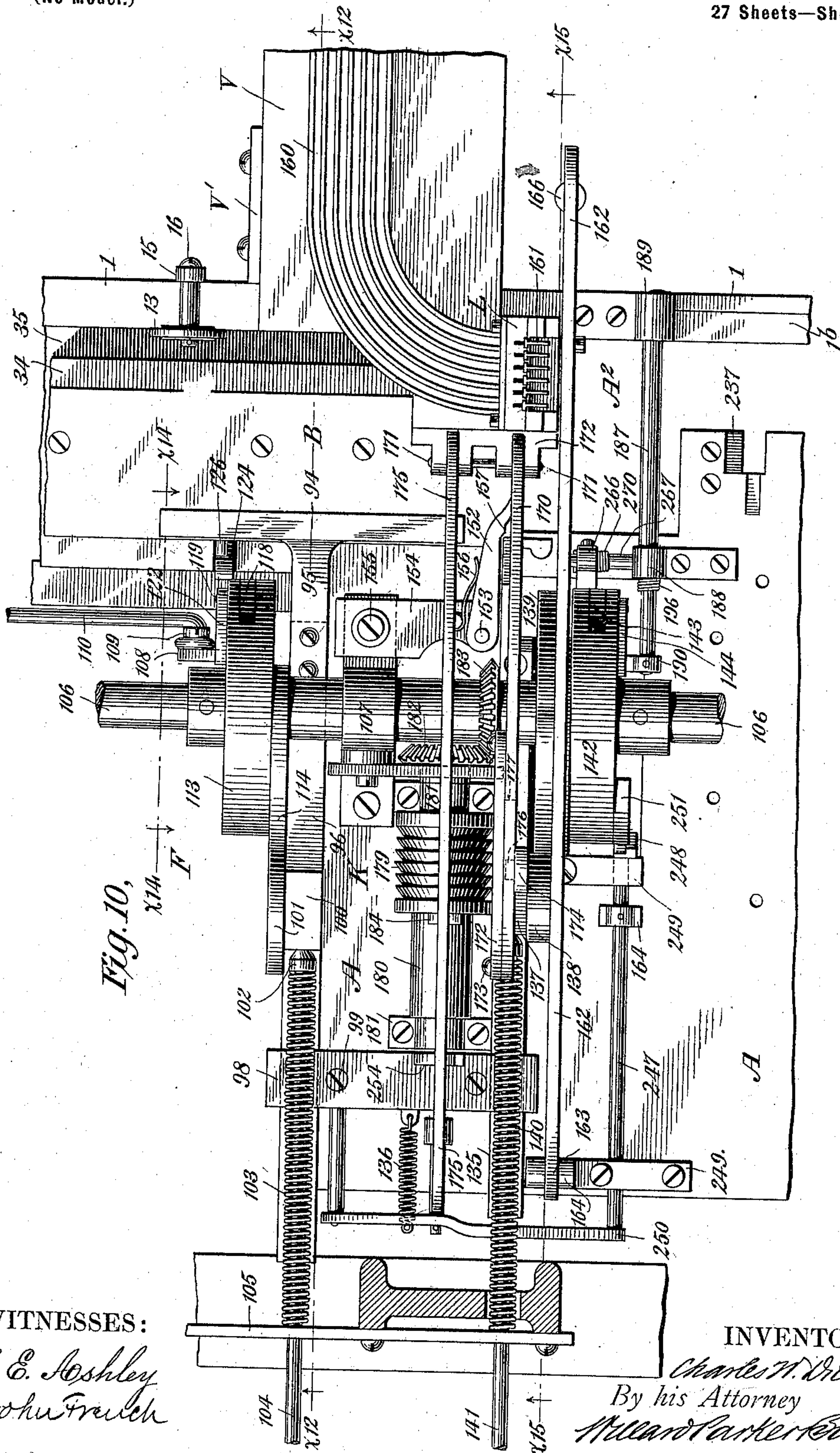


Fig. 10.

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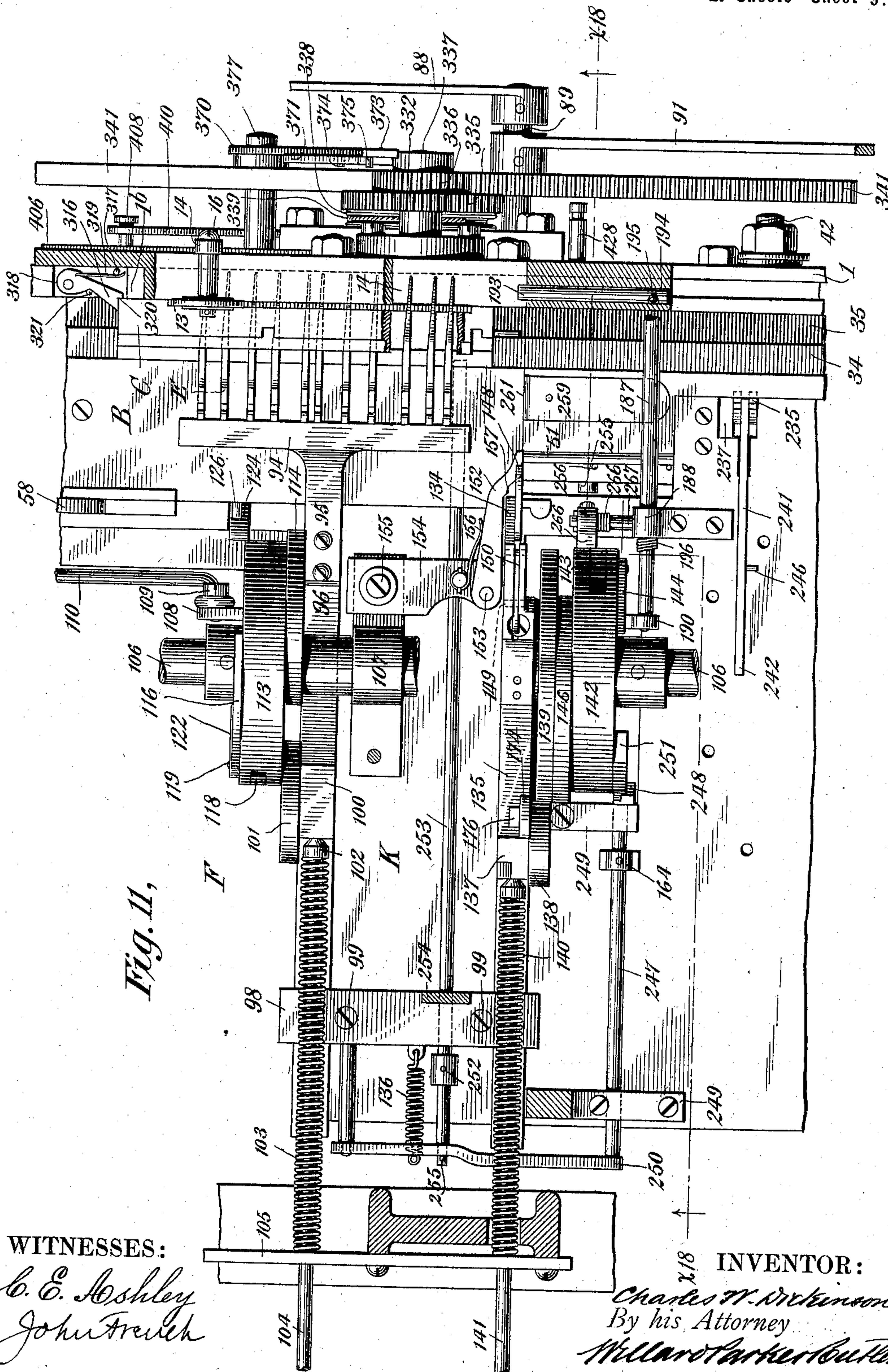


Fig. 11,

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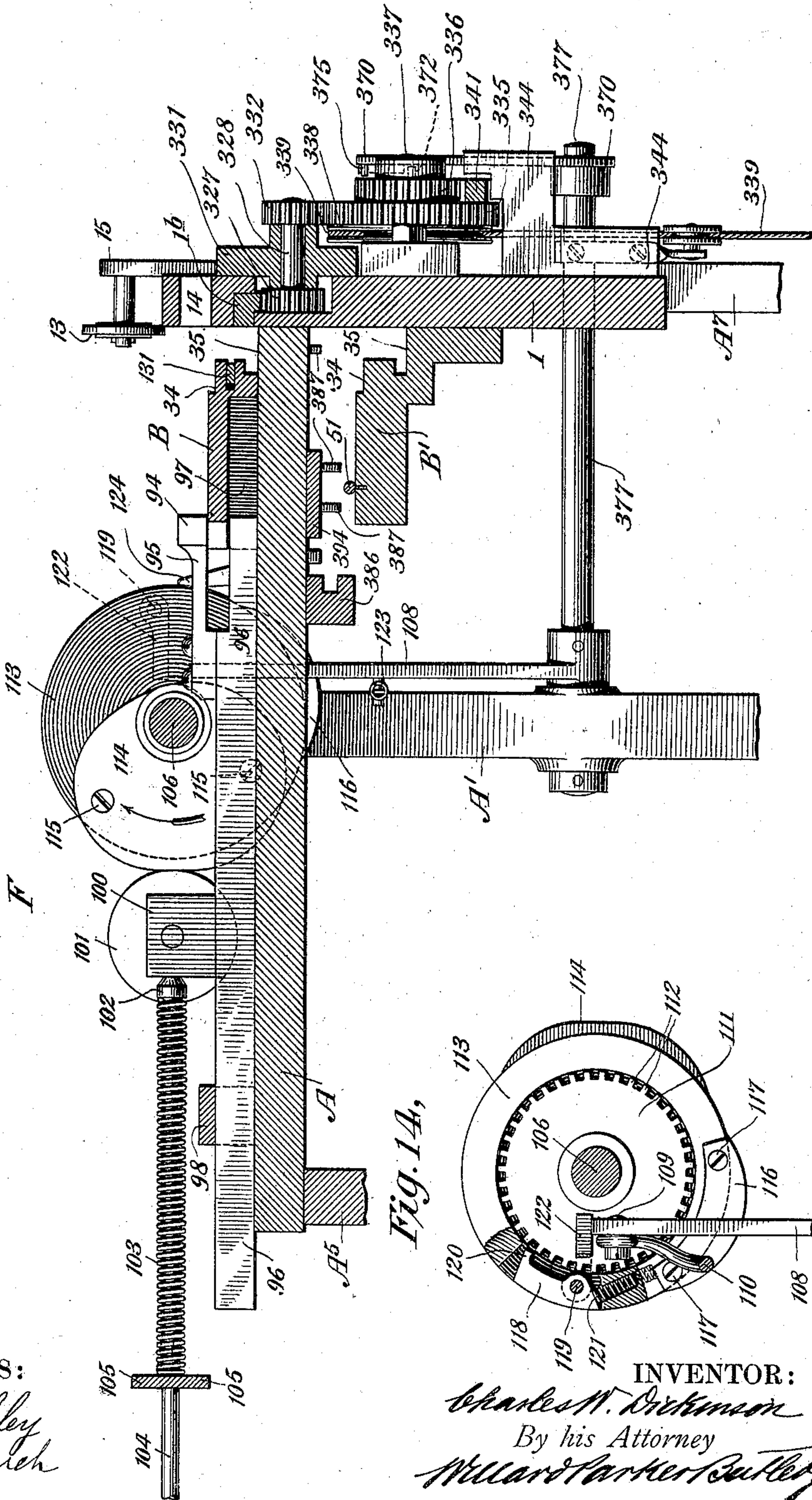
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Fig. 12,



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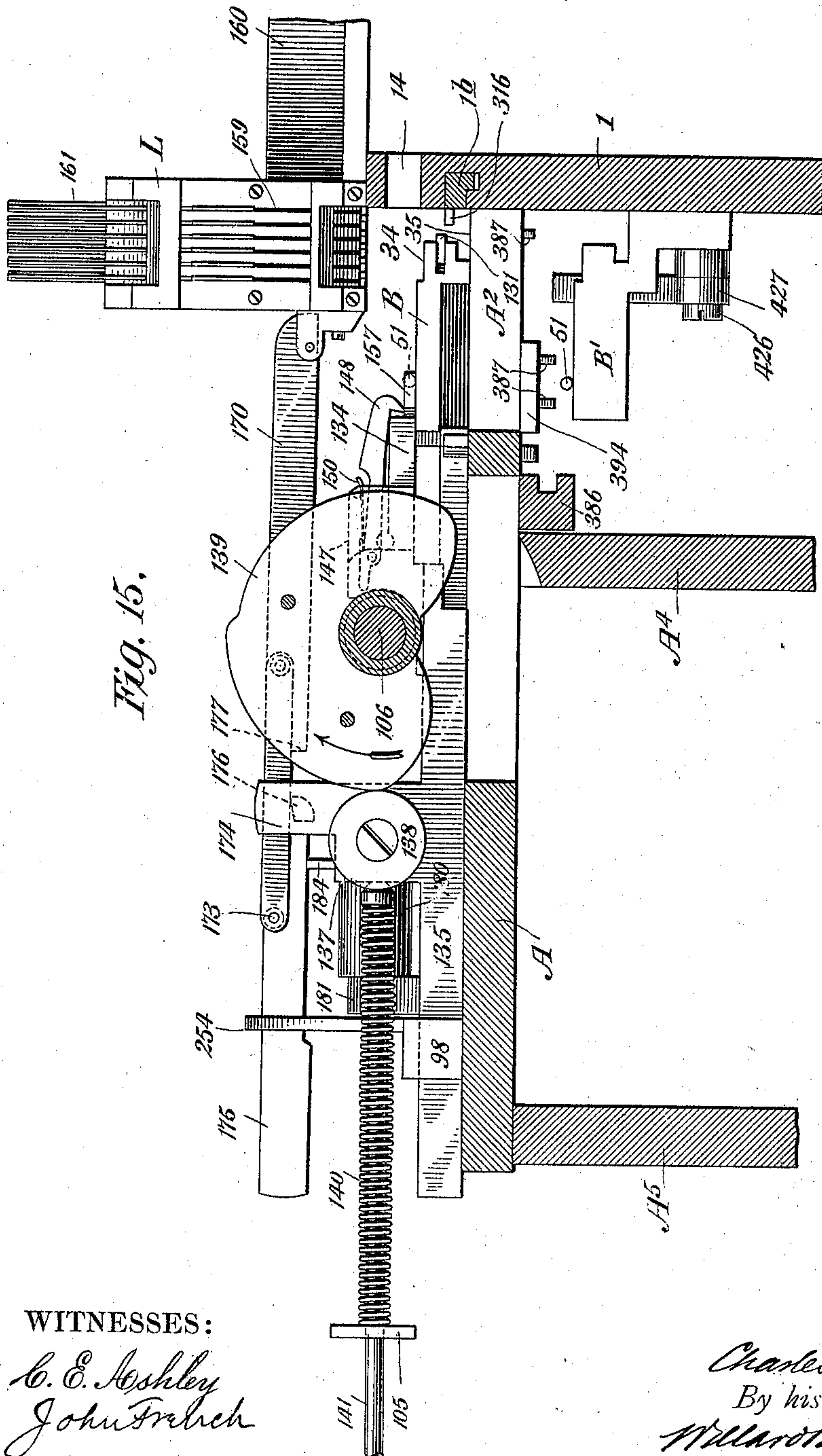
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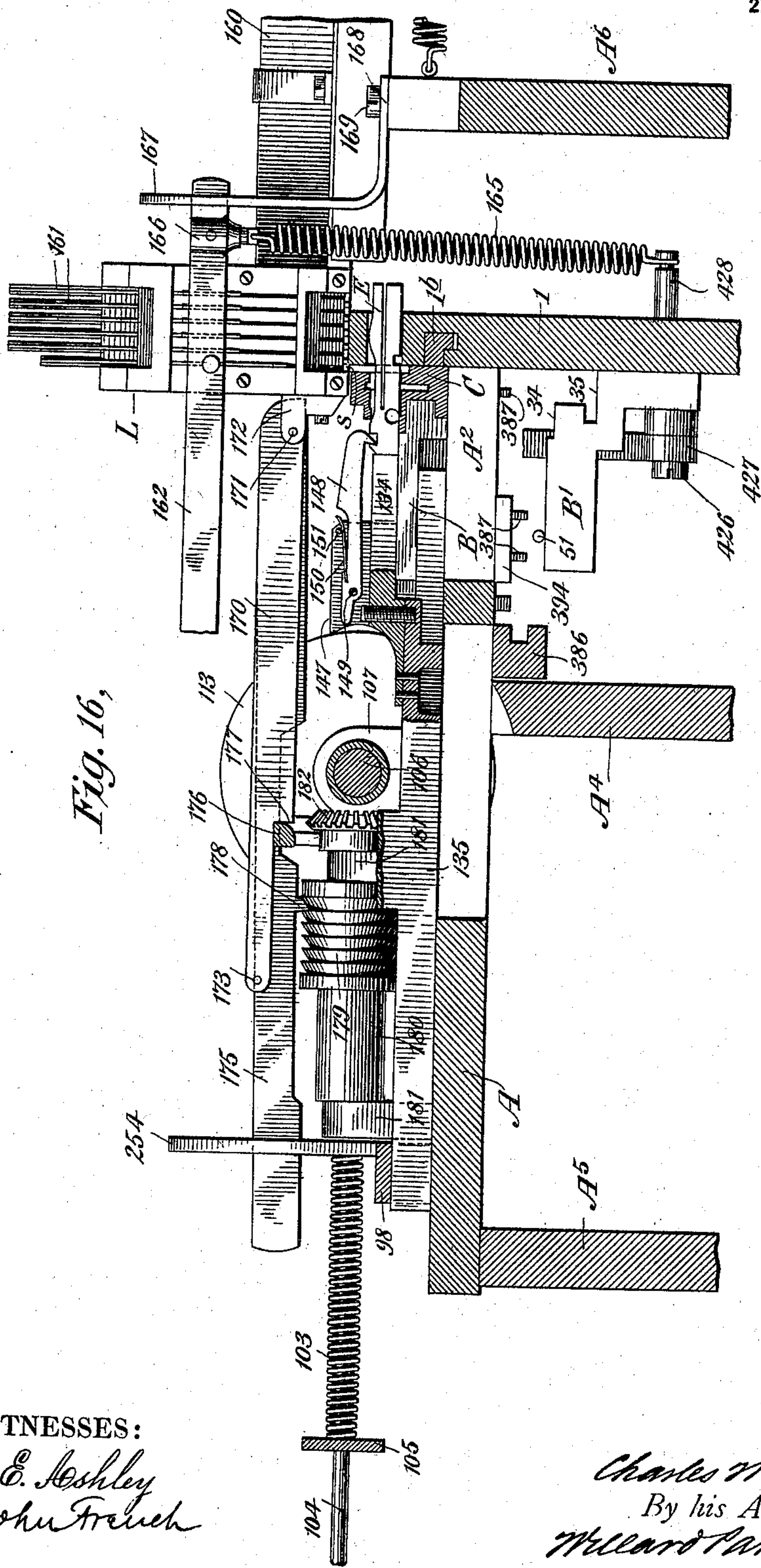


Fig. 16,

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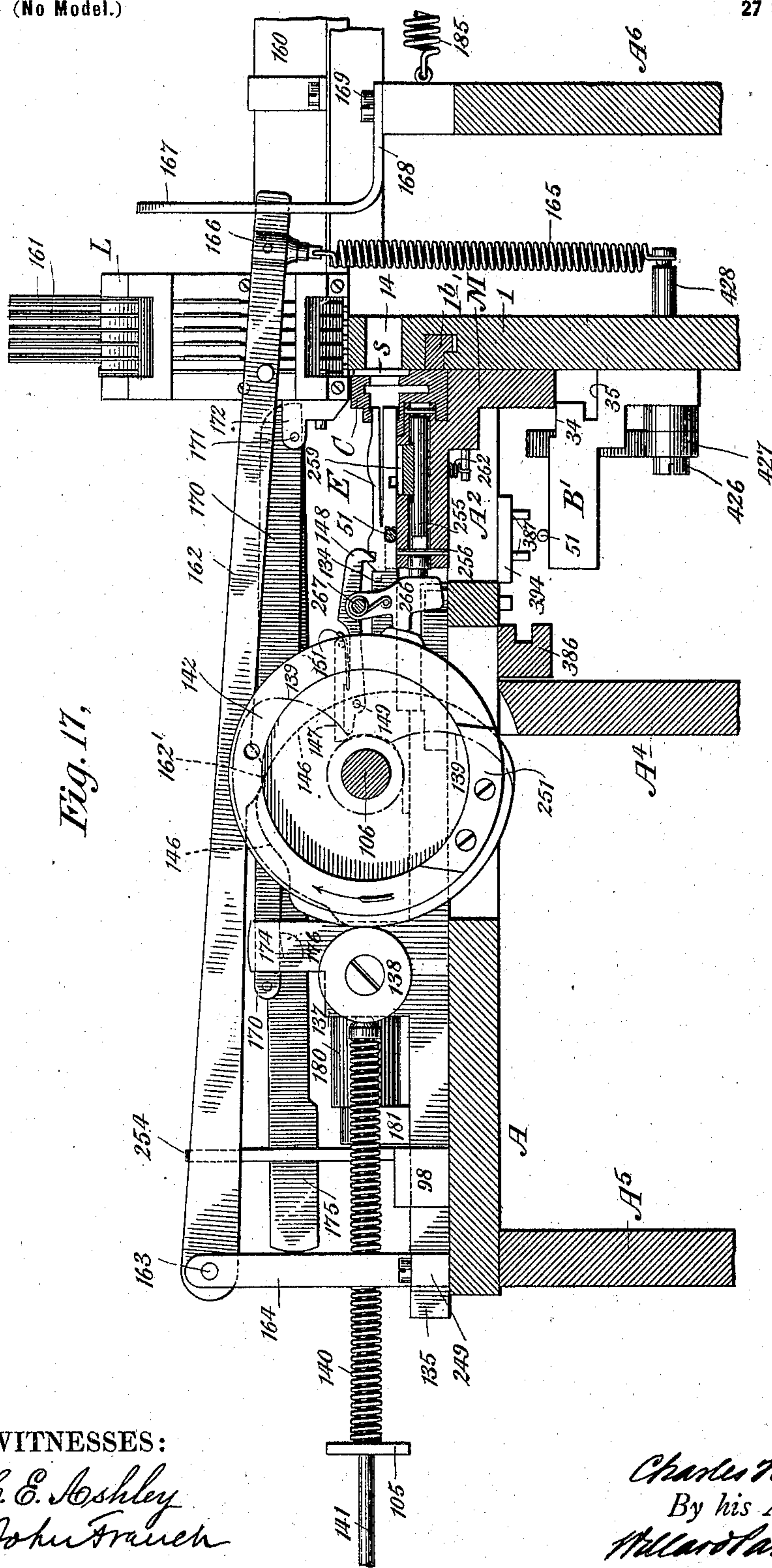
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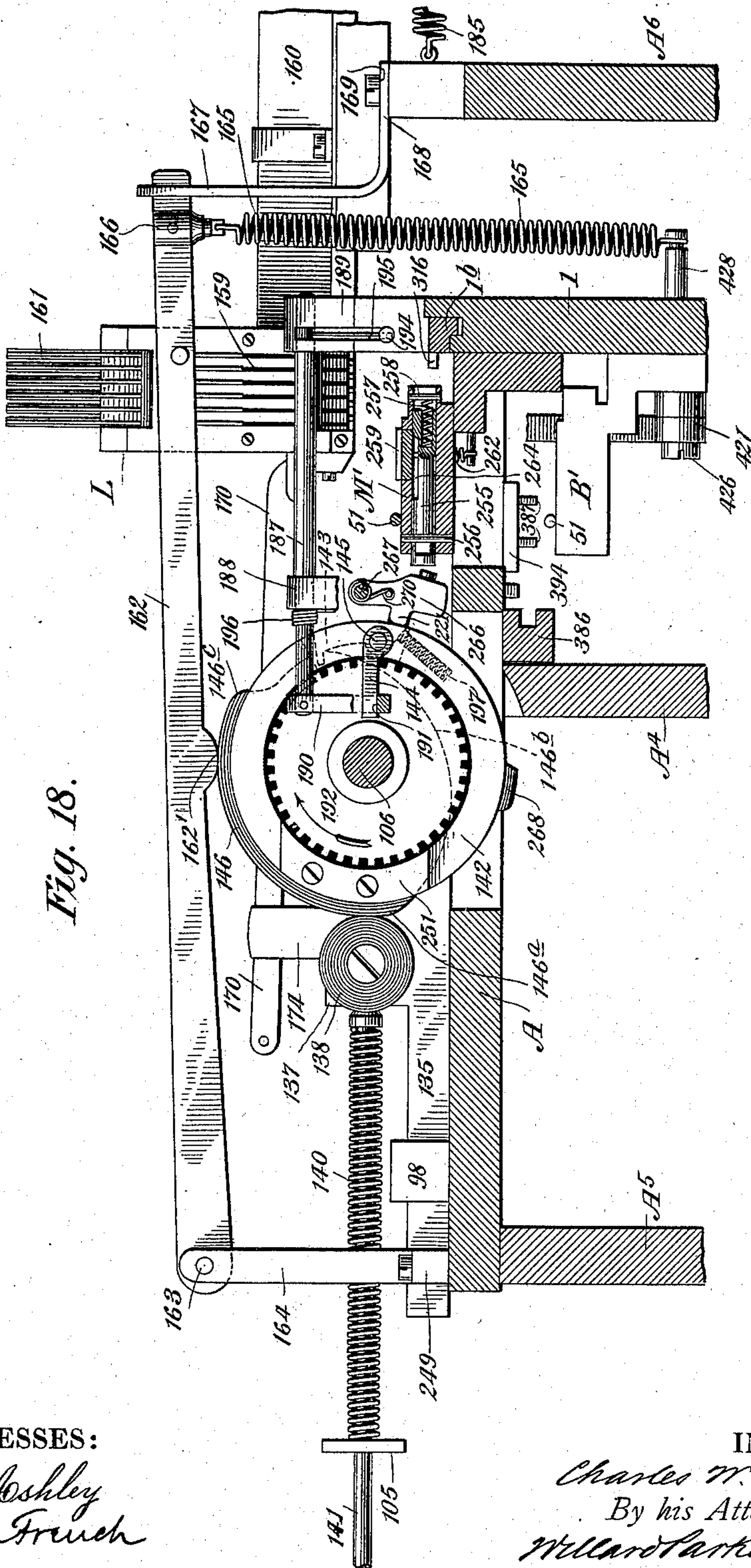
MACHINE FOR JUSTIFYING AND SPACING TYPE.

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Fig. 18.



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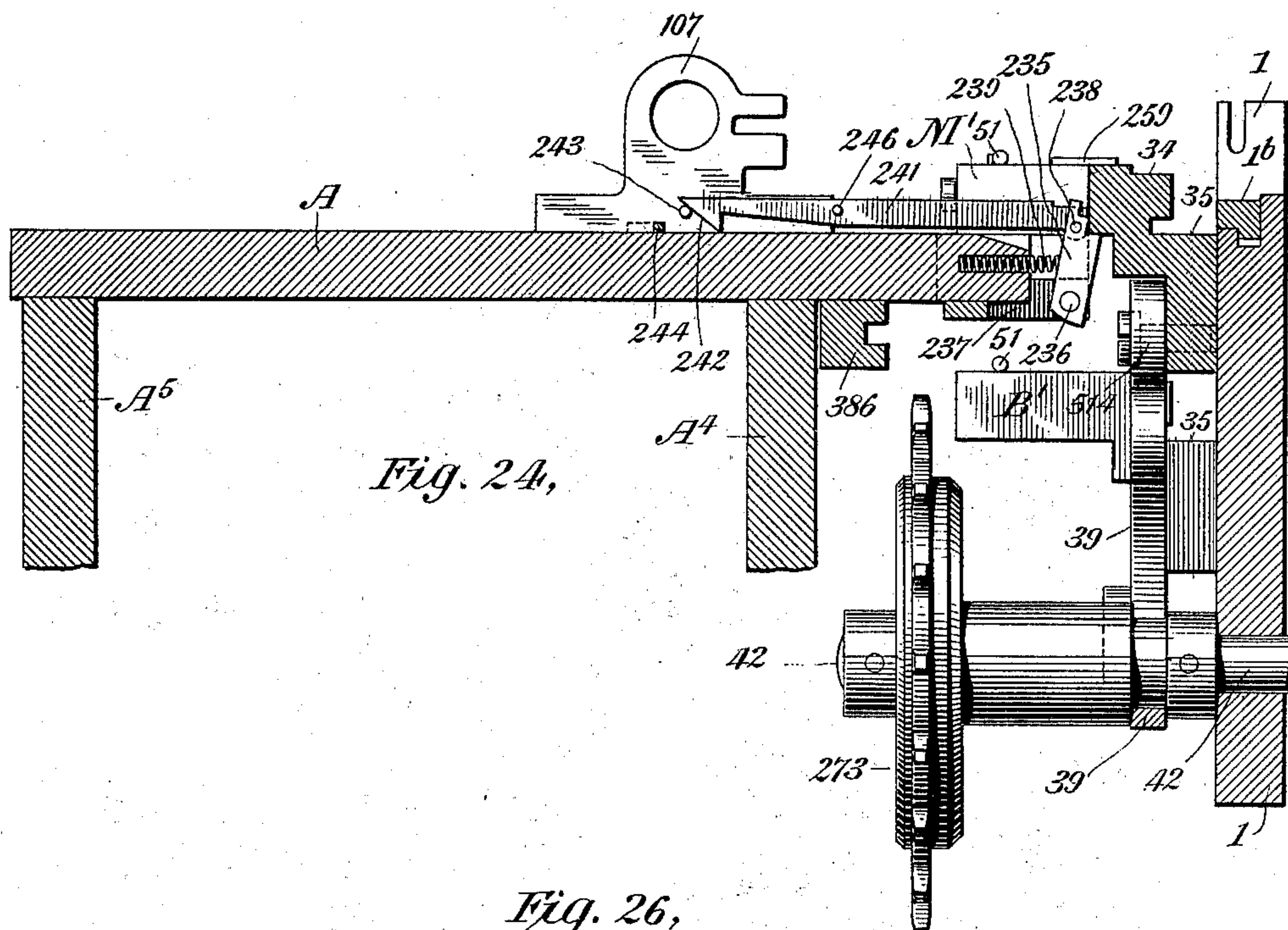


Fig. 24,

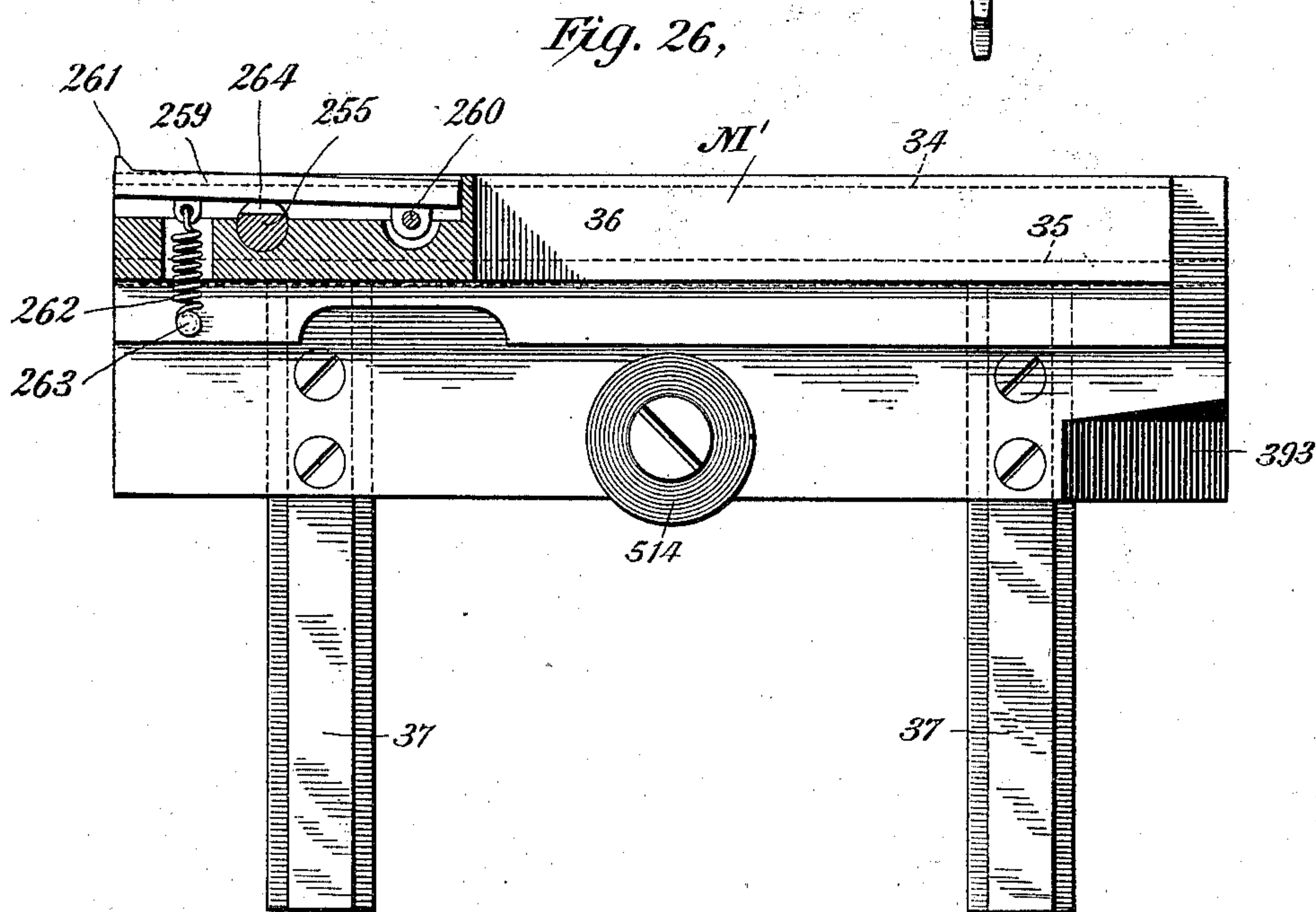


Fig. 26,

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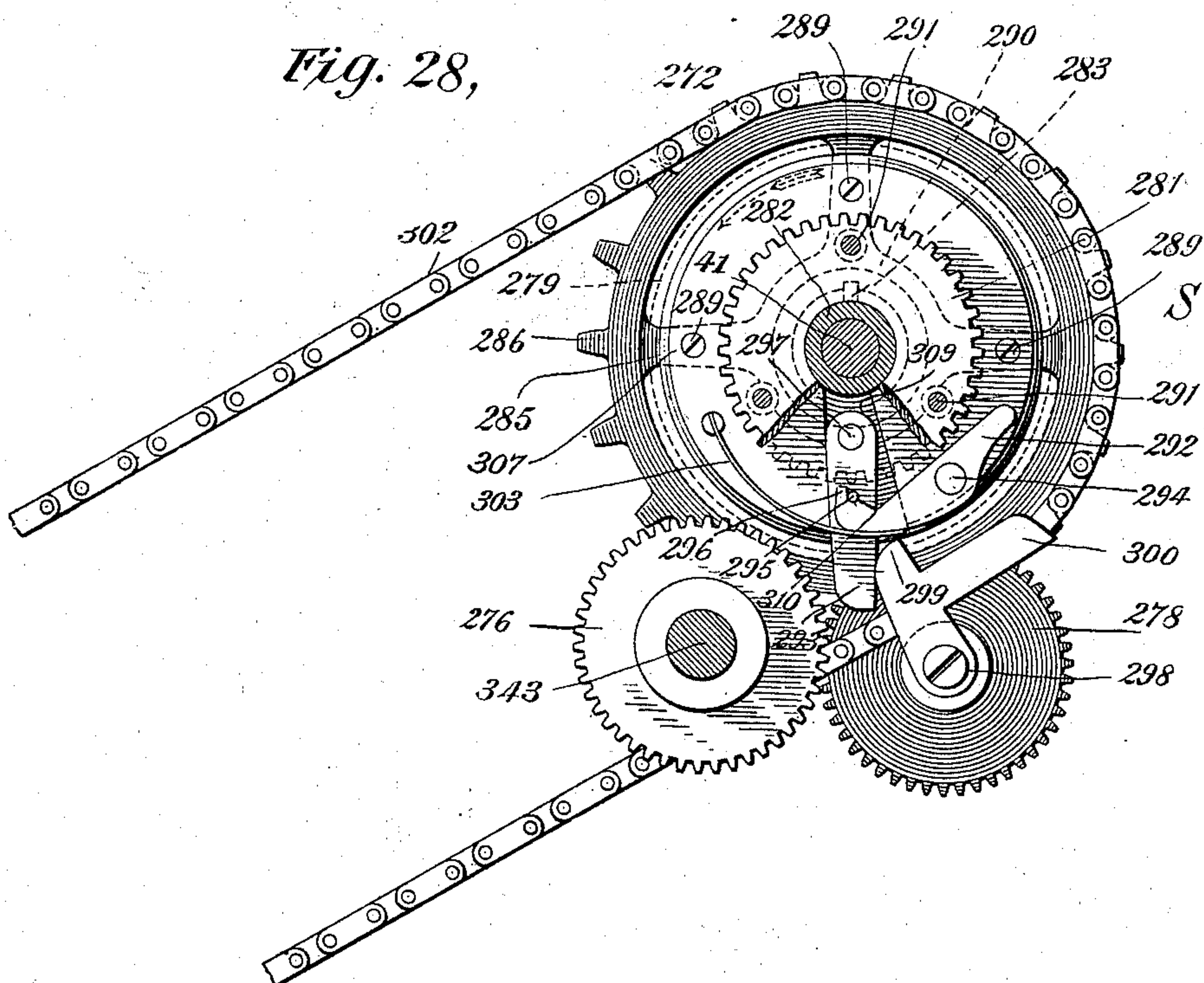
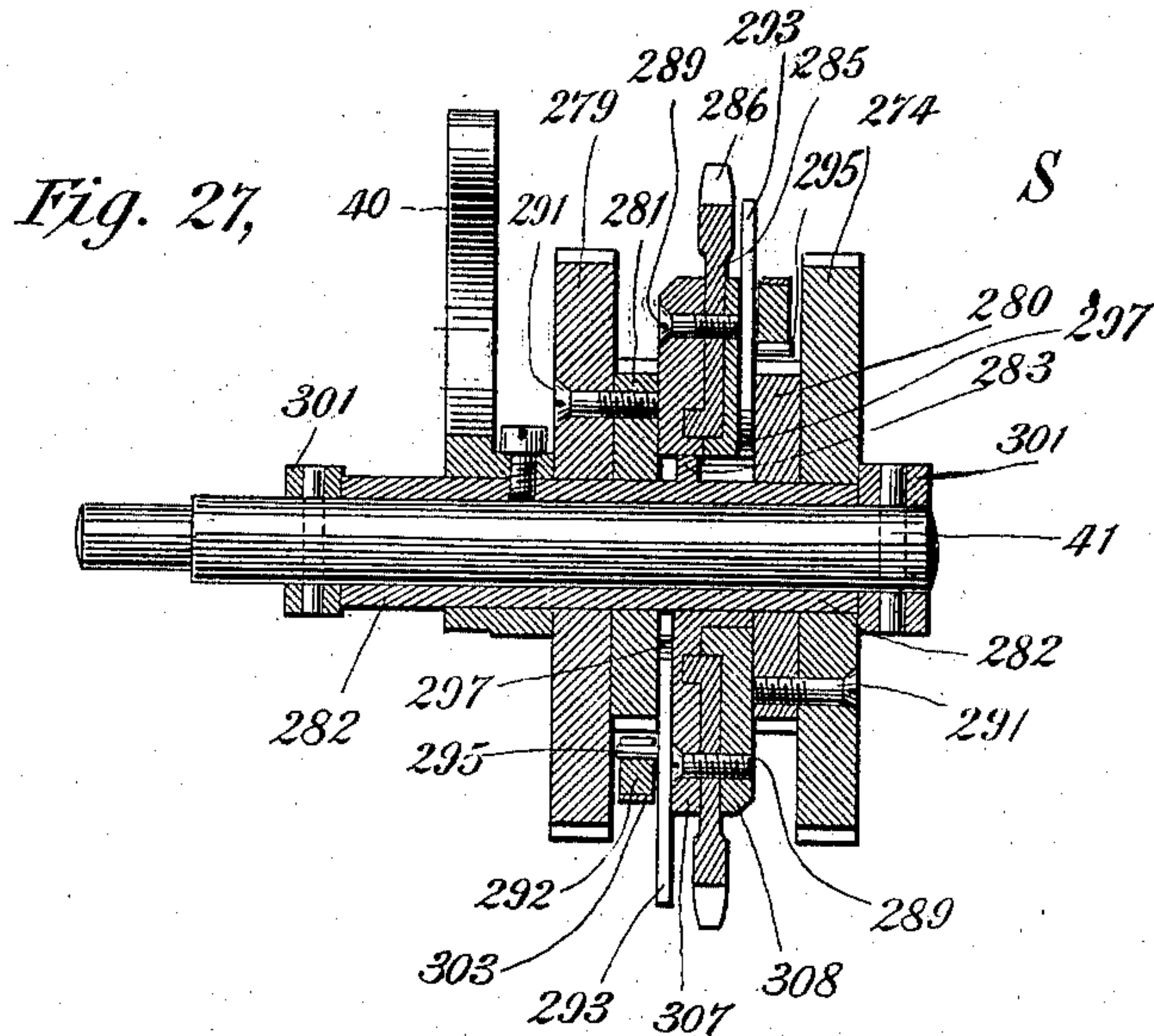
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MACHINE FOR JUSTIFYING AND SPACING TYPE.

(Application filed June 15, 1898.)

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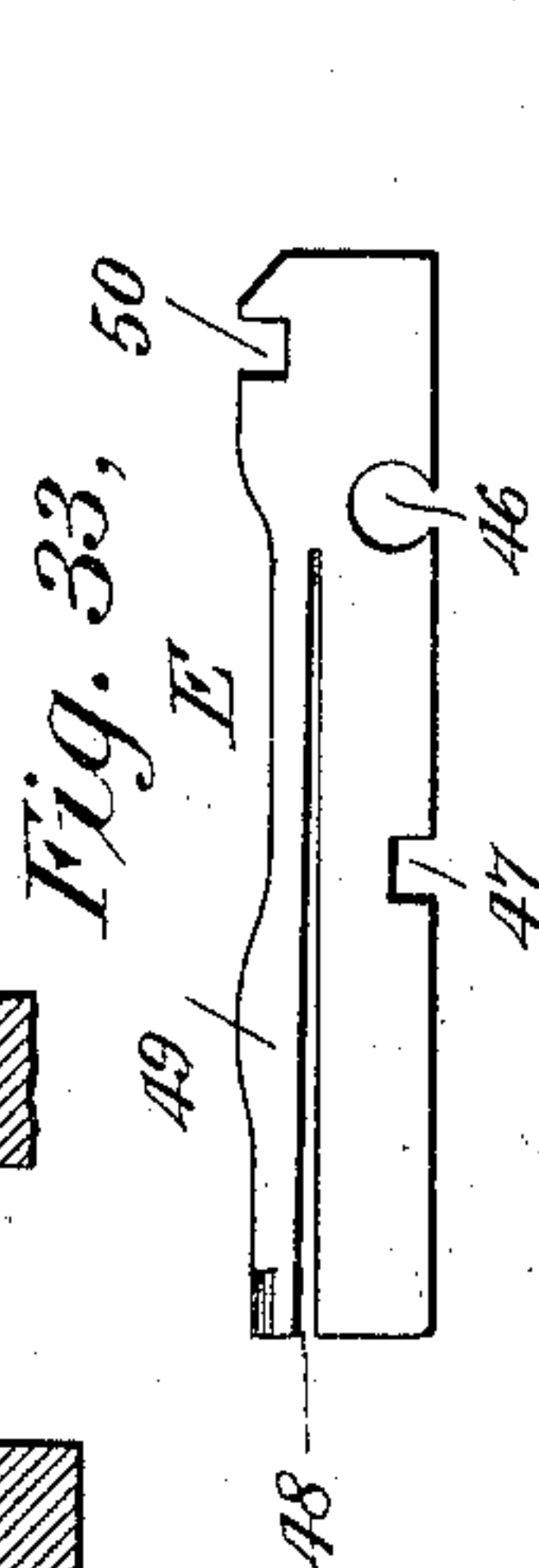
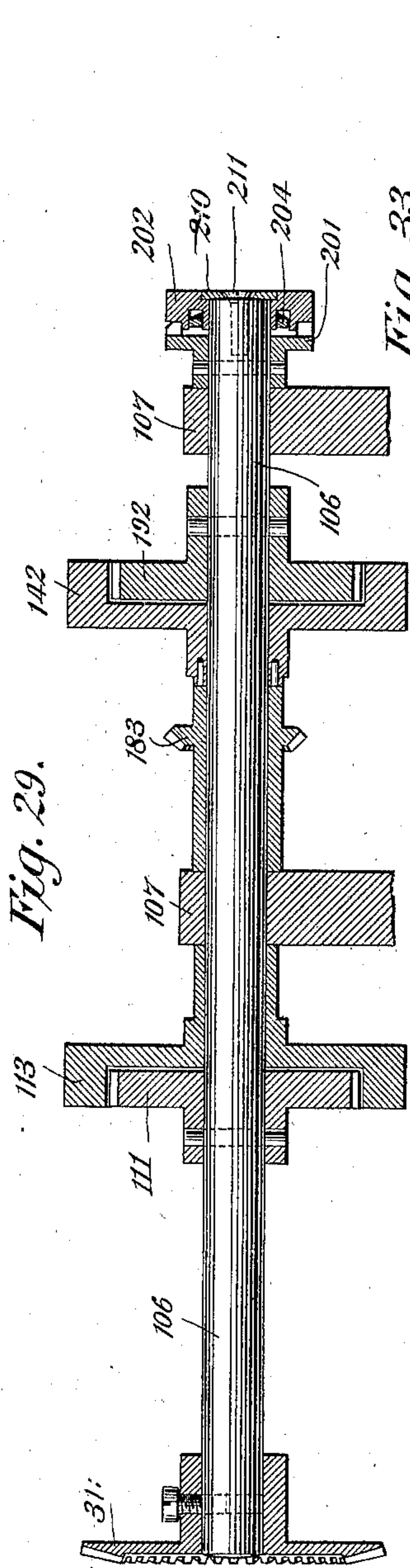


Fig. 31.

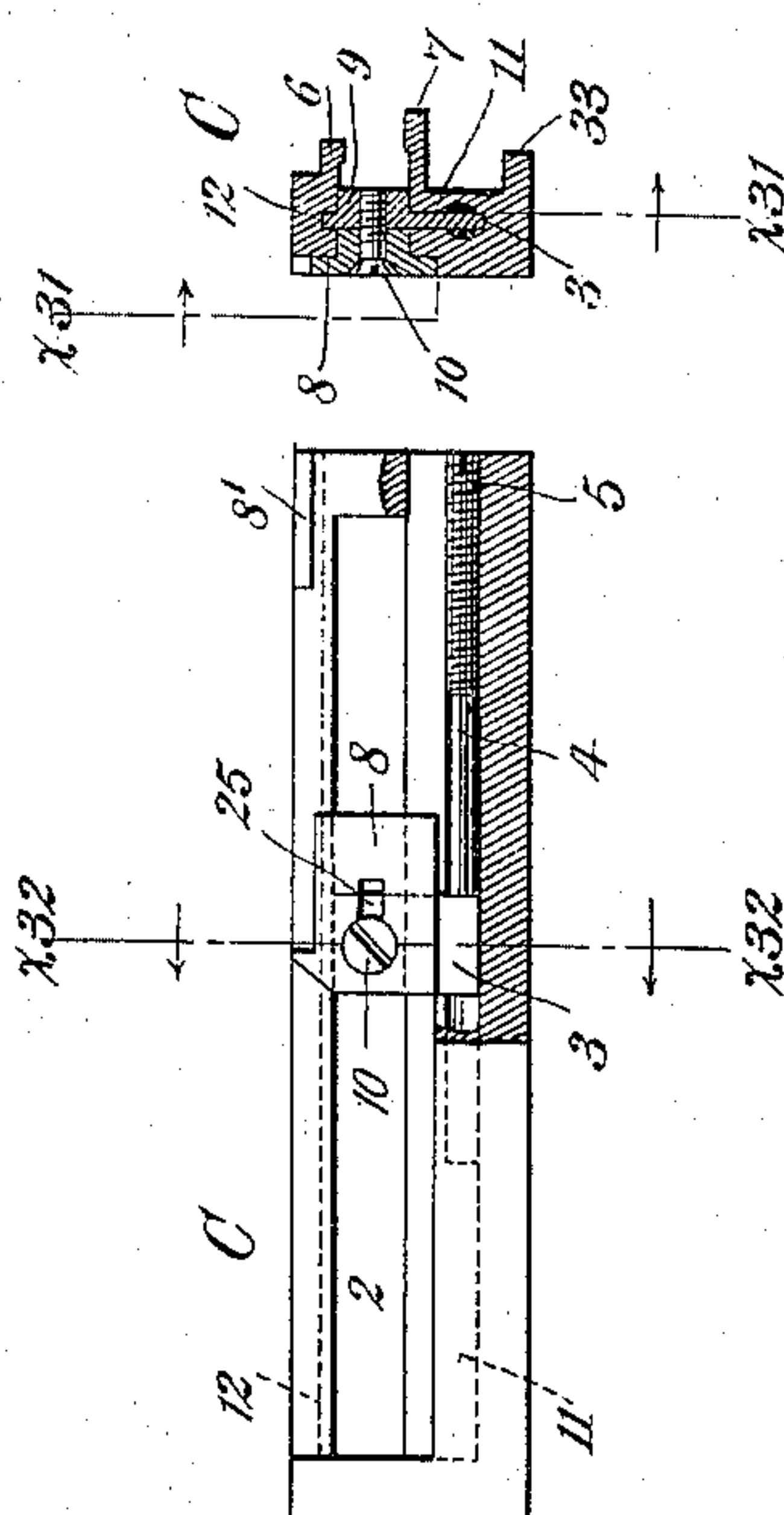


Fig. 32.

Fig. 37.

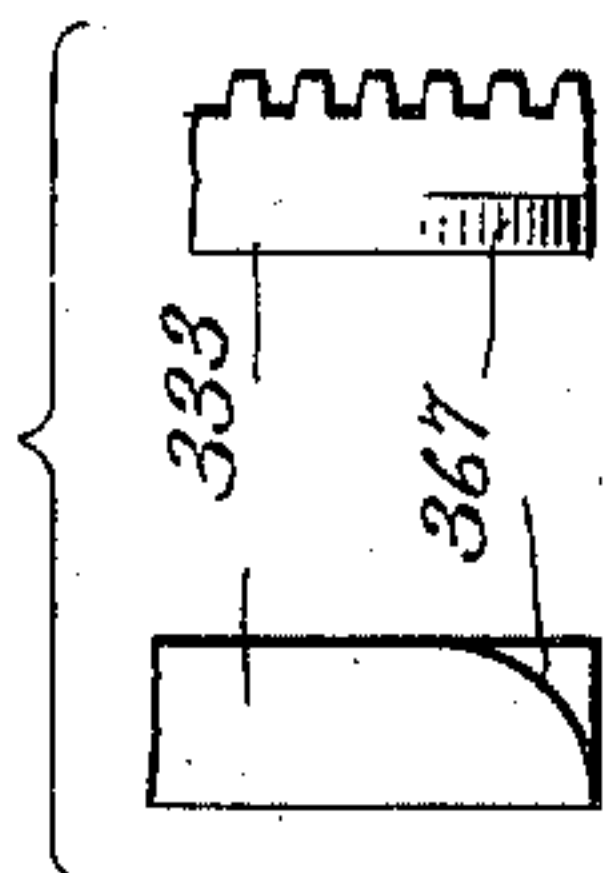
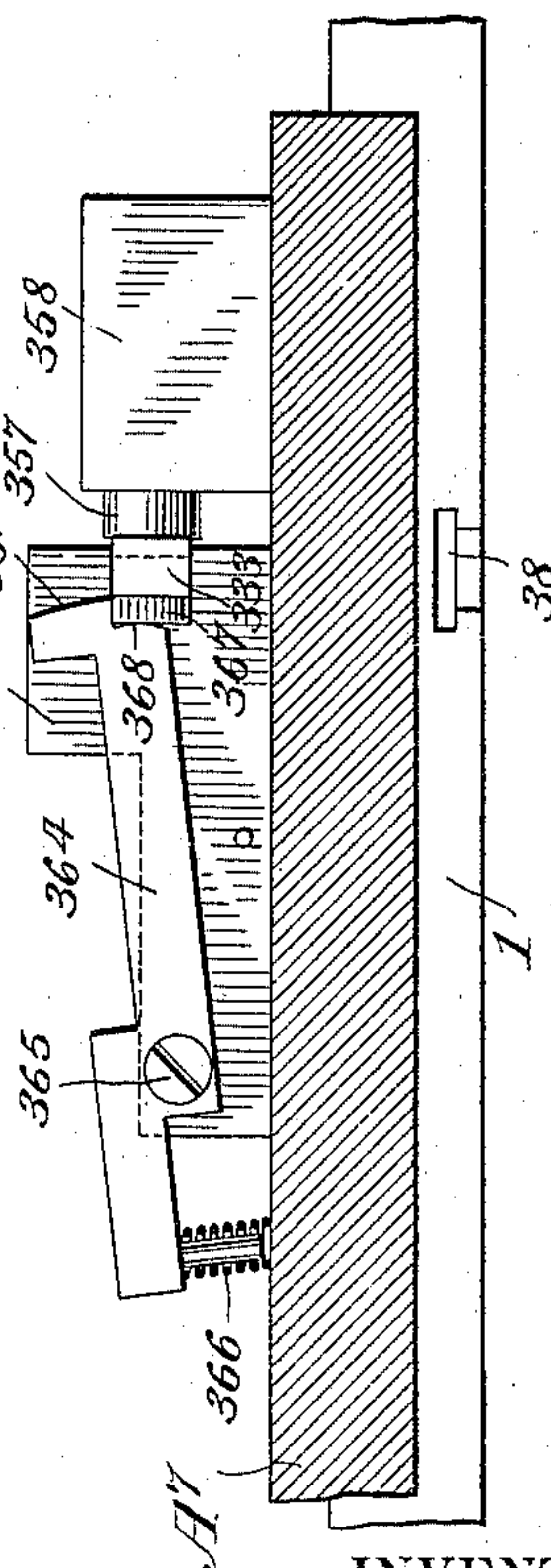


Fig. 36.



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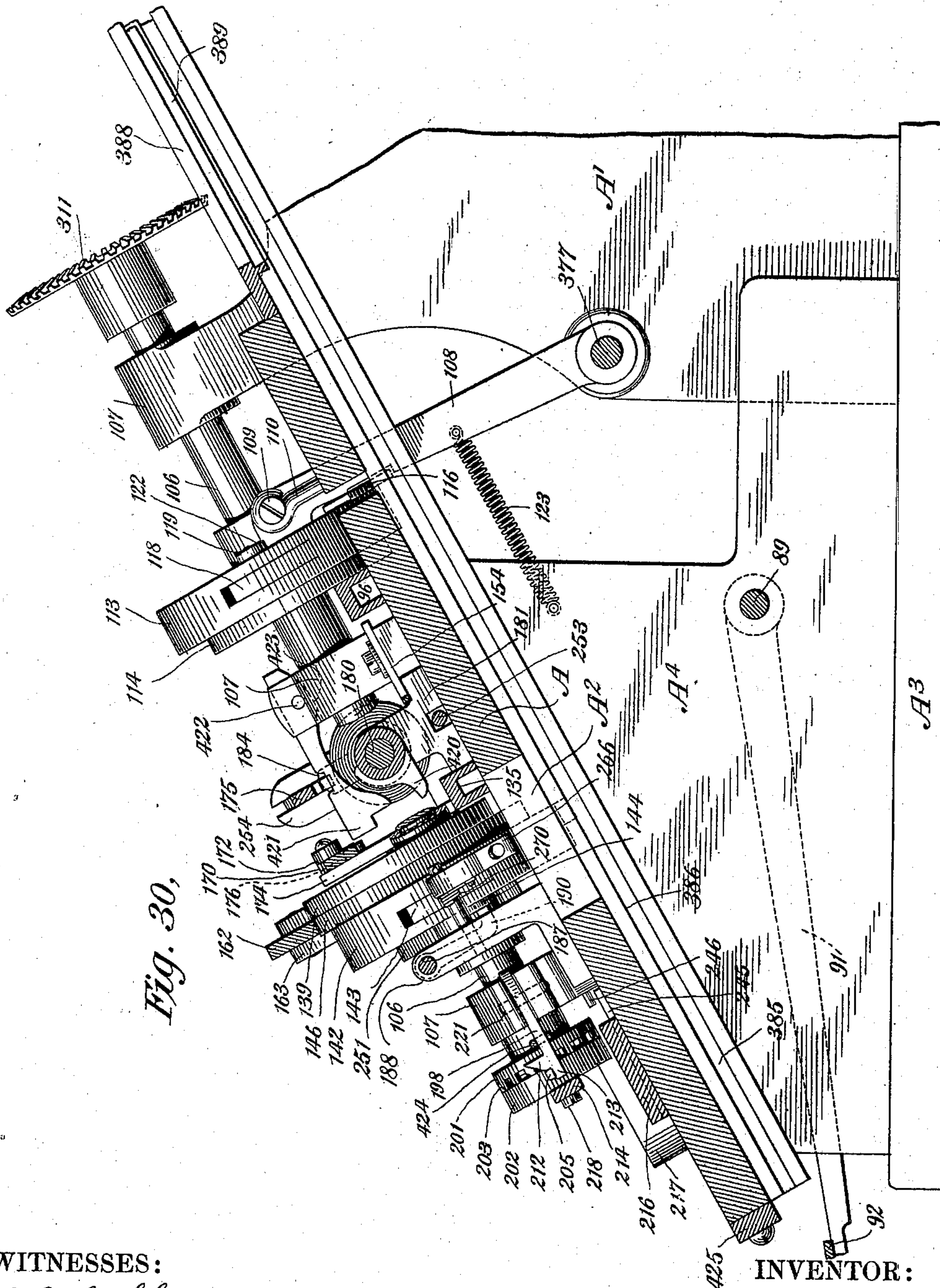


Fig. 30,

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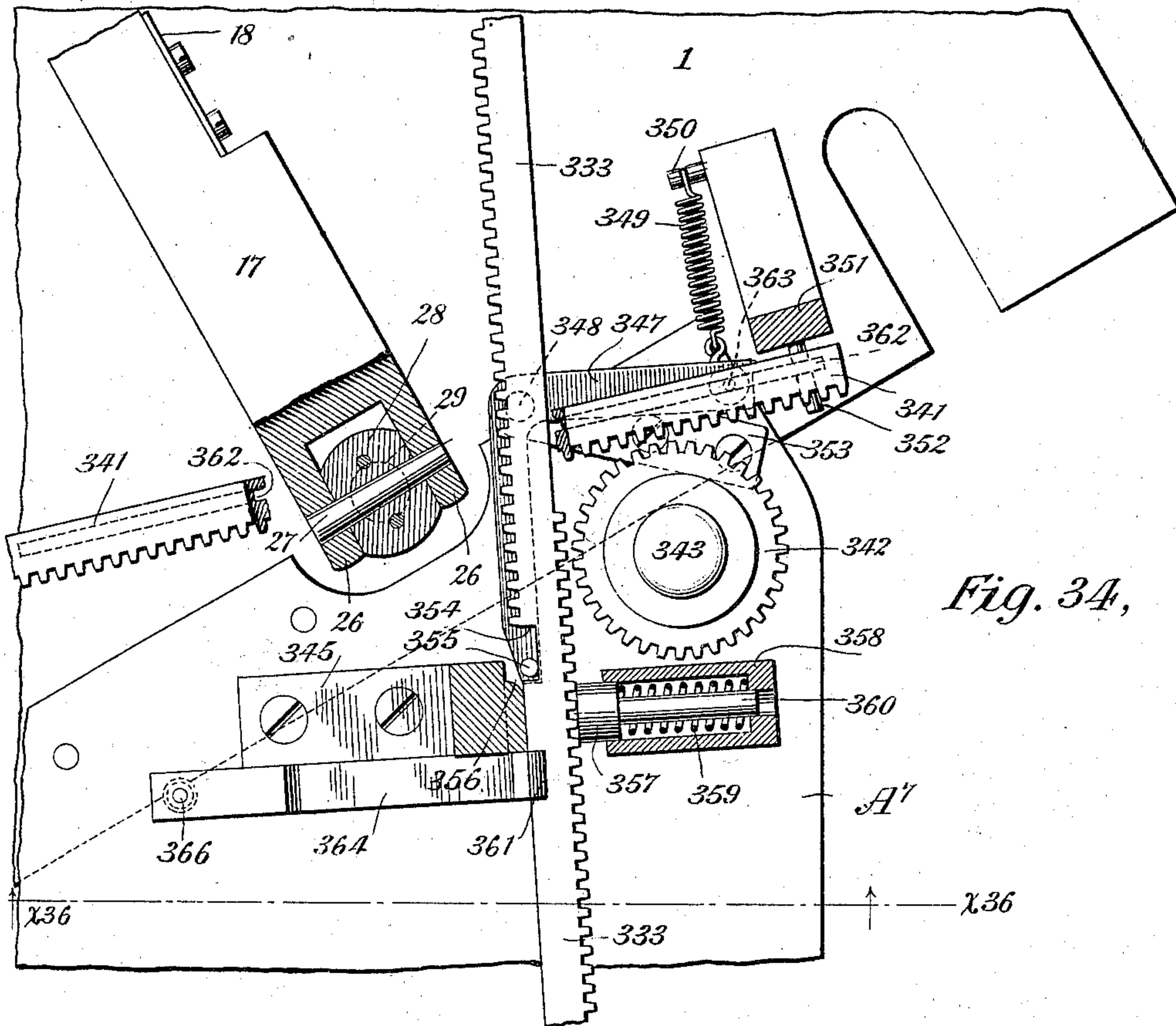
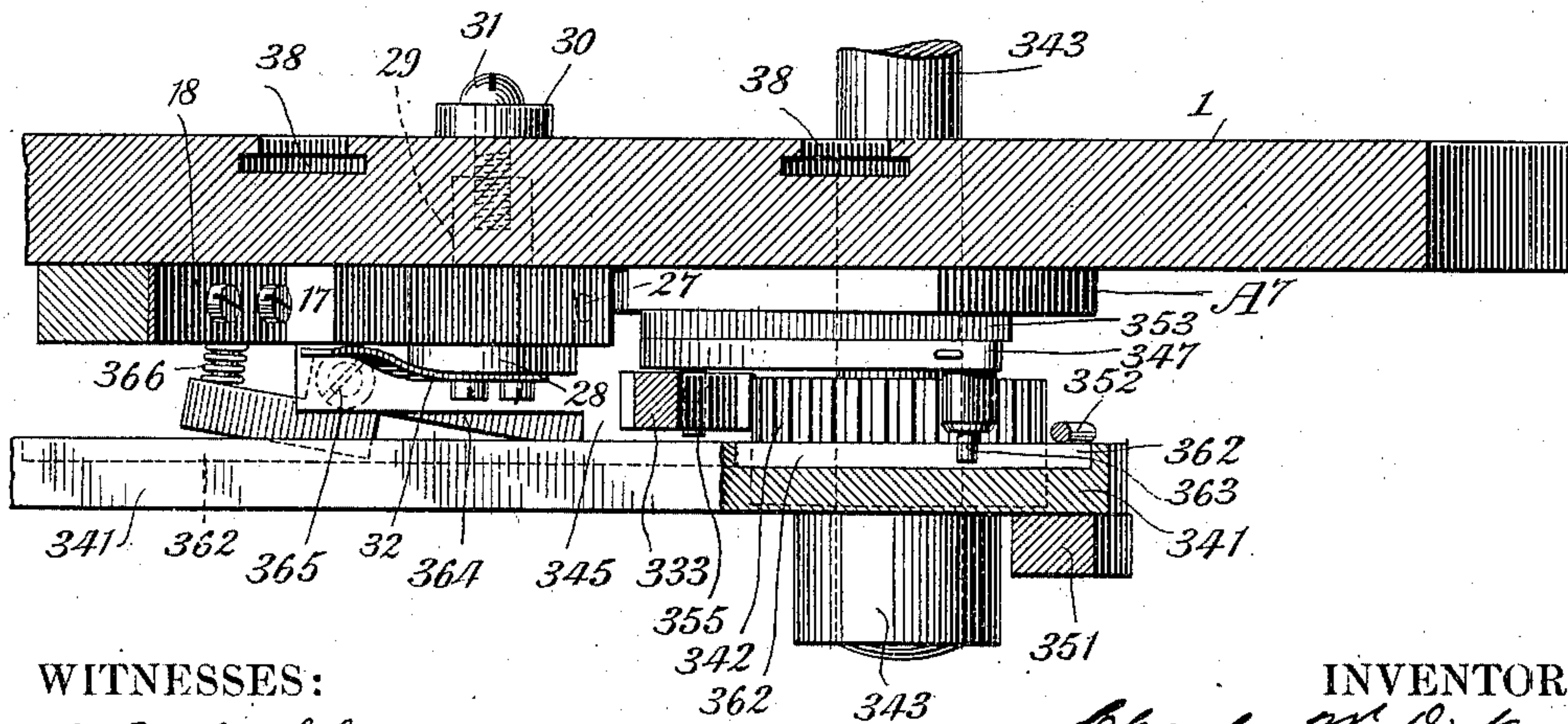


Fig. 34,

Fig. 35.



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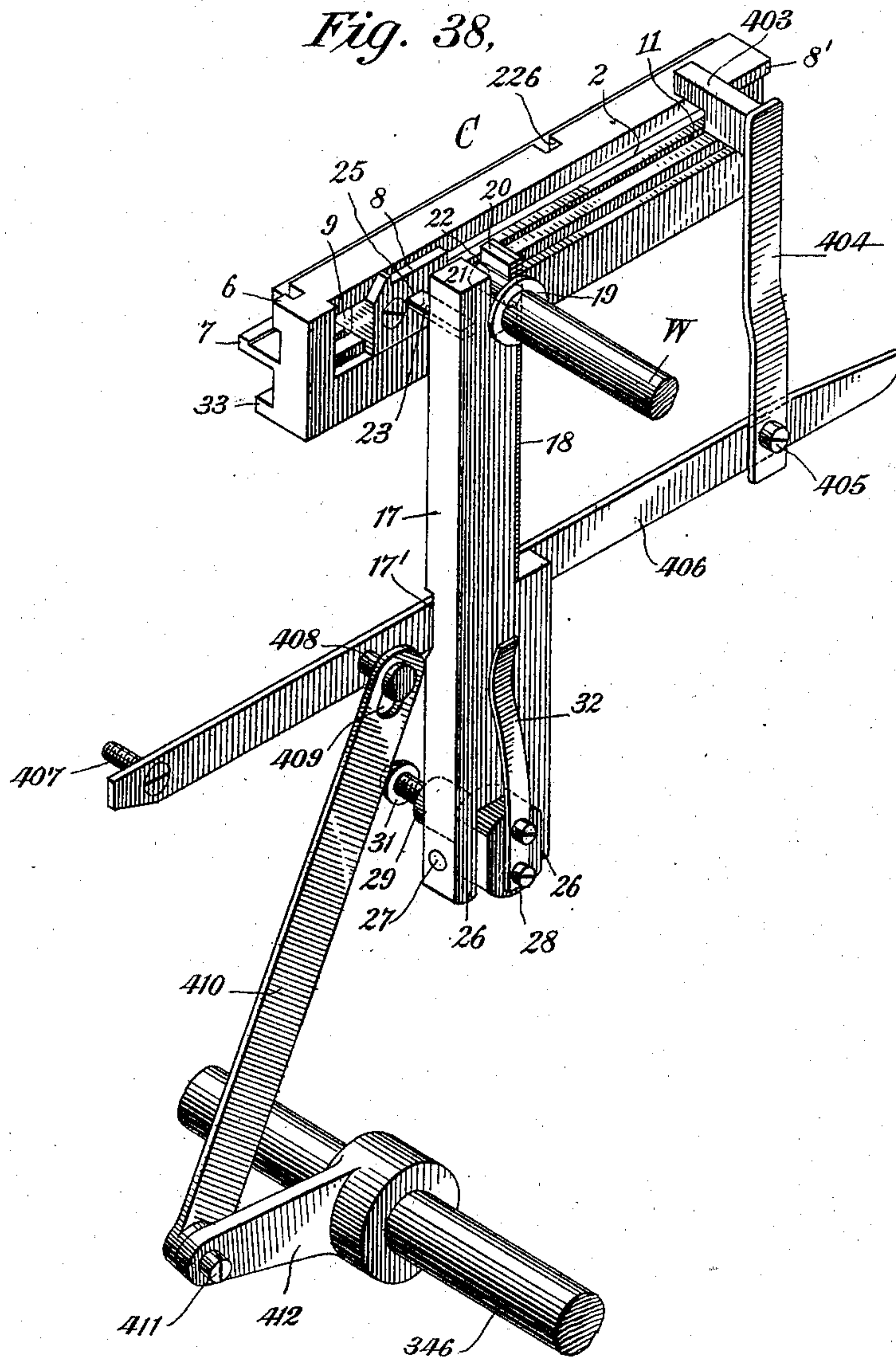
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(Application filed June 15, 1898.)

(No Model.)

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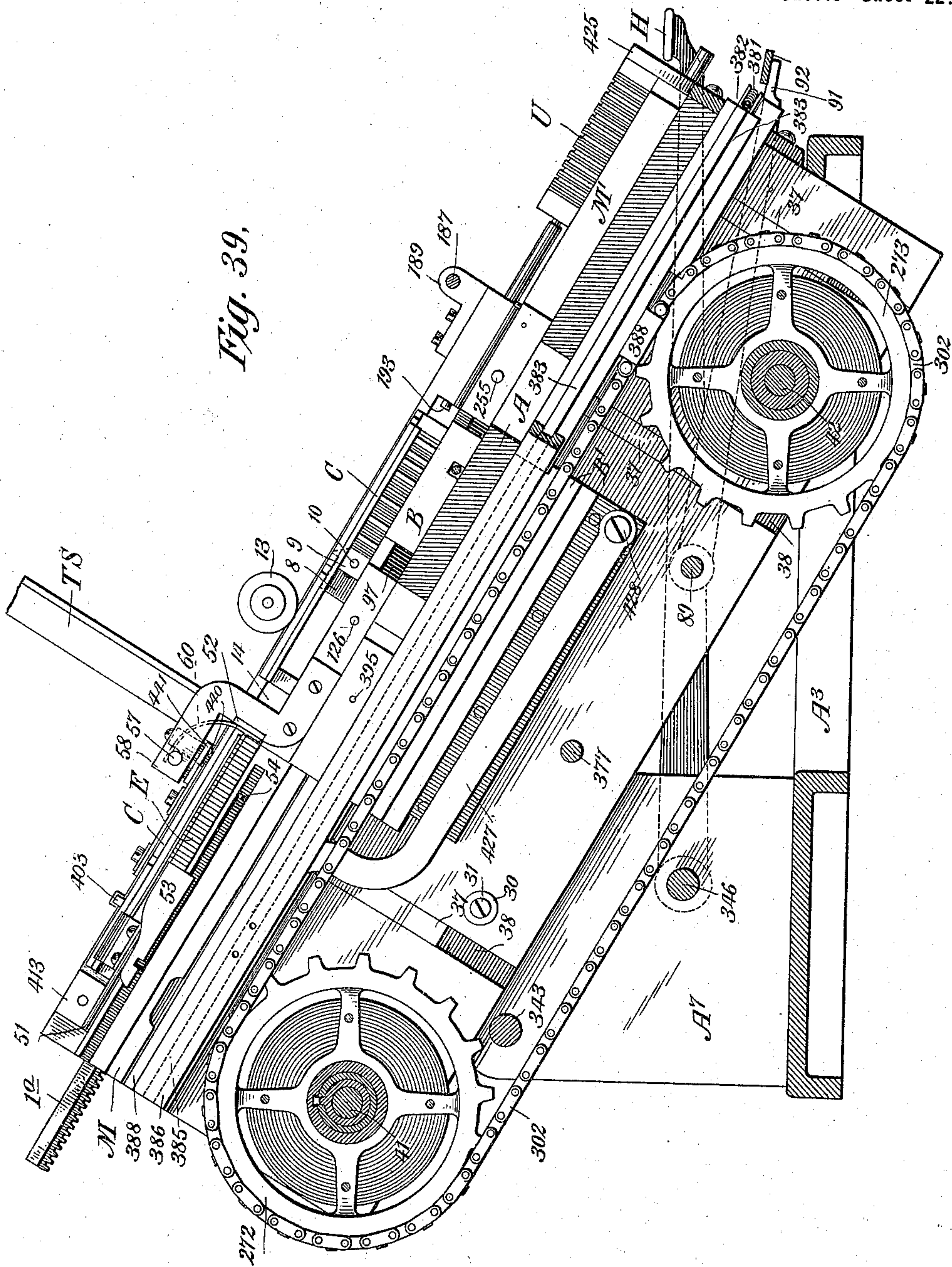
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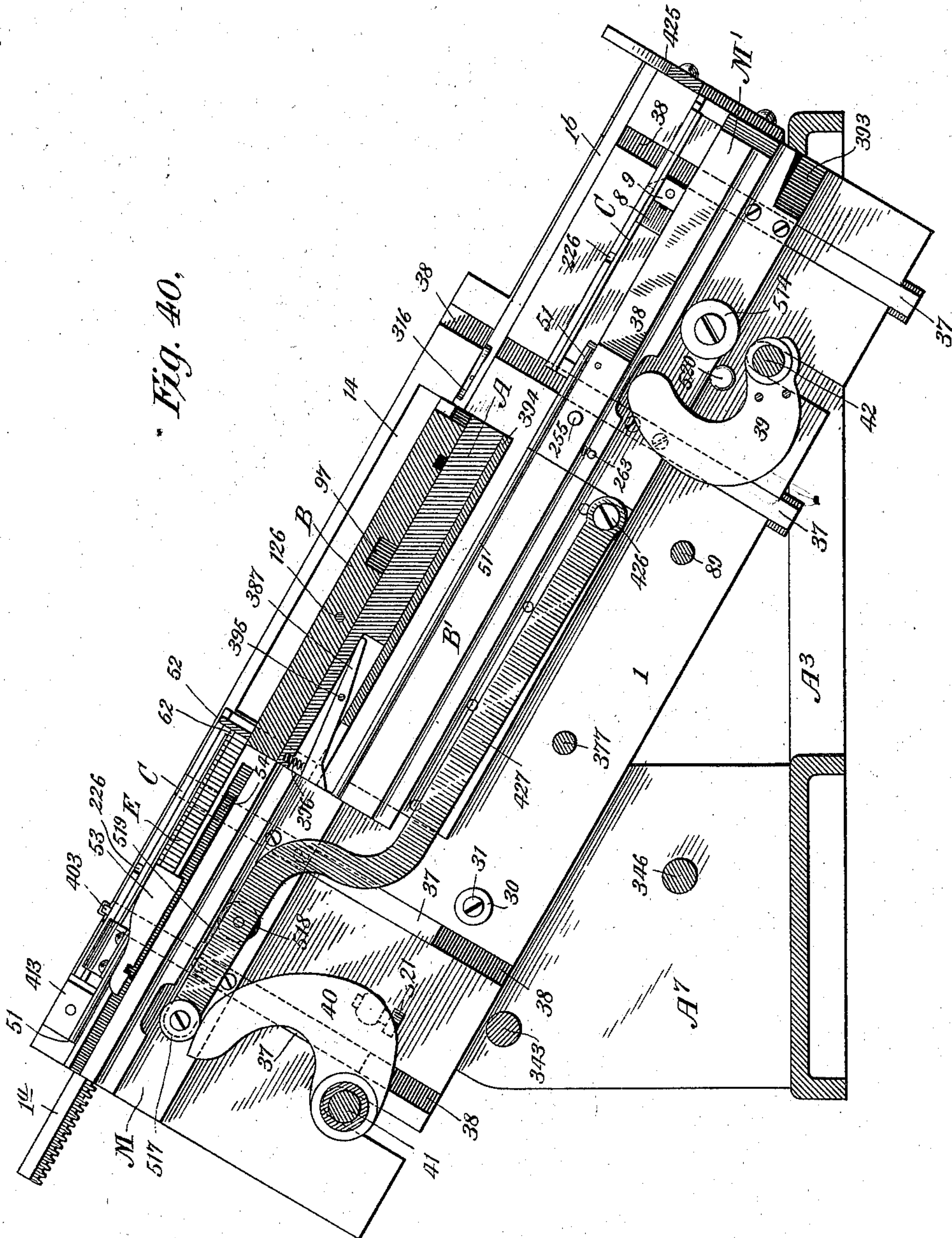
C. W. DICKINSON.

MACHINE FOR JUSTIFYING AND SPACING TYPE.

(Application filed June 15, 1898.)

(No Model.)

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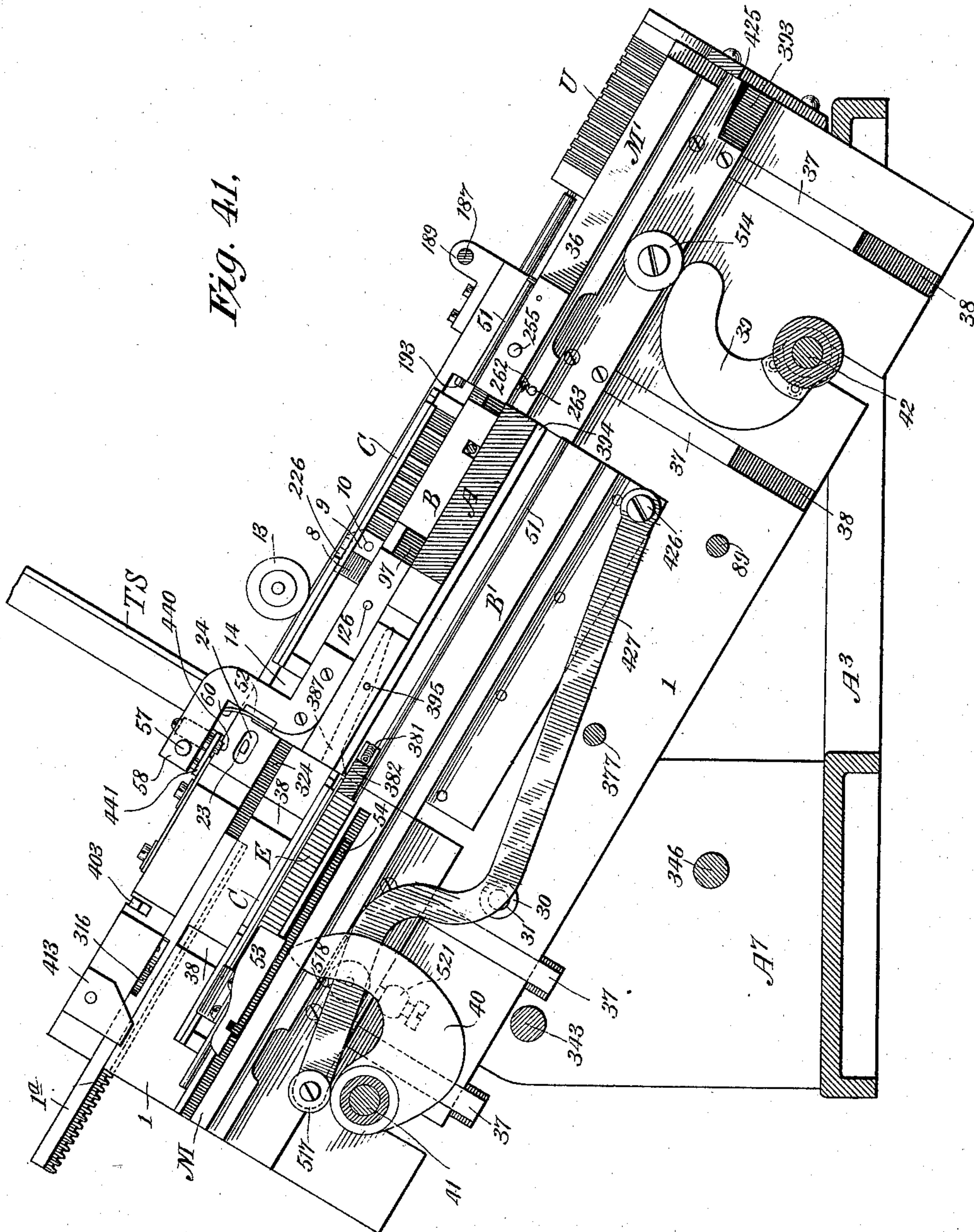
MACHINE FOR JUSTIFYING AND SPACING TYPE.

(Application filed June 15, 1898.)

(No Model.)

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Fig. 41.



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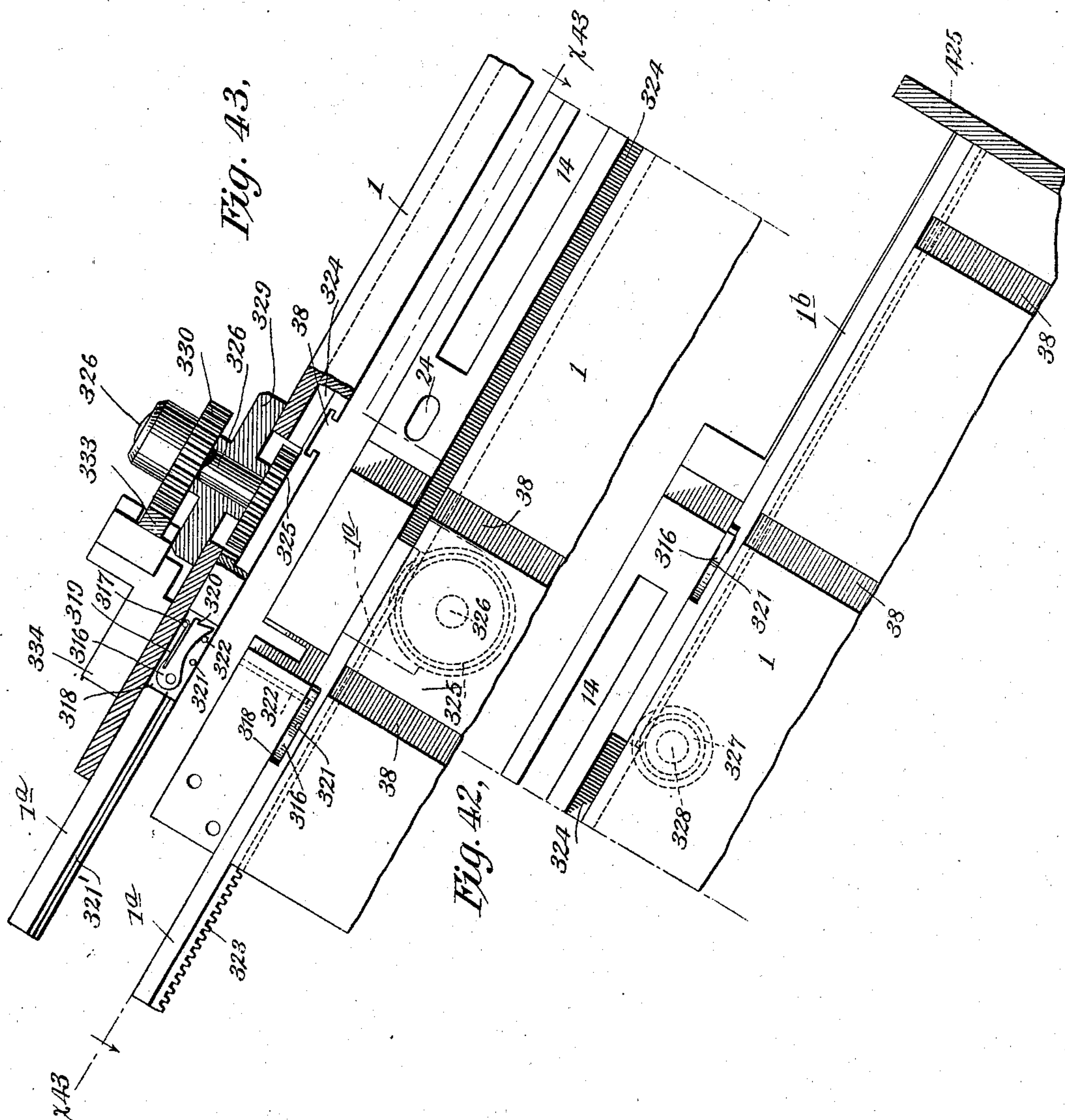
C. W. DICKINSON.

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(No Model.)

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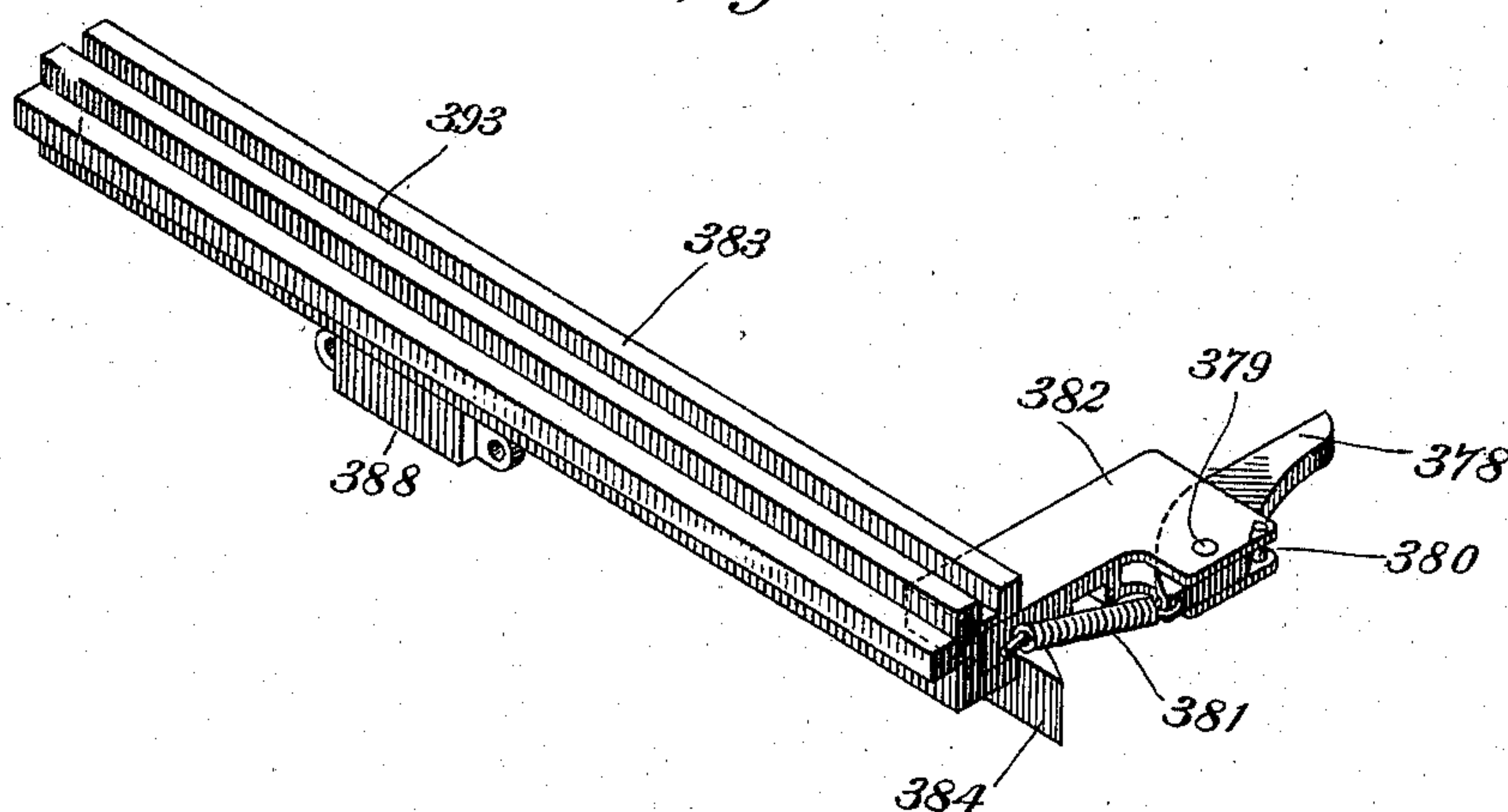
MACHINE FOR JUSTIFYING AND SPACING TYPE.

(Application filed June 15, 1898.)

(No Model.)

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Fig. 45.



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UNITED STATES PATENT OFFICE.

CHARLES W. DICKINSON, OF BELLEVILLE, NEW JERSEY, ASSIGNOR TO THE
EMPIRE TYPE SETTING MACHINE COMPANY, OF WEST VIRGINIA.

MACHINE FOR JUSTIFYING AND SPACING TYPE.

SPECIFICATION forming part of Letters Patent No. 633,309, dated September 19, 1899.

Application filed June 15, 1898. Serial No. 683,543. (No model.)

To all whom it may concern:

Be it known that I, CHARLES W. DICKINSON, a citizen of the United States of America, and a resident of Belleville, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Machines for Justifying and Spacing Type, of which the following is a specification.

The present invention relates to a novel machine or apparatus for justifying and spacing out lines of type to a uniform length or measure, and is to be regarded as an improvement on that class of machine in which the justifying or spacing is effected by introducing wedge-shape space-bars between the words in lieu of ordinary spaces as the type characters are assembled or set into the line-holder or shuttle, which is gaged to the exact length which it is desired to have the finished line, and in forcing all of the space-bars or spreaders simultaneously through the line until it is spread or spaced out so as to entirely fill the shuttle, then removing the space-bars successively and substituting ordinary spaces of equal or slightly less thickness than the space-bar which has been removed at the point at which it enters the line, and driving or forcing the remaining space-bars farther into the line to again expand it so as to fill the line-holder or shuttle whenever a substituted space of less thickness than the removed space-bar has been inserted. The present machine, which is entirely automatic in its action, rapidly and accurately performs the several operations above mentioned, and after the line of type is properly justified it removes the completed line of type from the machine to a galley.

The invention will be best understood by the accompanying twenty-seven sheets of drawings, forming a part of this specification, in which similar letters and numerals refer to similar parts throughout all of the several views.

Figure 1 is a complete plan view showing the entire machine. Fig. 2 is an end elevation of the entire machine, looking in the direction of the arrows, on the line $x^2 x^2$ of Fig. 1. Fig. 3 is a front elevation of the lower end of the machine with the framework and type-setting mechanism omitted. Fig. 4 is a rear

elevation of the entire upper end of the machine, omitting the pulleys. Fig. 5 is a side elevation of a part of the upper end of the machine, looking in the direction of the arrows, on the line $x^5 x^5$ of Figs. 1 and 4. Fig. 6 is an enlarged plan view of the parts designated by the letters C and D on the upper part of Fig. 1, showing the line-holder or shuttle, the space-bars or wedges, and the space-bar-inserting mechanism. Fig. 7 is a cross-section of the upper end of the machine, looking in the direction of the arrows, on the line $x^7 x^7$ of Fig. 1. Fig. 8 is a cross-section showing the details of the mechanism for advancing the type into the line-holder or shuttle, looking in the direction of the arrows, on the line $x^8 x^8$ of Figs. 1 and 2. Fig. 9 is a detail of the cam mechanism for actuating the same, looking in the direction of the arrows, on the line $x^9 x^9$ of Fig. 8. Fig. 10 is a plan view of the central portion of the machine, showing the various parts designated by the letters F, K, L, and V in Fig. 1. Fig. 11 is also a plan view of the central portion of the machine, showing the same mechanism other than the space-box, and in addition thereto the justifying or spreading mechanism, together with the addition of the shuttle with the parts in somewhat different position from that shown in Fig. 10. Fig. 12 is a cross-section of the space-spreading or justifying device, looking in the direction of the arrows, on the line $x^{12} x^{12}$ of Fig. 10. Fig. 13 is a plan, partly broken away, to show the line-holder or shuttle-brake. Fig. 14 is a detail of the cam mechanism employed in actuating the spreading or justifying bars, looking in the direction of the arrows, on the line $x^{14} x^{14}$ of Fig. 10. Fig. 15 is a cross-section of the fractional-spacing and space-bar-withdrawing mechanism, looking in the direction of the arrows, on the line $x^{15} x^{15}$ of Figs. 1 and 10. Fig. 16 is a similar cross-section of the mechanism shown in Fig. 15, showing the extreme position with the operating-cam removed and the space-bar-withdrawing mechanism in the act of operating. Fig. 17 is a similar cross-section of the mechanism shown in Fig. 15, showing the wedge drawn back in position to drop on the lower table, with the cams in their proper position. Fig. 18 is a cross-section, looking in

the direction of the arrows, on the line $x^{18} x^{18}$ of Figs. 1 and 11, but showing in addition thereto certain parts of the spacing mechanism. Fig. 19 is a plan view of the extreme front of the machine, showing the mechanism for removing the justified line of type from the line-holder or shuttle to the galley and also the device for releasing the gate and permitting it to fall. Figs. 20, 21, and 22 are enlarged details of the mechanism actuating the mechanism which removes the justified line from the line-holder or shuttle to the galley. Fig. 23 is a similar view of the mechanism shown in Fig. 19, showing more particularly the gate-release with the mechanism for actuating the line-removing device omitted. Fig. 24 is a cross-section through the bed-plate, showing the lower table in a raised position and the mechanism for supporting the same. Fig. 25 is a sectional detail of a part the table-release shown in Fig. 24. Fig. 26 is an enlarged view of the lower table, with upper part shown in section. Fig. 27 is a section of the sprocket-and-cam mechanism for driving the shuttles and lifting the tables, looking in the direction of the arrows on the line $x^{27} x^{27}$ of Fig. 5. Fig. 28 is a cross-section of the same mechanism, looking from left to right in Fig. 4. Fig. 29 is a section, looking in the direction of the arrows, on the line $x^{29} x^{29}$ of Figs. 1 and 3, showing the fast and loose connections upon the shaft which actuates the justifying mechanism. Fig. 30 is a complete side view of the justifying mechanism, looking in the direction of the arrows, on the line $x^{30} x^{30}$ of Figs. 1 and 3, showing the fast and loose connections upon the shaft. Figs. 31, 32, and 33 are detail views of the line-holder or shuttle, the space-bar, and the mechanism for advancing type within the former. Fig. 34 is an enlarged detail view of certain parts of Fig. 2. Fig. 35 is a plan view of Fig. 34. Fig. 36 is a sectional view of the same mechanism, looking in the direction of the arrows, on the line $x^{36} x^{36}$ of Fig. 34. Fig. 37 is a detail of the end of the perpendicular rack in Fig. 2. Fig. 38 is a perspective view of the vibrating arm which actuates the type-pusher in the line-holder and of the means for actuating the same. Fig. 39 is a vertical longitudinal section of the bed-plate of the machine, together with its details, looking in the direction of the arrows, on the line $x^{39} x^{39}$ of Fig. 4. Fig. 40 is a longitudinal view, partly in section, looking in the direction of the arrows, on the line $x^{40} x^{40}$ of Fig. 4. Fig. 41 is a similar view of the same parts, showing the tables and the cams for actuating them in a different position. Fig. 42 is a side view of the side plate 1 shown on Fig. 4, showing the racks which move the shuttles in their path. Fig. 43 is a plan view of the same part shown in Fig. 42, looking in the direction of the arrows, on the line $x^{43} x^{43}$ of Figs. 2 and 42. Fig. 44 is a plan view, partly in longitudinal section, of the front part of the machine below the bed-plate on the line $x^{44} x^{44}$ of Fig. 3, showing

the line-holder or shuttle and lower table depressed and the mechanism for returning the same under the bed of the machine. Fig. 45 is a perspective view of the mechanism for moving the space-bars and line-holder from the lower table to the upper table.

Introduction.—The machine comprises in its construction, first, two or more line-holders or shuttles, in which a line of type is assembled and which are provided with adjustable devices for determining and limiting the length of the line of type and which are provided with longitudinal openings, into which the line of type is assembled, letter by letter, by means of any composing-machine, which may be conveniently employed for setting up or assembling the line of type therein, which holders or shuttles travel upon a suitable track or way to the spacing and justifying mechanism and thence to the galley; second, devices for keeping the line of type continuously advanced in the line holder or shuttle as it advances therein; third, a series of tapering space-bars or wedges carried upon a suitable platform upon the way on which the line-holders or shuttles travel, arranged to be inserted temporarily between the words as they are set up in the line-holders or shuttles in lieu of the ordinary spaces after each word, suitable mechanism for inserting the space-bars at the proper time, and suitable mechanism for driving them all uniformly farther into and through the line after they are in place; fourth, a series of devices which in connection with the temporary space-bars determine the selection of the spaces of the required thickness to replace the successive space-bars; fifth, a reciprocating space-holder with suitable compartments containing one space each of the different thicknesses used, combined with suitable devices whereby spaces are constantly supplied to it and means for moving the space-holder to and fro across the line of type; sixth, mechanism for forcing each space-bar successively still farther into the line to take up and apportion any fractional space that there may be and after so doing for extracting or withdrawing the particular space-bar and inserting in its place an ordinary space of suitable size to fill up the opening in the line left by the withdrawal of the space-bar and thereupon forcing the space from the space-holder down in the gap entirely into the line; seventh, appropriate mechanism for advancing the shuttles along suitable ways and for holding the same stationary while the aforesaid operations are being carried out, and, eighth, mechanism for removing a completed line of type from the shuttle to the galley and then withdrawing the shuttle from the upper way to the lower way and returning it to the position for receiving another line.

In Fig. 1 the following parts, which are common to all type-setting machines of this particular type, may be briefly described and

designated as follows: A is the bed-plate of the machine. B and B' (the latter of which is not shown in this figure) are respectively the upper and lower shuttle-ways, upon the upper of which the justification takes place and upon the lower of which the line-holder or shuttle is returned to a position ready for refilling. C and C' represent the shuttles or line-holders. D represents the space-bar or wedge-inserting mechanism. E represents the space-bars or wedges. F represents the justifying mechanism. G represents the mechanism for operating the line-holder brake. L represents the space-box and the mechanism for operating the same and the space-selecting mechanism for inserting the spaces into the line of type in the shuttle as the space-bars are removed. K represents the fractional-spacing mechanism and the various parts of the same. M and M' represent the gate mechanism which receives the shuttle containing the justified line of type at the end of its line of travel and after the line of type is discharged from the shuttle into the galley moves downward with it to a position where it is in a line with the lower table B', upon which it is then removed by appropriate mechanism and carried back to a position where it can be elevated into the position which it assumes for the purpose of being refilled. R represents the bunter or line-removing mechanism whereby the justified line of type is removed from the shuttle to the galley at the appropriate moment. U is the galley. S is the main driving-shaft of the machine and the gearing mechanism whereby the power is taken therefrom and appropriately transmitted to the different parts of the machine. T T are the driving-pulleys. W is the driving-shaft actuating the type-setting mechanism. P is a continuously-driven pulley for actuating the same and which actuates also the space-inserting mechanism and the mechanism for advancing the type in the line-holder or shuttle. In addition to the foregoing there are found in other drawings certain other parts which are also common to all machines of this character—as, for example, T S, the space-channels and the space-supplying mechanism, and N the roller for leveling the type as it is set up in the line-holder or shuttle C.

For convenience in description the various portions of the mechanism will be described separately, the method of operation being described in connection with each, so far as possible, and the entire operation of the machine afterward. The order of description followed will be that of the successive steps to which the type character is subjected in the course of its travel through the machine from the setter to the galley.

The line-holding mechanism.—The line-holder or shuttle consists of a rectangular box C, Fig. 1, preferably of metal, provided with a hollow interior of such dimensions as to receive the type of the particular type-

body which is in use. The line-holders or shuttles C, of which two are used in each machine, are fitted to slide along a suitable vertical side plate 1 near the central part of the main plate A, which extends the entire length of the machine from the front to the back. The shape of the shuttle or line-holder is shown in Figs. 6, 8, 16, 31, 32, and 38. The line-holders C C are in reality composing-sticks, each holding a single line of type, having a longitudinal opening or slot 2, Figs. 31 and 38, extending the entire length of the recessed portion and provided with an adjustable sliding block 9, Figs. 31, 32, and 38, which limits the length of the recessed opening, having connected therewith a depending tongue 3, sliding in ways 11 and 12, lateral movement of which is limited by a follower 4, inserted in front of the screw 5, as shown in Fig. 31. Upon the opposite side of the line-holder to the plate 1 are provided the jaws 6 and 7, Figs. 7, 8, 31, 32, and 38, upon which the space-bars, hereinafter described, rest when they are inserted in the line-holder.

8 represents a block which is attached to the block 9 by the screw 10 and slides horizontally backward and forward with it, as clearly shown in Fig. 38. This block projects outward and fills up the slot 2 on the face of the line-holder in which the type are assembled. Mechanism hereinafter described causes the blocks 9 and 10 to vibrate backward and forward in the line-holder with great rapidity, the effect of which is to cause the type and wedges as they are assembled one by one in the end of the line-holder shown at the left of Fig. 38 to be constantly pushed forward or advanced, the motion of the block from left to right being limited by the follower 4, held in place by the screw 5. The block 8 is prevented from sliding out by the block 8'. It will be obvious from Figs. 31, 32, and 38 that the limitations of the distance traveled by the block 8 to the right will vary from time to time according to the length of the line which is to be set up in the line-holder. The block 8 contains in its outer face a longitudinal opening 25, adapted to receive the end of rod 23 in the arm 17, passing through the opening 24 in the plate 1 opposite the line-holder, as shown in Figs. 6, 8, and 41, in the manner hereinafter described. A longitudinal opening 14 is provided in the vertical side plate 1 of substantially the same width throughout the plate, and shown in Figs. 2, 11, 12, 15, 16, 17, 40, and 43, and is directly in line with the opening 2 in the line-holder, as seen in Figs. 16 and 17, and extends from the point where the space-bars, which will be hereinafter described, are inserted in the line to the point where they are removed. The opening 2 allows the space-bars to be moved freely longitudinally through the line-holder C between the type characters as they are inserted, and the opening 14 in the side plate 1 allows the line-holder, with the line of type and the space-

bars inserted therein, to move freely along suitable ways 34 and 35 upon the edge of the table M, the shuttle-ways B and B', and the table M', as shown in Figs. 4 and 12. It will be evident that the type must be set or assembled in the line-holder either singly or by successive words or portions of words. For the purpose of forcing the type after insertion downward to the bottom of the opening 2 in the line-holder a roller 13, Fig. 12, is employed, mounted upon a bracket 15, attached to the plate 1 by the screw 16, as shown in Fig. 2, under which the line-holder C passes when it moves downward.

For the purpose of imparting motion to the type-pusher 8 in the line-holder C during the assembling of the type a vibrating mechanism attached to the exterior frame 1 of the machine is provided, which is shown in detail in Figs. 2, 6, 7, 8, 9, 34, 35, and 38. This mechanism consists of a vibrating arm 17, provided at its upper end with an adjustable spring 18. The upper end of this arm terminates in two jaws 20 and 21, one of which arms—the arm 20—is attached to the extremity of the spring 18, while the jaw 21 is formed on the extremity of the arm 17. These jaws encircle a pin 22, which pin is attached to the surface of a disk 19 at the end of the shaft W, so as to produce by the rotation of the shaft an eccentric movement, the effect of which is to cause the arm 17 to vibrate rapidly backward and forward, according to the motion of the pin 22 between the jaws 20 and 21.

In case for any reason the motion becomes too great a certain amount of play or escape is afforded by reason of the fact that the jaw 20, forming one of the two contact-points, is attached to the yielding spring 18, which can yield when the pressure or movement becomes too great. The projection 23 on the inner surface of the arm 17 projects through the opening 24 in the vertical side plate 1 and engages with the rectangular opening 25 in the pusher 8 upon the line-holder C. The effect of the lateral movement of the arm 17 is to impart a quick vibrating motion to the pusher 8 and to constantly push the type forward as it is assembled in the line-holder.

To remove the connection between the pin 22 and the pusher 8 of the line-holder, the following mechanism is employed: The lower end of the arm 17 terminates in two jaws 26 and 26', Figs. 2, 34, and 38, which are attached by the pivot 27 to the block 28. The block 28 carries a horizontal pin 29, journaled in the vertical side plate 1, as shown in Fig. 35, and fastened by a collar 30 and screw 31, whereby the same is permitted to rotate. The vibratory motion above described is effected by the capacity of the arm 17 to rotate with the block 28 upon the pin 29. The lower end of the arm 17 carries a spring 32, corresponding in tension to the spring 18, which former spring is attached to the block 28. When the mechanism for releasing the line-holder after filling and causing the same to com-

mence its movement along its path of travel begins to operate, certain intermediate devices, which will be hereinafter described, operate to cause the arm 17 to rock outward upon the spring 32 and cause the pin 23 to escape from engagement with the opening 25 in the pusher 8 in the line-holder C. In order to hold the line-holder in its proper position during filling and to prevent it from being moved by the vibration of the arm 17, a friction-clutch 440 is provided on a plate 441, extending from the side plate 1 and bearing upon the line-holder C.

Line-holder-advancing mechanism.—For the purpose of advancing the line-holder after the same is filled and the space-bars have been inserted to the space-inserting mechanism, thence to the galley where the justified line is discharged, and thence back to its original position, ready to receive a new line of type, a series of mechanism is provided, which are shown in detail in Figs. 1, 2, 4, 5, 12, 27, 28, 34, 35, 36, 37, 39, 40, 41, 42, 43, and 44. For the purpose of carrying the line-holder or shuttle C and permitting it to travel an inclined track or shuttle-way B is provided, as shown in Fig. 1, the upper ends of which, M and M', are movable and detached, so as to form two tables vertically movable. M is the upper or rear table, and M' is the lower or front table, as shown in Fig. 1. The tables M and M' and the plate B are so grooved and formed upon the face opposite to the vertical plate 1 that the projections 7 and 33 on the line-holder, Figs. 31 and 32, engage with the corresponding ways 34 and 35 upon the face of the tables M and M' and the plate B, as shown in Figs. 4, 8, 12, and 16, thus holding the line-holder during its entire line of travel firmly against the vertical side plate 1. Beneath the plate or way B is a similar inclined plate or way B', as shown in the various cross-sections, and as in the earlier machines of this same type the tables M and M' are arranged to be alternately dropped and raised, carrying with them the line-holder, which by appropriate mechanism passes off of the plate B onto the table M', falls upon and with the latter, and after the fall of the table passes off and is carried upward upon the plate B', over which it travels, to the table M, and upon its arrival upon the table M the latter is raised and the line-holder brought into alignment with the plate B, in which position it is again filled, and thence passes off the table M and onto the plate B, the table M falling to its lower position to receive another line-holder, while the line-holder discharged onto the plate B travels downward, as before, and subjects the type now contained in it to the action of the justifying and fractional-spacing mechanism, as before.

The mechanism of the tables M and M' will be best seen by reference to Figs. 24, 26, 39, 40, 41, 42, 43, and 44. The tables themselves are preferably rectangular, as shown in the plan view; but the lower table M' is prefer-

ably cut out at one side, as shown at 36 in Fig. 44, to provide access to the lower part of the front end of the machine. The tables themselves move vertically upward and downward on suitable standards 37, sliding in corresponding ways 38, cut in the face of the vertical bed-plate 1, as shown. For the purpose of raising and lowering the tables two cams 39 and 40 are provided, which rotate, respectively, upon sleeves on the fixed shafts 41 and 42. The cam 39 raises and lowers the lower table M' and the cam 40 raises and lowers the upper table M. The lower table M' carries upon its lower surface a roller 514, which rests upon the extremity of the cam 39 when table is raised, as shown in Figs. 25, 26, and 41. By the rotation of the cam 39 on shaft 42 either in one direction or another the table M' is either raised or lowered. When the table is lowered, the cam 39 assumes the position shown in Fig. 40, which it retains until it is again rotated by means of the mechanism hereinafter described. The upper table M is moved by a similar cam 40, engaging with a roller 517 on end of a bent arm 427, pivoted at 426 to the shuttle-way B'. The arm 427 carries a second roller 518, which impinges against a plate 519 on the lower face of the table M. When the table is raised, the cam assumes the position shown in Fig. 40, and when the cam rotates on its shaft 41 the table drops and assumes the position shown in Fig. 41. The downward movement of the lower table is limited by the stop 520 and that of the upper table by the stop 521. The mechanism operating these cams is so timed that when the lower table M' is raised the upper table will be lowered, but will be just ready to be raised by the rotation of the cam 40, and when the table M' is dropped the table M will be raised, but will be on the point of being permitted to fall by the movement of the cam 39, the time occupied by the rotation of the cam 40 between the point when it permits the table M to fall and when it begins to raise it again being sufficient to enable the empty line-holder and the row of space-bars to be moved by the mechanism hereinafter described from the table M' across the lower shuttle-way B' to the table M, and the cam 39 will in turn occupy sufficient time in its rotation after the table M has fallen to permit the mechanism aforesaid to advance and move the line-holder off of the table M' before the latter begins to rise.

The space-bar-inserting mechanism.—Instead of ordinary spaces I use tapering or wedge-shaped space-bars E, which, as in other machines of this character, are inserted temporarily crosswise into and through the line between the words as composition proceeds or when the type is transferred to the line-holder and which are replaced mechanically by ordinary spaces, as will be fully described later. The space-bars E are clearly shown in Figs. 1, 6, 17, and 33. The particular form of space-bar which is employed in the present

case is most clearly shown in the elevation in Fig. 33 and in the plan view in Figs. 6 and 44. The space-bars are all of the same size, and from the points 43 to 44 the sides are parallel, and from the points 44 to 45 they taper on one side, as shown in Figs. 6 and 44. The lower surface of the space-bars is flat, so as to permit them to slide freely upon the tables M and M' and the shuttle-ways B and B' and into the opening 2 in the line-holder 6, and they are provided on their lower surface with a circular opening 46 and with a rectangular opening 47 each for a purpose to be hereinafter described. The end of the space-bar which enters the line-holder has a transverse longitudinal slot 48 extending nearly its entire length for the purpose of assisting in holding them in place by giving a certain amount of spring to the upper portion. The upper portion is provided on its upper edge with a curved shoulder 49, which engages with the projection 6 on the edge of the line-holder and serves to hold it when inserted vertically at the proper point in the line. It is also provided with a groove or nick 50, in which the hook forming a part of the space-bar-withdrawing mechanism, hereinafter to be described, ultimately engages. The space-bars E upon the upper table M at the upper end of the machine are held upon it by means of a circular rod 51, formed upon the upper face of the table M and passing through the openings 46 in the space-bars. The entire row of space-bars is kept constantly advanced against a shoulder 52, fixed upon the upper bed-plate of the machine, as shown in Figs. 4 and 6, by means of a sliding head 53, which is constantly pushed forward by means of a coil-spring 54, Figs. 40 and 41, or in any other convenient manner. The extremity of the shoulder 52 is provided with a finger 55, as shown in Figs. 4 and 6, and the forward end of the foremost space-bar in the line is held in a horizontal position with reference to the line of type by means of a stud 56 upon the extreme rear edge of the shuttle-way B. This stud is of such size that when the foremost space-bar is inserted into the line the opening 47 upon the lower surface of the space-bar will come opposite to it, and as the line-holder moves downward in its path the opening 47 will come opposite to the stud 56 and the space-bar in the line-holder will be permitted to pass over the stud and in that way pass down the shuttle-way B. It will be observed from Fig. 40 that the foremost of the line of space-bars is kept just over the edge of the table M and upon the extreme upper part of the shuttle-way B.

The space-bar-inserting mechanism consists of a rod 57, sliding horizontally in bearings 58 and 59 and carrying a curved arm 60, attached to it, as shown in Figs. 4 and 6. The arm 60 terminates in a vertical lug 61, directly behind the foremost space-bar 62 in the line, as shown in Figs. 4 and 6. When the sliding rod 57 moves from right to left in

Fig. 4 and from left to right in Fig. 6, it will engage with and cause the foremost space-bar 62 in the line to move forward and enter the line-holder and to be held in such position by the spring effect caused by the shoulder 49 engaging with the jaws 6 and 7 of the line-holder. For the purpose of imparting suitable movement to the sliding rod 57 a stud 63 is provided, engaging with an eccentric groove 64, cut upon the face of a block 65, in which block the shaft W rotates loosely at the normal rate of speed. The block 65 terminates at its outer end in a sleeve, as shown in Fig. 8, which is encircled by a disk 66 and a gear-wheel 67, provided with teeth 68 on its periphery. The gear-wheel and disk are fastened to the block by the screws 69. The large gear-wheel 67 upon the block 65 gears into an intermediate pinion 70, which rotates upon the shaft 71. This shaft also carries a second and larger gear-wheel 72, rigidly fixed to it, which in turn engages with a gear-wheel 73, provided with the teeth 74, as shown in Fig. 8, attached to or mounted upon the block 75, which, like the block 65, rotates loosely upon the shaft W. It will be obvious that if the block 75 be thrown into engagement with the shaft W a corresponding motion, but at a reduced rate of speed, will be imparted to the cam-block 65.

In order to effect the connection between the block 75 and the shaft, the mechanism shown in Fig. 9 is provided, which is also shown in Figs. 2, 6, and 8. In these figures W represents the shafts and 76 a trip-lever pivoted loosely at the point 77 to the block 75, and provided with a spring 78, bearing against the stud 79, also upon the block 75. The lever is bent, as shown in Fig. 9, and is held out of engagement with the fixed collar 84 by means of a pin 80 upon the arm 81. (Shown in Figs. 2 and 4 more in detail.) The movement of the other extremity of the lever is limited in one direction by a stud 82 upon the surface of the block 75, as shown in Fig. 9. The movement of the lever-arm 76 is limited in the other direction by the stud 83, formed upon the surface of the collar 84, which is attached to and rotates with the shaft W by means of the screw 85. The lever 81 is attached to a vertical arm 86, which is pivoted at the point 87 to an arm 88, which in turn is rigidly attached to a rock-shaft 89. The arm 88 is attached by a spring 90 to the bed-plate A, as shown in Fig. 2, the effect of which is to keep the arm 88 normally depressed and the arm 81 in the position shown in Fig. 2. The rock-shaft is actuated by means of a lever-arm 91, carrying a space-bar 92, and the opposite end of the space-bar 92 is attached at the other end of the machine to the other end of the rock-shaft, as shown in Fig. 44. The arm 86 is held normally in a forward position by the spring 86', which is attached to the upright A³, attached to the bed-plate A³, and after a space-bar has been inserted it restores the mechanism to its

original position. As a result of pressure exerted upon the space-bar 92 the rod 81 is lifted out of the position shown in Fig. 2 and the stud 80 disengaged from the lever 76, which thereupon assumes the position shown by the dotted lines in Fig. 9, by reason of the force of the spring 78 acting upon the pin 79. The shaft thereupon makes a single revolution, and the revolution is transmitted through the gear-wheels above described to the cam-block 65, thus causing the rod 57 to move horizontally and the space-bar to be inserted. At the end of the revolution the extremity of the lever 76 strikes the pin 80 and assumes its normal position and the motion of the shaft ceases to be imparted to the cam-block 75. As the cam-block 75 runs loosely upon the shaft W, in order to cause it to resume its normal position, in which it can act again after a single revolution, a balance-spring 93 is provided, as shown in Fig. 2, which engages with a suitable groove or nick upon its periphery and exerts sufficient pressure upon it to hold it normally in such position that it can be thrown into operation when the space-bar 92 is operated, the force of the shaft being sufficient to disengage it from the spring 93 when the shaft begins to operate. In order to compel the cam-block 65 to return after the operation to its normal position ready for a new operation, the disk 66 is slightly flattened at the top, as shown in Fig. 2, and the pin 80 upon the shaft 81 is extended over the same, as shown in Figs. 6 and 8, the disk 66 being sufficiently large to engage with the extended rod 80, as shown in Fig. 2, and stop the disk, and consequently the block 65, at the proper position, where it remains held until the pin 80 is again raised.

The justifying-bar mechanism.—The insertion of the temporary space-bars farther into the line of type in the line-holder in order that the wedge portion may operate to cause the words to be spaced or spread apart to entirely fill the line-holder is effected by the so-called "line justifying" or "spreading" mechanism, which is designated generally by G in Fig. 1. This is best shown in Figs. 1, 10, 11, and 12. Taking up Figs. 11 and 12 it will be seen that the justifying-bar itself is a horizontal bar 94, which is supported upon an arm 95 behind the row of wedges in the line-holder as it moves down upon the shuttle-way B and is arranged to move forward and drive in the entire series of wedges as assembled in the line-holder by being advanced from left to right, as shown in Fig. 11. The arm 95 is attached to a rectangular sliding bar 96, which slides upon the main bed-plate A of the machine, as shown in Figs. 10, 11, and 12. One end of this rod enters into a suitable opening 97 in the bed-plate B, as shown in Figs. 12, 40, and 41, and the other end of it passes through an opening in the block 98, which is attached to the bed-plate of the machine by screws 99, as shown in Figs. 11 and 12. The sliding bar 96 carries a block

100, which in turn carries a loosely-rotating roller 101. The block 100 impinges against a head 102, attached to a spiral spring 103, which is carried on a rod 104, passing through a vertical standard 105 on the main frame-work of the machine. The tendency of this spring is to cause the block 100, attached to the sliding bar 96, to be constantly moved forward; but it is held compressed and in the position shown in Fig. 12 by means of the cam mechanism now about to be described. 106 is a driving-shaft, actuated in the manner hereinafter described, rotating in three vertical bearings 107. The shaft 106, Fig. 14, has attached to it a cog-wheel 111, provided on its periphery with the teeth 112, which cog-wheel is surrounded by an annular sleeve or ring 113, running loosely upon the shaft 106, but which can be made to engage with the cog-wheel 111 and rotate with the shaft 106 by devices hereinafter described. The ring 113 has attached to its periphery two cams, one of which, 114, engages with the roller 101, mounted upon the block 100 on the bar 96, as shown in Fig. 12, in such manner that when the shaft 106 actuates the cam 114 and the cam 114 is moved out of engagement with the roller 101 the bar 96 is moved forward by the expansion of the spring 103 and the entire row of space-bars E is driven forward by the justifying-bar 94 and into the line of type held within the line-holder C until the line is expanded so as to completely fill out the line-holder, the tension of the spring being only just sufficient to press the bar 94 forward a sufficient distance to drive the line of space-bars sufficiently into the line to take up all looseness in the line and fill out the line-holder. The cam 114 is attached to the surface of the ring 113 by means of screws 115 or in any other convenient manner. A second cam 116 is also provided upon the periphery of the ring 113 for the purpose hereinafter described by means of screws 117. (Shown in Fig. 14.)

In order to intermittently connect the gear-wheel 111 with the loose ring 113 for the purpose of actuating the cam 114, a pivoted dog 118 is provided in the periphery of the ring, pivoted at the point 119, and provided with a tooth 120, engaging with the teeth 112 upon the wheel 111. The lower end of the pivoted dog is pressed constantly in engagement against the cog-wheels by means of a spring 121 (shown in Fig. 14) and is lifted out of engagement with and kept free from the cogs 112 by means of the arm 122, rigidly attached to the dog 118, in the manner shown in Fig. 14. The arm 122 is supported by the rod 108, which throws the mechanism in and out of gear in the manner hereinafter described. Attached to the rod 108 by a pivot 109 is an arm 110, Fig. 14, for the purpose hereinafter described. It will be apparent from the foregoing description that when the rod 108, as shown in Figs. 5, 14, and 30, is moved outward the expansion of the spring 121 will

cause the teeth 120 of the dog 118 to engage with the cogs 112 of the wheel 111, and the sleeve 113 and the cam 114, attached thereto, will make a single revolution, and the roller 101 will be released, and the rod 96 will move forward and the space-bars driven in and the line correspondingly spread in the line-holder C. The rod 108 is normally held in the position shown in Fig. 30 by means of a spring 123, attached at the other end to the vertical frame-plate A⁴ of the machine, so that until the rod 108 is moved by the proper agencies the justifying-bar 94 remains at rest and is not operated and the ring 113 rotates loosely on its collar on the shaft 106.

The line-holder-arresting mechanism.—The object of this is to hold the line-holder while the justifying-bar is operating. This consists of a horizontal bar or lever 128, which is pivoted at 130 in a slot 129, cut longitudinally in the front face of the shuttle or line-holder way B, as shown in Figs. 7 and 13. A spring 132, set into an opening 133 in the plate B, as shown in Fig. 13, serves to constantly throw the forward end of the lever 128 outward or from left to right in Fig. 13. The forward end of the lever 128 is provided with a hook 131, which engages with the line-holder and holds it by reason of the projection of the hook 131, which engages with the front corner of the part 33 of the line-holder. The lever 128 is operated by means of a sliding rod 126, abutting against its rear end, passing through a horizontal opening 127 in the plate B, and the other end of which impinges against a pivoted latch 124, Figs. 7 and 13, pivoted on the rod 125 to the bed-plate. The end of this latch when the lever is at rest touches upon the surface of the roller 113; but when the shaft 106 has been rotated in the manner above described for the purposes of driving in the space-bars the latch 124 is tripped by the cam 116 upon the surface of the roller 113, and the rod 126 is driven inward, thereby throwing out the inner end of the lever 128, compressing the spring 132, and releasing the hook 131 from the corner of the line-holder C, thus permitting the line-holder to resume its movement upon the shuttle-way B by the operation of the lower driving-rack, which at this instant has begun to operate, as will hereinafter be described. It will be obvious that this movement will continue until the cam 116 has passed the latch 124, and when this has been accomplished the force of the spring 132 throws the lever 128 back to its original position, as shown in Fig. 13, and the mechanism will be in position to stop the second line-holder as it descends. By means of mechanism which throws the roller 113 into engagement with the shaft 106 at the proper instant it is possible to cause a line-holder to be held and to be released and move on with each revolution of the shaft 106.

In order to announce to the operator that the line-holder has been filled, any convenient

form of bell mechanism may be employed. In the present case a bell 414 is shown attached to the support 415 upon the block 429, sliding in the ways 430 upon an extension of the vertical bed-plate at the upper end of the machine. It is struck by the hammer 416. It is provided with an arm 419, kept in a constant position by the spring 417, attached to the block at 418 at one end and to the rod 419 by the arm 419' at the other end, and limited in its play by the stud 428. The rod 419 is supported on the top of the line-holder, and when the line-holder moves down beyond the end of the rod the rod drops by reason of the action of the spring and the bell is struck. When the line-holder rises on the upper table, it lifts the rod 419 with it and compresses the spring 417. The block on which the bell is attached may be set at any particular point with reference to the length of the line by adjusting it in the sliding ways 430, as shown on Fig. 5.

The space-selecting mechanism.—By this title is understood that particular mechanism which arrests the line-holder after the space-bars have been driven in and the line expanded and then drives in the space-bars successively, so as to take up any looseness in the line, and withdraws them one by one and inserts in the place of the bar so withdrawn an ordinary space of appropriate thickness to replace the temporary space-bar and ultimately to properly space out the line. The present machine differs from other machines of the same general character in that this operation takes place by driving in each space-bar successively, so as to completely fill up the line, and then removing and replacing it by permanent spaces, and not by driving in all the space-bars simultaneously and then removing and replacing the first and simultaneously driving in the remaining ones and then removing and replacing what is then the foremost space-bar, and so on. The mechanism which accomplishes this result in the present machine may be conveniently divided into three parts: first, the line-arresting mechanism or line-holder brake; second, the fractional spacing mechanism, and, third, the space-selecting mechanism. These will now be described separately.

(a) *Line-holder brake.*—In order to hold the line-holder stationary during the operation of the driving in and removing of the space-bar and inserting a space, a line-holder brake consisting of a sliding rod 253 is provided. The outer end of the rod 253 slides in a bearing in the strap 98, and the motion of the rod is limited by a collar 252, attached to it at the outer end. The rod terminates in a cross-head 250, fastened by a pin 255 to the rod, and a spring 136 is provided for normally holding the cross-head 250 and the rod in an advanced position and constantly thrown forward. One end of the cross-head bears against a sliding rod 247, provided with a limiting-stop 164, which is arranged to slide

in bearings 249 upon the bed-plate A. The other end of the rod 247 carries a cam-shoe 248, which by reason of the tension of the spring 136 is constantly held against the cam projection 251 upon the ring 142, as shown in Figs. 10, 11, and 18. When the ring 142 is thrown into connection with the constantly-rotating shaft 106, the cam 251 will be withdrawn from the shoe 248, and the rod 247 will be driven forward by the cross-head 250 and its retractile spring 136 as far as its stop 164 will permit. The cross-head 250 will then drive the sliding rod 253 forward until it bears upon the line-holder C at its lowest projecting part, (marked 33 in Figs. 4 and 32.) By this means the line-holder will be held firmly until the space-selecting mechanism has completed its operation and will not be released until the ring 142, carrying the cam 251, has nearly completed its revolution and it is necessary for the line-holder to move forward again, and spring 136 will be compressed, and the brake-rod 253 will be withdrawn from the line-holder C, and the latter will be permitted to move forward until the foremost space-bar or wedge strikes the rod 193, which actuates the mechanism, throwing the ring 142 in and out of engagement with the shaft 106. In the meantime the cam 251 will be held against the cam-shoe 248 and the brake held in the released position (shown in Fig. 11) until such time as the mechanism is thrown into operation again, this operation being repeated each time that the line-holder advances, so that the space-bar impinges against the rod 193.

(b) *The fractional spacing mechanism.*—It will be obvious from the foregoing that after the justifying-bar has driven all the space-bars into the line-holder, so as to fill out and expand the line, the instant when the line-holder comes under the space-selecting mechanism all the space-bars will be inserted a like distance into the line. If, then, the first space-bar be removed and the appropriate space inserted and if the operation be continued successively and if in each case a proper space is selected to precisely fill in the amount of space occupied in the line by the space-bar, perfect justification will be effected. As a matter of practice, however, no space inserted in place of any space-bar does actually occupy precisely the same amount of space as was occupied by the space-bar. Therefore as the space-bars are removed and replaced by spaces one by one a slight looseness in the line will be observed, which looseness must constantly increase as the operation of removing and replacing the space-bars continues. To take up this looseness and compensate for it and put in a theoretically correct space as the operation of justification continues, the fractional spacing device is employed, which consists, as is shown in Figs. 10, 15, and 16, of a sliding bar 134, Figs. 15 and 16, which slides horizontally across and over the shuttle-way B and is attached to a sliding bar 135, which slides horizontally on the bed-

plate A, as shown in Figs. 15 and 16, in the block 98. The sliding bar 135 carries a vertical arm 137, carrying a roller 138. This roller engages with a double irregular cam 139, arranged to be operated from the shaft 106 by substantially the same agencies as are employed for the purpose of operating the cam 114, which operates the justifying-bar. The arm 137 and the bar 135 are constantly kept thrown forward by means of a spring 140 on the rod 141, attached to the frame 105, in the same manner as before. In Figs. 10 and 11, 142 is an annular ring similar to the ring 113. 143 is a dog similar to the dog 118. 144 is a bar similar to the bar 122, pivoted at the point 145 in the same manner as the bar 122. Between the cam 139 and the annular ring 142 is a second cam 146, which operates the space-ejecting mechanism in the manner hereinafter described. When the cam 139 is thrown into engagement with the shaft 106 and the bar 135 moves forward through the engagement with the roller 138, the bar 134, carried on it, moves forward also and comes in contact with the end of the space-bar E, as shown in Fig. 16, and drives it forward, so as to take up any looseness in the line. Attached to the arm 134 is a bracket 147, carrying a pivoted hook 148, pivoted to the bracket 147 at the point 149, Fig. 16. This hook, when the arm 134 is not in operation, assumes the position shown in Fig. 15 by reason of a spring 150, inserted into the top of the hook and bearing against a pin 151 upon the upright 147. The end of the hook is curved, as shown in Figs. 15 and 16, and the point is sharpened, as there shown, in such manner as to enable it to engage with the indentation 50 upon the rear end of the space-bar E, so that when the bar 134 moves forward and impinges against the end of the space-bar and drives it into the line-holder the curved end of the hook 148 is tripped over the beveled end of the space-bar and engages with the nick, as shown in Fig. 16. At the instant that the forward motion of the bar 134 ceases and the retrograde motion commences and the space-selecting mechanism begins to operate, the hook 148 is firmly attached to the space-bar, and as the bar 134 moves backward, and the hook being mounted upon it, carries with it the space-bar and withdraws it from the line-holder. For the purpose of driving down the space-bar so withdrawn by the hook 148 the instant that the same is placed upon the shuttle-way B a device in the nature of a latch is employed, which is shown in Figs. 10 and 15. This latch consists of a bent arm 152, pivoted at 153 to a plate 154, conveniently mounted by a screw 155 to the plate A. The plate 154 may be conveniently arranged to meet the construction of the machine, but in the drawings it is shown attached to the base of the bearing 107. The arm of the latch 152 is kept constantly thrown forward by means of a spring 156. It is beveled on its inner face at the point 157, as shown in Fig. 10, so that

when the rod 134 moves forward the extremity of that rod will impinge against the latch at the point 157 and cause the same to open it, and the instant that the bar 134 moves backward the spring 156 will advance the latch and the latch will gently move the space-bar previously released from the line on the shuttle-way B and advance the same downward upon the same a short distance, so as to leave a free space upon the shuttle-way for the bar 134 to advance and remove the next spaces. The movement of the latch is limited in a forward direction by the front end of the bar 134. The effect of the latch is to keep the line of space-bars as they are removed one by one constantly forced down upon the lower table M' and to assume the position shown in Fig. 17 with the opening 46 in the space-bar in position to pass over the upper end of the rod 51 on the table M', corresponding to the rod 51 on the table M. In this way the space-bars are all gradually removed to make way for succeeding operations and are ultimately assembled, as shown in Fig. 41, at the upper part of the table M'. 70 75 80 85 90

c. Space-bar-holding mechanism.—In order to hold the space-bars as they are withdrawn one by one and forced forward by the latch 152 in alinement on the table M' and assemble them in proper order, the mechanism shown in Figs. 17, 18, 26, and 44 is provided. This consists of a horizontal rod 255, arranged to slide in the upper end of the lower table M'. The horizontal motion of this rod is limited by a vertical pin 256, inserted in a recess of the rod 255, which also prevents it from turning. A spiral spring 257, impinging against a corresponding pin 258 at the other end, is recessed in the end of the rod 255, as shown in Fig. 18. The effect of this construction is to keep the rod 255 constantly thrown forward from right to left, as shown in Fig. 18, pressing against the vertical pin 256. The sliding motion of this rod from left to right in Fig. 18 controls the dropping of a horizontal stop-plate 259, as shown in Figs. 17, 18, 26, and 44. This stop-plate, as is shown in Fig. 26, is pivoted at one end at the point 260 in the recess in the table M', and it is provided at its upper end with a flange 261, against which the space-bar rests when it is withdrawn from the line-holder C and forced down by the latch 152; and a spring 262 is provided at the free end of the plate 259, which is held normally in the position shown in Figs. 26 and 44. The lower end of the spring 262 is attached to a pin 263 upon the bed-plate A. The tendency of this spring is to draw the free end of the plate 259 constantly downward. The upper surface of the rod 255 is provided with a beveled slot 264, which is of a width large enough to receive the plate 259, so that when the rod 255 moves forward from left to right in Fig. 15 and the slotted portion 264 comes under the plate 259 the tension of the spring 262 will draw down the free end of the plate 259 and the foremost 95 100 105 110 115 120 125 130

space-bar E will pass over the shoulder 261 and onto the plate 259, and when the rod 255 moves back from right to left the beveled end 265 of the slot 264 will raise the plate to its original position, (shown in Figs. 18, 26, and 44,) with the shoulder 261 ready to hold another space-bar. In order to properly move the rod 255 the proper distance and at the right instant, a pivoted lever-arm 266 is provided, pivoted on the shaft 267, (shown in Fig. 18,) and to trip the same a cam-lug 268 is provided on the periphery of the ring 142, which is of such size and is so timed as to its revolution that it engages at the proper instant with the lever 266, as shown in Fig. 17, and throws it forward, so that the extension-piece 269 engages with the end of the rod 255 and throws the same forward a distance equal to the distance which the same can travel upon the pin 256. A spring 270 holds the lever 266 normally away from and out of contact with the rod 255, and after the shoulder 271 of the lever 266 is tripped by the cam 268 restores it to its original position.

(d) *The space-selecting mechanism.*—The space-selecting mechanism is best shown in Figs. 3, 10, 15, 16, 17, and 18. In the drawings, L represents a suitable sliding space-holder containing compartments 159 of suitable sizes to which the spaces are constantly supplied through appropriate channels 160. Appropriate space-ejectors 161 operate to eject a space from the particular compartment 159 from which the selected space is to be ejected. The ejecting is effected by an ejecting bar or rod 162, Figs. 10, 16, 17, and 18, which bar is pivoted at the point 163 to a standard 164 upon the bed-plate A, as shown in Figs. 10, 17, and 18, and is normally held down by means of a spring 165, attached to the rod 162 at its loose end at the point 166, and at the other end to the vertical frame of the machine 1 at the point 428, as shown in Figs. 17 and 18. The upward movement of the rod 162 is guided by a strap or rod 168, attached to the frame at the point 169 in the manner shown in Figs. 16, 17, and 18. In Fig. 16 the rod 162 is shown in the act of descending and the spring 165 correspondingly compressed. In Fig. 17 the rod has completed its movement downward and ascended a short distance. The rod 162 carries on its lower surface a projecting lug 162', which is so adjusted with reference to the cam 146, referred to above, that during a part of the rotation of the cam on its axis the lug 162' will engage with the surface of the cam 146 in the manner shown in Figs. 17 and 18, and when the cam is not in operation the rod 162 is held normally in a raised position, as shown in Fig. 18. The rod 162 is provided with a pin 162^a, which slides in a ledge on the face of the space-box L. Each space-compartment is provided with an ejector 162^a, a shoulder of which extends out of the slots 159 and serves to cause the pin 162^a to engage with the particular ejector over which the pin is brought when the space-

box L comes to rest. When the bar 162 moves downward, the pin engages and draws down the ejector, and the proper space is pushed down into the line. When the cam begins to rotate, for a portion of the rotation the lug 162' will travel over that part of the surface of the cam of greatest diameter until the point 146^a is reached, whereupon the rod 162 is drawn downward by the force of the spring 165, carrying a space-ejector 161 with it. When the lug reaches the point 146^b, the shortest diameter of the cam, the arm 162 will be drawn to its lowest position and the space driven in to its full length into the line, from which point the rod 162 will continue to be raised by contact with the surface of the cam until the point 146^c is reached, when it is restored to its highest point and stops at the point where its movement began at the end of a revolution.

Fig. 16 shows a space-blank s just commencing to enter the line of type, and Fig. 17 shows one entirely driven in.

(e) *Space-box and selecting mechanism.*—The space-box L is arranged to slide horizontally in suitable ways a distance proportionate to the number and variety of spaces it contains, and it carries upon its lower face a lug 172, containing two bearings, into one of which a rod 170 is pivoted at the point 171, and in the other of which a rod 175 is pivoted, as shown in Figs. 10, 15, 16, 17, and 18. The rod 170 carries at its extremity a plate 172, rigidly attached to it at its outer end on its inner face by screws 173 in order to widen it, as shown in Figs. 10 and 28. The sliding bar 135 carries an upright 174, which contains on its inner surface a lug 176, adapted to engage a projection 177 upon the lower surface of the rod 170, as shown in Fig. 15. As the bar 135 moves forward, the lug 176 moves with it, and the lug 176, engaging with the shoulder 177 on the rod 170, pushes the bar 170 and the space-rack L, to which it is attached, a sufficient distance forward so that when the bar 135 ceases to move the space-rack will have stopped directly over the opening in the line-holder in which the space is to be inserted when the space is withdrawn. As the space-holder L does not have to move over as great a distance ordinarily as the rod 135 has had to move in order to drive in any one of the wedges, the movement of the machine is so timed that by making a short distance between the lug 176 upon the vertical arm 174 and the shoulder 177 on the bar 170 the space-box will not begin to move until after the bar 135 has moved a certain part of the distance which it has to travel, so that the space-box will come to rest with the appropriate space-compartment directly over the line-holder, and when the space-bar is removed the properly-selected space can be inserted. In order to positively hold the space-holder for the proper length of time at the proper moment in the proper position, the rod 175 is employed, which is

provided on its lower surface with a detent-hook 178, arranged to engage with a rotating detent-stop composed of as many conical depressions 179 on a rotating shaft 180 as there are space-compartments in the space-holder. The shaft 180 rotates in the bearings 181 and carries at its extremity a beveled gear-wheel 182, meshing into a corresponding beveled gear-wheel 183 upon the shaft 106 and rotating with the cams 139 and 146 when they are in engagement. 184 is a lug fastened to and rotating with the shaft 180 of the detent-stop 179, as shown by dotted lines in Fig. 30. As the space-holder L moves forward from left to right the loosely-held detent-hook 178 moves over the depressions in the rotating detent-stop, rising and falling as it goes until the space-holder stops. In order to lock the space-holder at the right instant by letting the detent-hook fall into the proper stop, a tripper 420 is provided on the shaft 180, arranged to raise the end of a latch 421, pivoted to the bearing 107, as shown in Fig. 30. The loose end of the latch is arranged to lift in turn the rod 170 from the lug 176. At the instant that this release is effected the detent-hook falls by its own weight into the detent-stop directly under it, where it is held by the action of the spring 185 on the space-box L, on which stop it rests, thereby holding the space-box in a fixed position until the detent-rod 170 is raised. While so held, the proper space is inserted by the ejector into the space formed in the line by the withdrawal of space-bar. On the completion of a single revolution of the shaft 180 the lug 184 is so arranged that it comes in contact with and raises the rod 175 and its detent-latch 178 from the detent-stop 179. The space-holder L is then at once returned to its original position by the spring 185, Fig. 1, and is held there by the stop V' bearing against the side plate 1. The spring 185 is shown in Figs. 1, 17, and 18 and is attached to the frame of the machine and to the bottom of the space-box L, which slides in suitable ways 186 upon the frame of the machine. The stop V' is placed on the frame of the machine, as shown in Fig. 1. The details of the mechanism for advancing the spaces in the space-channels and for ejecting the spaces are not shown, as any suitable mechanism may be employed.

For the purpose of driving the justifying and spacing mechanism the auxiliary shaft 106 is employed, rotating in the bearings 107. This terminates at its upper end in a beveled gear-wheel 314. The driving-pulley T carries on its shaft 343 a bevel-wheel 277, which meshes into another bevel-wheel 311, carried on the end of a vertical shaft 312, Figs. 4 and 5. At the other end of the shaft 312 is a smaller pinion 313, meshing into the beveled gear-wheel 314 on the shaft 106, whereby appropriate rotary motion is imparted thereto, the size of the gear-wheels being so related to each other that the proper speed of the shaft 106 results.

The bunter mechanism.—This consists of a horizontal pusher 215, operated intermittently by the shaft 106, which is thrown into operation by appropriate mechanism when the line-holder reaches a proper point in the line of its travel, so that when the line-holder stands directly in front of the galley the justified line of type can be removed. This mechanism is shown in detail in Figs. 3, 19, 20, 21, 22, 23, and 25, and it consists of a sliding plate 216, sliding horizontally upon the bed-plate A, to which is attached, at one end, a horizontal bunter 215, as shown in Figs. 3 and 19. The plate 216 slides in the straps 217 on the bed-plate A. The bunter 215 carries on its upper rear edge a suitable bearing 219, to which is pivoted at 220 a bar 214, which in turn is pivoted at 218 to the edge of a disk 202, mounted upon the shaft 106, so that when the disk revolves an eccentric motion will be imparted to the rod 214 and the bunter 215 will be caused to slide horizontally forward and backward. The shaft 106 carries a collar 201, which is fastened to and rotates with it. This collar contains on its periphery a series of gear-teeth 203, as shown in Figs. 19 and 22. Between the collar 201 and the disk 202 is placed a ring 204, (Shown in detail in Fig. 21.) This ring has an ear or lug, with an opening containing a pin 207 at one end and on the other end a somewhat longer ear or lug 205, the shape of which is shown in detail in Fig. 21. The inner surface of the ring 202 is formed in the manner shown in Fig. 20, and is provided on either side with two channels 206, adapted to hold and receive the two ears or lugs of the ring 204. When the ring 204 is placed in position between the collar 201 and the disk 202, the condition of things is shown in Fig. 22. Two spiral springs 209 are provided on either side of the ear or lug 205, the effect of which is to keep the ring 204 constantly pressed against the collar 201, which rotates with the shaft 106. The disk 202 rotates loosely upon the shaft 106 and is held in position by a circular disk 210 and a screw 211, which screws into the head of the shaft 106. It will be obvious from Fig. 22 that as long as the ring 204 is in engagement with the teeth 203 upon the face of the collar 201 the ring 204 will rotate with the shaft 106 and a reciprocating motion will be imparted to the bar 214. In order to throw the ring 204 out of engagement with the teeth 203 on the collar 201 and to stop the rotation of the ring 202, a retaining-pawl is provided, 212, (more clearly shown in Fig. 30,) attached to an arm 198, pivoted to the bearing 107 by the pivot 221. The tendency of this pawl is to keep the ear 205 out of engagement with the teeth by means of a spring 199, which constantly tends to throw the upper end of the pawl 198 outward and the lower end inward. The pawl 212 is actuated by a rod 424, which engages with the end of a lever 222, which is pivoted at 223 to an extension-piece 224 upon the foremost of the

straps 217 or at any other convenient point on the bed-plate. The lever 222 is provided with a nose 225, which is arranged to engage with a notch 226 in the front edge of the line-holder. A spring 227 is provided at the other end of the lever 222, which spring bears against the edge 6 of the line-holder C as it comes forward. As the line-holder comes down and stops at the end of its line of travel the spring 227 strikes the edge 6 and throws the nose 225 into the notch 226, thereby pulling the rod 424 forward and releasing the pawl and causing the ear or lug 205 to take the position shown in Fig. 22, thereby causing the ring 202 to rotate with the shaft 106 and the plate 215 and the bunter 216 to move forward and its forward face to come in contact with the line of type in the line-holder through the opening 2 therein and to push the line of type from the line-holder off onto the galley U. For the purpose of adjusting the length of the bunter to the length of the line of type formed in the line-holder, a sliding plate 229 (shown in Figs. 3, 19, 20, and 21) is provided. This slides in a suitable way 230, cut in the interior of the bunter 215, upon a suitable track 231, Fig. 3, and may be shifted laterally and fitted to suit the length of any line of type in the line-holder by means of a thumb-screw 232. By moving the plate 229 forward or backward in the way 230, as shown in Fig. 19, the length of the surface 234 presented to the surface of the type in the line-holder may be increased or diminished.

The table-supporting mechanism.—For the purpose of supporting the lower table M' an adjustable latch (shown in Figs. 19, 23, 24, and 25) is provided. This latch is carried upon an arm 237, screwed to the lower front edge of the plate A, as shown in Fig. 23. To this arm is pivoted at 236 the latch proper, 235, the upper end of which is made in the form of steps, as shown in Figs. 24 and 25. To the upper end of the latch 235 a sliding bar 241 is pivoted at 238, which carries a stop 246, which stop engages with the foremost of the straps 217 on the bed-plate A and limits the movement of the bar 241 from left to right, as shown in Fig. 23. The extremity of the bar 241 is provided with a beveled termination in the form of a hook 242, Figs. 24 and 25. A spring 239, recessed in the front end of the plate A and bearing against the latch proper, 235, throws the latch constantly forward into the position shown in Figs. 24 and 25. An arm 245 is fastened to the plate 216, upon which the bunter slides and moves forward with the plate, provided with a projecting lug 244. The length of the lug 244 is such that when the plate 216 moves forward the lug comes under the beveled end 242 of the bar 241, lifts it and passes under it, and permits the bar 241 to drop. At the instant that the bunter 215 and the bar 216 move forward to eject the type the table M' is held in an elevated position upon the step 234 of the latch 235, and as the plate 216 moves for-

ward the head 242 is lifted by the lug 244 on the bar 245. The instant that the plate 216 begins to move backward, the lug 244 engages with the inner face of the hook 242 and causes the latch 235 to be moved from right to left and the spring 239 to be compressed. A pin 243 is so placed on the bearing 107 that the beveled surface of the hook 242 will ride up upon it for a distance sufficient to lift the point of the hook over the lug 244, which is thereupon restored to its original position by the spring 239. While this operation is taking place, the seat or stop 235' will have been withdrawn and the table M' will have been allowed to drop to its lower position, carrying with it the empty line-holder and space-bars, which are then in position to be removed therefrom by the operation of the line-holder-returning mechanism hereinafter described. In the meantime the latch 235 will have resumed the position shown in Figs. 24 and 25. When the table M' moves upward, it passes over the latch 235 by the compression of the spring 239, which spring throws the latch forward after the table has passed, and the latter rests upon the stop 235 again, and is supported in the same manner as before until the bunter mechanism again moves forward. It will be obvious from the foregoing that the table will be held firmly in the upper position until such time as the descent of the line-holder operates the bunter mechanism, which at the instant that the line is discharged from the line-holder throws the table latch into operation and permits the table to fall.

In order to throw into engagement and release the cam 146 at the appropriate moment, the trip mechanism shown in Figs. 3, 10, 11, and 18 is provided. This consists of a rod 187, rotating on bearings 188 and 189, the latter of which is formed on the upper edge of the vertical plate 1. The rod 187 terminates at its outer end in an arm 190, Figs. 3 and 11, which at its end has a projection 191, Fig. 18, fitting under the lever 144, attached to the dog 143, whereby when the shaft 187 is rotated the arm 144 is raised or lowered, according to the direction of rotation, and the dog 143 is thrown into or out of engagement with the cog-wheel 192, attached to the shaft 106, and the annular ring 142 and the cams 146 and 139 will thus be caused to rotate in substantially the same manner as the mechanism at the other end of the shaft 106, for operating the justifying-bar, is caused to be rotated. The rotation of the shaft 187 is effected by contact with the foremost space-bar in the line-holder C, which comes in contact with a rod 193, sliding in a suitable seat 194 in the vertical plate 1, as shown in Fig. 11. One end of the rod 193 impinges against the foremost space-bar in the line-holder when the line-holder moves down at the commencement of the operation of withdrawal and justification. The other extremity of the rod 193 is connected by a fixed vertical arm 195,

(shown in Figs. 3 and 18,) which arm, as is shown in these figures, is attached to the rod 187 at its upper end, so that when the rod 193 slides in the seat 194 it will push the rod 195 forward and cause a rotation of the rod 187 and arm 190, release the lever 144, and cause a corresponding movement of the dog 143 and engagement with the gear-wheel 192, resulting in a corresponding motion of the cams 146 and 139. In order to return the rod 187 to the original position after the rotation of the cam a spring 196 is provided, attached to the bearing 188, as shown in Figs. 3, 11, and 18. It will be apparent from the foregoing that as each temporary space-bar is removed and the appropriate space has been inserted the spring 196 will rotate the rod 187, thus breaking the connection with the shaft 106 and throwing forward the rod 193, so that it can be tripped by the next space-bar when it comes forward in the constantly-moving line-holder. It will be observed that each time this mechanism is tripped by the space-bar, the cam 146 is caused to make a single revolution, and at the end of the revolution the rod 193 will be thrown back to its original position ready to be acted upon by the next space-bar when the line-holder comes down to the position where the same is removed. The rod 193 is thrown back after the lever 144 has passed by the spring 196, when the space-bar which is pressed against the rod 193 by the lower short rack and weight is withdrawn by the hook 148.

Line-holder-returning mechanism.—For the purpose of returning the line-holders one by one from the lower table M' across the lower line-holder way B' to the upper table M a chain-and-sprocket mechanism (shown in Figs. 2, 4, 5, 24, 27, 28, 39, and 44) is provided. This chain-and-sprocket mechanism is so arranged that the same will move in two different directions. In the drawings, 302 represents the sprocket-chain, 272 the upper sprocket-wheel, and 273 the lower sprocket-wheel. The lower sprocket-wheel 273 is an ordinary wheel arranged to rotate on an axis 42, as shown in Figs. 24 and 39. The upper sprocket-wheel is of the peculiar construction shown in Figs. 4, 5, 27, and 28. 41 is an auxiliary shaft carrying a loose sleeve 282, which is held in the position upon the shaft 41 by means of two fixed collars 301 at either end. The sleeve 282 carries two loose gear-wheels 274 and 279, each of equal size, and each connected by means of intermediate gear-wheels 276 and 278 with the main driving-shaft 343, so that the gear-wheel 274 rotates in one direction loosely on the shaft 41 and sleeve 282 and the gear-wheel 279 loosely on it in the other direction. The direction of these wheels is shown by arrows upon Figs. 5 and 28, the first of which shows movements of the gear-wheel 274 and the second that of the gear-wheel 279. The gear-wheel 279 is shown in Fig. 28 by dotted lines. To these gear-wheels are fastened, by the screws 291, two smaller

gear-wheels 280 and 281, as shown in Fig. 27. The wheel 280 is fastened to the gear-wheel 274 and the wheel 281 to the gear-wheel 279. Between these two disks 307 and 308 are placed, between which is set a sprocket-wheel composed of the spokes 285, with the teeth 286 on its periphery, which is keyed to the sleeve 282 by a key 283. The sprocket-wheel is fastened to the disks by screws 289. The opposite faces of the two disks are each slotted, as shown at 309 in Figs. 5 and 28, and in each slot is placed a flat trip-lever 293, pivoted at the point 297 and carrying on its outer surface a stud 295. 292 represents two toothed dogs, one of which is pivoted to the outer face of the disk 307 and the other to the outer face of the disk 308, as shown in Figs. 5, 27, and 28. Each of these dogs is provided with a tooth 296 and a notch 310, as shown in Figs. 5 and 28. A spring 303 is fastened upon the face of each of the disks 307 and 308, impinging against the end of the dog 292 upon that particular disk, whereby the tooth 296 of the dog is kept normally engaged with the stud 295 upon the corresponding flat lever 293. It will be obvious that if for any reason the upper end of the lever 292 be thrown outward and the tooth of the dog be thrown out of engagement with the pin 295 and the pin be thrown down into the notch 310 the tooth 296 will engage with the teeth on the periphery of the gear-wheel 280 in the one case and with those on the periphery of the wheel 281 in the other case, and the sprocket-wheel will thereupon rotate in the same direction as that in which the gear-wheel 274 is rotated in the one case and the gear-wheel 279 in the other case, and will be carried in the direction shown by arrows in Figs. 5 and 28, thereby giving a similar rotation in each case. The extremities of each of the flat levers 293 extend out beyond the sprocket mechanism, and in order to trip the lever 293 at the proper time an arm 110 is provided, which is connected with the mechanism which actuate the racks and is moved as hereinafter described. This arm 110 is arranged to engage with the end of the flat lever 293, extending outward from between the disks shown in Figs. 5 and 27, which lever is slightly beveled on its rear end, as shown at 306. When the rod 110, Fig. 5, comes in contact with the lever 293, it throws the pin 295 from its position, as shown in Fig. 5, in the tooth 296 into the notch 310 in the dog 292, whereupon the tooth 296 engages with the gear-wheel 280, and the sprocket-wheel 272 rotates in the same direction as the direction of rotation of the gear-wheel 281. The lever 293 will obviously rotate with the gear-wheel 280, and when nearly the entire revolution is completed the beveled end 306 of the lever 293 will come in contact with a pin or stud 305, held at the end of a fixed arm 304, supporting the rod 110, as shown in Fig. 5. Thereupon the lever 293 will be restored to its normal position, the teeth 296 thrown out of engagement, the connection between the disk

and the sprocket-wheel and the gear-wheel 280 will be released, and the chain 302 upon the sprocket-wheel will cease to move. At the instant when the fixed rod 304 operates to throw the sprocket-wheel out of connection with the gear-wheel on the one side of the two disks the corresponding lever 293 upon the other side of the disk will be tripped by a Y-shaped stop 299 300, pivoted fast at 298 upon the auxiliary shaft 279. The effect of tripping this lever will be to cause the lever 293 on the inside of the disk to move, so that the stud will come into the corresponding notch in the lever 292, attached to the inner disk, and cause the tooth 295 of the dog 292 to engage with the gear-wheel 281, rotating with the gear-wheel 279, and thereby impart a reverse direction to the chain 302 upon the sprocket-wheel 285. When an almost complete revolution is effected, the shoulder 306 upon the flat lever 296 comes in contact with the curved extremity 299 of the Y-shaped stop 299 300, and thereupon the lever 293 will be tripped and the dog 292 will assume its former position, thus releasing the connection between the cog-wheel 281 and the sprocket-wheel 285.

The space-bar-returning mechanism.—This consists of a block 383, sliding in a slot or way 385 in a plate 386, extending the full length of the machine, as shown in Fig. 30. It is also guided at the upper end by a lug 389, formed on an extension-plate 388, as shown in Figs. 4 and 30, traveling in the way 392 on the block 383. This block 383 is shown clearly in Fig. 45. It carries on its underface a chain-fastener 388, by means of which it is attached to the chain 302, passing over the sprocket-wheels 272 and 273, as shown in Fig. 39. As the sprocket-wheels turn from right to left the sliding block 383 by engagement with the chain-fastener moves up on its ways, and when the sprocket-wheels move in the other direction the fastener moves the block back again to its original position.

The block 383 carries a slide 382, set at right angles to it, as shown in Fig. 44, which carries a spring-latch 378, pivoted at the point 379 to the slide, and the movement of which is limited by a stop-pin 380, against which it is held by a spring 381. A friction-pin 391, running in the way 392, is provided in lower part of the bed-plate A to regulate the movement. The outer end of the slide 382 has to be provided with the latch 378 in order to enable it on its downward movement to pass the table M and the roller 514. The lower end of the table M is cut out, as shown at 393, which enables it to pass by the table and assume its original position, ready to remove the line-holder and space-bars when the table falls again. This will be best seen by reference to Fig. 41. As the slide 382 descends by the downward movement of the chain 302 the extremity of the latch 378 comes in contact with the upper edge of the table M and is compressed. As it descends still farther it comes

in contact with the roller 514 and is still farther bent in by it until finally it reaches the point where it passes the edge of the cut 393 and then is restored by the spring 381 to the position shown in Fig. 44.

In order to enable the space-bars when removed from the table M' by the upper surface of the slide 382 to pass over the projection 261 on the pivoted plate 259 on the table, a projecting lug 384 is provided on the block 383, so that when the block moves upward the beveled edge of the lug 384 comes in contact with the sliding rod 255 in the table M and causes the same to slide inward in the same manner as it was caused to slide by the block 266 when the space-bar passed originally down onto the table, thus depressing the plate 259 and permitting the bars to be moved over the edge 261 and off of the table on the shuttle-way B'. In order to support the space-bars as they move off the shuttle-way B', three pivoted spring-catches 387, pivoted at 395 in the bed-plate A and actuated by springs 396, as shown in Figs. 7, 13, and 40, are employed. The space-bars are further guided by the plate 394, in the end of which the catches are inserted, which plate extends entirely over to the lower end of the shuttle-way, practically covering it.

We will now take up and describe the various actuating mechanisms employed.

The line-holder-driving mechanism.—This will be best seen from Figs. 2, 34, 35, and 43. The rack 1^a is driven by the gear-wheel 325, rotating on the shaft 326. The rack 1^b is driven by the gear-wheel 327, rotating on the shaft 326. The shaft runs in a bearing 329 and carries on it a cog-wheel 330, and the shaft 328, Fig. 12, runs in a bearing 331 and carries at its extremity a cog-wheel 332. The cog-wheel 332 engages with a larger cog-wheel 335 upon an independent shaft 337, which carries a cog-wheel 336 and also a sheave-pulley 338, over which passes a cord 339, attached to a weight 340. The effect of the weight upon the sheave is to keep the rack 315 normally in the position shown in Fig. 2. The cog-wheel 330, which drives the upper rack 314, engages with a sliding rack 333, with teeth at one side at one end and on the opposite side at the other end, sliding in a way 334, and the cog-wheel 336 engages with a sliding rack 341, formed in the manner clearly shown in Fig. 2, with teeth on one side at one end and at the opposite side at the other end, sliding in the ways 344 and 351.

Each of the racks 1^a and 1^b carries a latch 316, provided in a recess 318 on the upper face of the rack. The latch is of the same construction in each case and is provided with a spring 319, which throws it constantly forward, and with the two pins 217 and 321 in the recess on either side for limiting its movement. A pin 322 is placed in the upper end of the way 324 on the side plate 1, in which the rack 1^a slides, which pin is arranged to move in a groove 321' on the face of the

rack, which pin retracts the latch of the rack 1^a when it rises and permits the line-holder to pass by it when the table A is raised.

The ends of the racks 333 and 341 are operated by mechanism (shown more clearly in Figs. 34, 35, 36, and 37), which alternately engage with a gear-wheel 342 on the main driving-shaft 343 by means of the action of a right-angled rocking arm 347, pivoted at 348 to the frame of the machine. The extremity of the rack 341 is normally held out of engagement with the wheel 342 by means of the rocking-arm 347, pivoted at 348 to an arm 353 upon the frame of the machine. The upper end of the arm 347 is held up by a spring 349, one end of which is attached to the arm 347 and the other end to a pin 350 on the bearing 351 on the frame of the machine. The inner face of the rack 341 carries at the rear end a groove 362, in which a pin 363 upon the upper end of the arm 347 slides. When the upper arm of 347 is depressed, the rack 341 comes into engagement with the wheel 342 and moves from left to right, as shown in Fig. 2. In order to depress the arm 347 at the right instant with respect to the movement of the rack 333, which actuates the driving-rack 1^a, a recess 354, Fig. 34, is formed on front edge of the rack 333 below the point where the teeth on that edge cease, and a pin 355 is provided on the lower end of the bent arm 347, projecting horizontally forward, so as to engage with and enter the recess. In order to throw the rack 333 into engagement with the wheel 342 and to bring it back to its original position, the devices shown in Figs. 34, 35, 36, and 37 are employed. These consist of a spring-plunger 357, impinging against the teeth of the rod 333, carried on a pin 360, encircled by a spiral spring 359, sliding in a block 358, attached to the upright plate A⁷. On the opposite side is a block 345, shaped as shown, containing a groove in which the rod 333 slides vertically, it being forced constantly inward by the plunger 357, and it is held in a locked position by the pivoted spring-lever 364, pivoted to the block 345 at 365 and provided with a jaw 368, engaging with the rack, as shown in Fig. 36, and normally held in engagement by the action of the spring 366. When the rack 333 is rocked forward by the key H, the latch 368 by the action of the spring 366 at once flies back of it, and the face 361 engages with the smooth face of the rack as it rises and holds it constantly in engagement with the wheel 342 until it passes out the jaw 368 and into the block 345. When the key H is depressed, the pin 369' on the bent lever 369 throws the lower end of the rack 333 forward from left to right, compressing the spring 359 and throwing the upper teeth on the rear edge of the rack 333 into engagement with the teeth on the constantly-rotating cog-wheel 342. The rack 333 thereupon begins to move upward, imparting its motion to the wheel 330, and the driving-rack 1^a begins then to travel down-

ward. The latch 316 is released from the pin 322 and moves, engaging the end of the line-holder and pushing it with it. When the rack 333 is pushed outward, the pin 355 is withdrawn from the lower shoulder of the recess 354, and the shoulder will then pass by the pin, and the rack 333 will move upward. When the lower end of the rack 333 has passed up beyond the block 364, the spring-plunger 359 will immediately throw the end of the rack from right to left, thus releasing it from engagement with the wheel 342, whereupon it ceases to move. As the rack 333 is thus driven by the spring-plunger from right to left it strikes against the pin 355 and pushes it into the shoulder 356 in the upper block 345, whereupon the pressure of the spring-plunger 359 against the rack 333, acting on the pin 355, will depress the upper arm of the rocking arm 347 by means of the groove 262 and pin 263, and the rack 341 will be thrown into engagement with the wheel 342, causing the former to travel from left to right on the ways 344 and 351, thereby causing the lower rack 1^b to begin to move upward, pushing with it upper rack 1^a back to its original position. When the rack 1^b reaches the end of its line of travel, the rack 333 will have descended a sufficient distance to again engage with the pin 355 and trip the rocking arm 347, thereby raising the end of the rack 341 and breaking the connection with the arm 342. The instant that the rack 341 is released from engagement with the wheel 342 the weight 340 is free to drop, and it commences to unwind the sheave 338 gradually as the bars are removed one by one and drive down the lower rack. The latch 316 upon the upper end of the rack 1^b thereupon engages with the upper end of the line-holder C, as shown in Fig. 11, and drives it forward. The beveled end 367 of the rack 333 guides it into and through the block 361, compressing the spring 366 into the original position shown in Fig. 34, and as it descends the pin 355 slides down on the smooth face of the rack until the recess 354 comes opposite to the pin 355 on the rocking arm 354, whereupon the spring 349 draws the arm back to its normal position, lifts the rack 341 out of engagement with the wheel 342, and holds the pin firmly in the position shown in Fig. 34, while the lower end comes against the pin 369 at the extremity of the bent arm of the lever 345, ready for a new movement.

Sprocket-mechanism actuator.—In order to trip the sprocket mechanism at the proper time by rocking the arm 108, a shaft 377 is provided, extending across the machine under the bed-plate and carrying on its end opposite to the arm 108 a fixed arm 370, as shown in Fig. 2. This latter arm carries at its extremity a pivoted arm 371, attached to it at 373. The motion of the arm 373 is limited in one direction by the pin 374 and in the other by the pin 375 engaging with a depression in the edge of the arm 371. This plate is so arranged with respect to the plate

370 that a heel projects out beyond it, which heel is arranged to be tripped by a pin 372 on the face of the gear-wheel 336. When the gear-wheel 336 rotates from right to left, the pin 372 hits the sharp edge of the heel of the arm 371, trips the arm 370 upward, and thereby imparts a short rocking movement to the arm 370, which in turn rocks the shaft 377 and the arm 108 and the rod 110, attached to it, and causes the sprocket mechanism to engage with the cog-wheels 279 and 281, as the case may be, and the chain 302 to move in one direction. The arm 371, after the pin 372 has passed it, immediately drops back to its original position by reason of the weight of the free end, and the arm 370 is restored to its original position by the tension of the spring 123, acting on the arm 108. When the gear-wheel 336 begins to move in the opposite direction, the pin 372 moves over the beveled edge of the heel and lifts the arm 371 until it passes it without rocking the arm 370 or affecting the arm 108, and thus the device is in position to act again when the gear-wheel begins to rotate from right to left.

The vibrator-actuating mechanism.—In order to operate the vibrator and to throw the vibrating mechanism out of engagement with the shuttle when the line-holder is completely filled, a block 403 is provided, extending to the line-holder, attached to an arm 404, which is pivoted at 405 to an arm 406, pivoted at 407 to the frame 1. The arm 406 carries a pin 408, sliding in a slot 409 on the end of a rod 410, which in turn is pivoted at 411 to a crank-arm 412, attached to the rock-shaft 346. The vertical arm 17 is provided with a horizontal groove 17' in its inner surface, which is beveled at its lower edge, as shown in Fig. 38. The arm 406 passes through this groove when in a raised position. When the line-holder C passes downward after having been partially filled, the block 403 is released, and when the key H is depressed and the shaft 346 is rocked forward the arm 410 is depressed, carrying with it the arm 406, which travels downward on the beveled edge 17' of the arm 17, throwing it outward against the spring 32, and thus throwing the pin 23 out of the slot 25 in the plate 8 of the vibrator. When the line-holder is raised upon the table M to its original position ready to be refilled, its upper edge strikes upon the block 403, lifts the rod 406, and permits the rod 23 of the vibrating mechanism by the force of the spring 32 to enter the opening 25 in the plate 8 and cause the mechanism to vibrate, as before.

In order to throw the line-holder as it moves upon the table M forward at the proper instant, so that it shall assume the proper position to engage with first wedge 62 in the line and also so that it may engage with the block which actuates the vibrating mechanism, the beveled plate 413 is provided, attached to side plate 1 at the top, as shown in Fig. 41.

In order to restore the plate 8, which is a

part of the vibrating mechanism, to the proper position at the forward end of the holder when the latter is raised by the table M and the operation of filling is commenced, a spring-catch (shown in Figs. 2 and 44) is provided, arranged to be operated by the line-holder as it moves upward upon the lower shuttle-way B'. This consists of a pin 400, adapted to slide in the plate 1, fitted at one edge with a yielding spring 401 and beveled at the other end, as shown at 402. As the shuttle or line-holder moves upward the beveled edge 402 engages in the aperture 25 of the plate 8 and drives it down to the front end of the shuttle, and as the shuttle passes upward the give of the spring permits the pin 400 to be pushed back and beyond the line-holder and be restored by the spring 402.

Method of operation.—The method of operation of the entire machine is as follows: When the machine is ready to operate, the line-holder C stands in the proper position (shown in Fig. 1) on the table M at the upper end of the vertical side plate 1 above the shuttle-way B and the vibrating mechanism is constantly operating, throwing the plate 8 in the line-holder backward and forward at a very quick rate, the vibrator having previously been set by the screw-rod 5 in such a manner as to limit the length of line to be set up in the line-holder. The keyboard of the type-setting mechanism, which may be of any convenient form and placed in any convenient position with reference to the present machine, is then operated and the type characters inserted one by one through the type-channels T S. As fast as each letter enters the space 2 of the line-holder C it is pushed forward by the vibrator 8 and assumes a position behind the next preceding letter in the line-holder. As soon as a single word is assembled the operator depresses the key 92, whereupon the space-bar-inserting mechanism D throws the foremost of the space-bars from the top of the table M forward into the line-holder up to the point where the shoulder 49 begins. Thereupon the operation of setting up the next word is continued, and when the next word has been assembled the key 92 is again struck and another space-bar inserted into the line-holder behind the word. Meanwhile the vibrating mechanism constantly forces the line-holder, aided by the weight of the holder itself as it is being filled, downward on the table M until the point is finally reached, when the line-holder moves from under the bell-crank 418 and the bell 417 rings, thus indicating that the desired line has been set up and the line-holder is full. Thereupon the key H is depressed and the rack 1^a begins to slide downward and the latch 316 upon its lower end comes in contact with the line-holder and forces it down off of the table M and onto the shuttle-way B to a point where it is stopped by the line-holder brake 128. At this instant the justifying or spreading mechanism G operates by the rotation of

the shaft 106, and the justifying-bar 94 is pushed forward and drives all the space-bars equally into the line, carrying them over the shoulders 49 until they expand the line so as to entirely fill the line-holder. When this operation is completed, the lower rack 1^b engages with the line-holder C by means of the latch 316 on the upper end and pushes it down in front of the space-bar-extracting mechanism K, which operates at the right instant to push in the space-bars one by one, so as to take up any looseness left in the line and to withdraw them and after withdrawal to insert into the line instead of them an appropriate space from the appropriate compartment of the space-box L. As fast as the space-bars are withdrawn the line-holder is moved forward by the action of weight 340 upon the sheave 338, which drives the rack 1^b and the line-holder downward as rapidly as the space-extracting mechanism will permit. During the operation of driving in and removing each of the space-bars the line-holder is held stationary by the brake 253, and when the operation is completed it will by the action of the weight have been moved forward off of the shuttle-way B and onto the table M' and the rack 1^b will return to its original position. The space-bars as they are withdrawn will have passed from the shuttle-way over the vertical edge 261 of the plate 259 onto the table M' and will have been assembled there side by side in a row. While the operation of justification and subsequent insertion of spaces is being proceeded with upon the shuttle-way B with the first line-holder the table M will hold the second line-holder, with respect to which the operation of assembling is being proceeded with. As soon as the first line-holder has taken up its proper position upon the table M' the bunter mechanism R will be set in operation by the tripping mechanism actuated by line-holder, and thereupon the bunter 234 will move forward and discharge the justified line of type upon the galley U. At the instant that the discharge is effected and the bunter 234 withdrawn the lower table M' will fall by reason of the release of the table-holding mechanism 235, and when the second line-holder has by striking of the key II been moved forward to the justifying and spacing mechanism the sprocket mechanism 273 will operate to advance the plate 382 and push the first line-holder, which is now empty, and the line of space-bars behind it off of the table M' on the shuttle-way B', and the table M' will then immediately rise to receive the second line-holder when the justification of the line held in it shall have been completed. In operation both tables are in a raised position at the same time, the table M' rising to receive the line-holder containing the justified line just before the table M rises with the empty line-holder which is to be refilled. The lower table is arranged to drop a little ahead of the upper table, so that an interval of time may

take place, during which the slide 382 can operate. The instant that either line-holder passes off the table M down to the justifying mechanism the table M will drop, ready to receive the returning line-holder and row of space-bars as they are carried upon the shuttle-way B'. When the returning line-holder and the set of space-bars used with it have been moved onto the table M, the sprocket-chain mechanism will return the line-holder-advancing mechanism 382 to the lower end of the machine, so as to bring it back in position to take up the other line-holder when this is dropped on the table M'. It will be observed that during the operation of pushing in the space-bars simultaneously and pushing them separately farther into and withdrawing them from and inserting spaces into the line in the line-holder which has been first filled the other line-holder is being filled and that when the first line-holder is moved down to the table M' by the weight 340, and when the bunter R has ejected the type from it to the galley, the second line-holder will move forward and be subjected to precisely the same operation. This operation continues automatically and successively, the only act not automatic and dependent on the volition of the operator being the insertion of the space-bars at the proper moment after a word is assembled by the mechanism D and the engagement of the mechanism which causes the line-holder after falling to start downward and begin its line of travel through the machine.

If desired, a single line-holder only may be used, or if two are used the second may not be filled until after the first has been filled and the line justified. The cams 39 and 40 are so arranged that the table M' is kept raised until the line-holder has moved forward and tripped the bunter mechanism and the latter has operated quite independently of the assembling mechanism, and it remains lowered with the empty line-holder on it until the line-holder which has been filled has moved downward to the justifying mechanism. Hence if the line-holders are filled separately the table M', with the previously-emptied line-holder, remains down until the operation of driving in the space-bars into the line-holder in which the line is being assembled is completed, whereupon it rises, so as to receive the line-holder, when the subsequent operation of replacing the space-bars with permanent spaces is complete.

I disclaim for the purposes of this case any of the inventions described in and claimed by Frank McClintock, of Grand Junction, Colorado, in a certain Letters Patent for improvements in justifying-machines, granted by the United States Patent Office on the 26th day of July, 1898, and numbered 608,002.

I claim as my invention—

1. The combination of a line-holder for containing a line of type, forming with the frame-plate on which it slides, a rectangular recep-

tacle provided with a rectangular opening in its side wall; and a vibrating plate in the opening for feeding each letter as it enters the line-holder, forward therein and correspond-

5 ingly advancing the line-holder.

2. The combination of a line-holder for containing a line of type, forming with the frame-plate on which it slides a rectangular receptacle provided with a rectangular opening in
10 its side wall; a horizontally-vibrating plate sliding in said opening for feeding each letter as it enters the line-holder forward therein and correspondingly advancing the line-holder; and means for actuating the vibrating plate,
15 substantially as described.

3. The combination of a line-holder containing a line of type, forming with the frame-plate on which it slides a rectangular receptacle, provided with a rectangular opening in its
20 side wall; a horizontally-vibrating plate, sliding in said opening, for feeding each letter as it enters the line-holder forward therein and correspondingly advancing the line-holder; and means actuated at the proper instant from
25 the driving-shaft, for actuating the vibrating plate, substantially as described during the operation of filling the line-holder.

4. The combination of a line-holder for containing a line of type, forming with the frame-plate on which it slides a rectangular receptacle provided with a rectangular opening in
30 its side wall; a horizontally-vibrating plate, sliding in said opening, for feeding each letter as it enters the line-holder forward therein, and correspondingly advancing the line-holder; means actuated from the driving-shaft for actuating the vibrating plate, substantially as described; means for throwing
35 the actuating mechanism out of engagement when the line-holder has been filled, and means for throwing it into engagement when the line-holder is ready for filling.

5. A line-holder for containing a line of type, forming with the frame-plate on which it slides
45 a rectangular receptacle, provided with a rectangular opening in its side wall; a vibrating plate in the opening for feeding each letter as it enters the line-holder, forward therein and correspondingly advancing the line-holder; and devices substantially as described, for limiting the distance in the line-holder through
50 which the plate can vibrate according to the length of the line to be set up therein.

6. The combination of a line-holder for containing a line of type, forming with the frame-plate on which it slides a rectangular receptacle, provided with a rectangular opening in
55 its side wall; a vibrating plate in the opening for feeding each letter as it enters the line-holder, forward therein, and correspondingly advancing the line-holder; a rotating shaft carrying on its extremity a cam; a vibrating arm arranged to rock in two directions vibrated by the rotation of said cam; a pin on
60 said arm engaging with an opening in the vibrating plate; a spring for holding said arm normally in engagement with the vibrating

plate and devices for throwing the vibrating arm and the pin thereon, in and out of the opening in the vibrating plate, at the proper
70 instant.

7. The combination of a line-holder for containing a line of type, forming with the frame-plate on which it slides a rectangular receptacle, provided with a rectangular opening in
75 its side wall; a vibrating plate in the opening for feeding each letter as it enters the line-holder forward therein, and correspondingly advancing the line-holder; an arm terminating in two jaws so attached to the vertical
80 frame-plate of the machine, as to permit the arm to vibrate at one end and to be capable of lateral movement outward from the frame-plate at the other end, and provided on its inner surface with a beveled slot; a rotating
85 driving-shaft carrying an eccentrically-set pin on its end, arranged to rotate in the jaws of the arm; a pin on the extremity of one of the jaws of the vibrating arm, engaging with an opening in the vibrating plate; a spring for
90 holding said arm normally in engagement with the vibrating plate; a bar resting in the slot, connected by suitable levers with a lever arranged to be tripped by the line-holder, whereby the vibrating arm with the pin there-
95 on, is thrown out of the opening in the vibrating plate at the proper instant, by the rocking of the rock-shaft, and is thrown in again by the action of the line-holder against the lever.
100

8. The combination of a line-holder for containing a line of type, forming with the frame-plate on which it slides a rectangular receptacle provided with a rectangular opening in
105 its side wall; a vibrating plate in the opening for feeding each letter as it enters the line-holder forward therein, and correspondingly advancing the line-holder; an arm terminating in two jaws so attached to the vertical frame-plate of the machine, as to permit it to
110 vibrate at one end and to be capable of lateral movement outward from the frame-plate at the other end, and provided on its inner surface with a beveled slot; a rotating driving-shaft carrying an eccentrically-set pin on
115 its outer face, arranged to rotate in the jaws of the arm; a pin on the extremity of one of the jaws of the vibrating arm, engaging with an opening in the vibrating plate; a spring for holding said arm normally in engagement
120 with the vibrating plate; a bar resting in the slot connected at either end by suitable levers whereby the vibrating arm with the pin thereon, is thrown out of the opening in the vibrating plate at the proper instant, by the
125 rocking of the rock-shaft, and is thrown in again by the action of the line-holder against the lever; and devices for actuating said levers substantially as described.

9. The combination of a line-holder for con-
130 taining a line of type, forming with the frame-plate on which it slides a rectangular receptacle provided with a rectangular opening in its side wall; a rock-shaft actuated by a fin-

ger-key attached to it; a vibrating plate in the opening for feeding each letter as it enters the line-holder forward therein, and correspondingly advancing the line-holder; an arm terminating in two jaws so attached to the vertical frame-plate of the machine, as to permit it to vibrate at one end, and to be capable of lateral movement outward from the frame-plate at the other end, and provided on its inner surface with a beveled slot; a rotating driving-shaft carrying an eccentrically-set pin on its outer face, arranged to rotate in the jaws of the arm; a pin on the extremity of one of the jaws of the vibrating arm engaging with an opening in the vibrating plate; a spring for holding said arm normally in engagement with the vibrating plate; a bar resting in the slot connected at one end by a lever arranged to be tripped by the line-holder, and at the other with a lever moved by the rock-shaft, whereby the vibrating arm with the pin thereon is thrown out of the opening in the vibrating plate at the proper instant, by the pressure of the operator on the finger-key, and is thrown in again by the action of the line-holder upon the lever.

10. The combination of a line-holder for containing a line of type, forming with the frame-plate on which it slides a rectangular receptacle provided with a rectangular opening in its side wall; a vibrating plate in the opening for feeding each letter as it enters the line-holder forward therein, and correspondingly advancing the line-holder; an arm terminating in two jaws, one of which is held normally closed by a spring so attached to the vertical frame-plate of the machine, as to permit the arm to vibrate at one end and to be capable of lateral movement outward from the frame-plate at the other end, and provided on its inner surface with a beveled slot; a rotating driving-shaft carrying an eccentrically-set pin on its end, arranged to rotate in the jaws of the arm; a pin on the extremity of one of the jaws of the vibrating arm engaging with an opening in the vibrating plate; a spring for holding said arm normally against the vertical side plate and in engagement with the vibrating plate; a flat bar resting in the slot connected at one end by a lever arranged to be tripped by the line-holder, and at the other with the rocking shaft which is actuated by the key which sets the line-holder-driving mechanism in motion, whereby the vibrating arm with the pin thereon, is thrown out of the opening in the vibrating plate at the proper instant, by the rocking of the rock-shaft, and is thrown in again by the action of the line-holder upon the lever.

11. The combination of a line-holder supported on a suitable table; a row of space-bars supported on said table in front of the line-holder, arranged to be inserted into it one by one; a sliding rod provided with a shoulder engaging with and forcing the foremost of the space-bars into the line of type; a power-shaft driven from a suitable source

of power; a loose collar containing a cam-groove, arranged to rotate on the power-shaft; a series of devices for transmitting the power of the shaft to the sleeve at the desired moment; a stud at the end of the sliding rod moving in the cam-groove; and a finger-key actuated by the operator, for throwing said devices in and out of connection with the shaft, and imparting the desired sliding motion to the rod.

12. The combination of a line-holder supported on a suitable table; a row of space-bars supported on said table in front of the line-holder, arranged to be inserted into it one by one; a sliding rod provided with a shoulder engaging with and forcing the foremost of the space-bars into the line of type; a power-shaft driven from a suitable source of power; a loose collar arranged to rotate on the power-shaft containing a cam-groove; a cog-wheel carried on the face of said collar; a second loose collar on said shaft carrying a smaller cog-wheel; intermediate cog-wheels for reducing the speed of the latter to that of the former; a fixed collar rotating with the driving-shaft; a spring trip-lever attached thereto, arranged to engage with the second loose collar and impart motion to both collars; an arm provided with a pin for tripping the lever; a rock-shaft connected with said arm; a stud at the end of the sliding rod moving in the cam-groove; and a finger-key actuated by the operator, for actuating the rock-shaft throwing said devices in and out of connection with the shaft, and imparting the desired sliding motion to the rod.

13. The combination of a line-holder supported on a suitable table; a row of space-bars supported on said table in front of the line-holder, arranged to be inserted into it one by one; a sliding rod provided with a shoulder engaging with and forcing the foremost of the space-bars into the line of type; a power-shaft driven from a suitable source of power; a loose collar arranged to rotate on the power-shaft containing a cam-groove; a cog-wheel carried on the face of said collar; a second loose collar on said shaft carrying a smaller cog-wheel; intermediate cog-wheels for reducing the speed of the latter to that of the former; a fixed collar rotating with the driving-shaft; a spring trip-lever attached thereto arranged to engage with the second loose collar and impart motion to both collars; an arm provided with a pin for tripping the lever; a rock-shaft connected with said arm; a stud at the end of the sliding rod moving in the cam-groove; a finger-key actuated by the operator, for actuating the rock-shaft throwing said devices in and out of connection with the shaft, and imparting the desired sliding motion to the rod; and devices for restoring the loose collars to their original position on the shaft after each revolution, to enable them to be again engaged by the tripping mechanism.

14. The combination of a line-holder for con-

taining a line of type forming with the frame-plate on which it slides, a receptacle for containing a line of type as the same is assembled; vibrating plate sliding in a suitable opening in the line-holder, for feeding each letter as it enters the line-holder forward therein and correspondingly advancing it; a mechanism actuated at the proper instant from a driving-shaft, for actuating the vibrator; and devices substantially as described, attached to and actuated by the same shaft at the proper instant, for effecting the insertion of the space-bars into the line of type.

15. The combination with the vertical side plate, of a spring-catch arranged to engage with the vibrating plate of the line-holder when the latter moves back, and restore the same to a position when the cam engages with the vibrating mechanism.

20 16. A space-bar, consisting of a wedge having parallel planes at the thick end, and a uniform taper between said parallel planes and the other end provided with a longitudinal slot extending through the greater part of its length, and at the top with a curved shoulder for the purposes set forth.

17. The combination of a line-holder containing a line of type forming with the frame on which it slides a rectangular receptacle provided with a rectangular opening in its side walls; a vibrating plate in the opening for feeding each letter as it enters the line-holder forward therein, and correspondingly advancing the line-holder; an arm terminating in two jaws, one of which is held normally closed by a spring, so attached to the vertical frame of the machine, as to permit the arm to vibrate at one end and to be capable of lateral movement upward from the frame-plate at the other end, and provided on its inner surface with a beveled slot; a rotating driving-shaft carrying an eccentrically-set pin on its end, arranged to rotate in the jaws of the arm; a pin on the extremity of one of the jaws of the vibrating arm, engaging with an opening in the vibrating plate; a spring for holding said arm normally against the vertical side plate and in engagement with the vibrating plate; a flat bar resting in the slot connected at one end by a lever arranged to be tripped by the line-holder and at the other with the rocking shaft which is actuated by the key which sets the line-holder-driving mechanism in motion, whereby the vibrating arm with the pin thereon is thrown out of the opening in the vibrating plate at the proper instant, by the rocking of the rocking shaft, and is thrown in again by the action of the line-holder against the lever; a row of space-bars supported upon the table on which the line-holder travels in front of the line-holder, arranged to be inserted into it one by one; a sliding rod provided with a shoulder engaging with and forcing the foremost of the space-bars into the line of type; a loose collar containing a cam-groove arranged to rotate upon the same shaft as the shaft actuating the vi-

brating plate; a series of devices for transmitting the power of the shaft to the sleeve at the desired moment; a series of devices for reducing the speed of the shaft and transmitting it to the sleeve at the desired instant; a stud at the end of the sliding rod moving in the cam-groove; a finger-key actuated by the operator for throwing said devices in and out of connection with the shaft and imparting the desired sliding motion to the rod; and devices substantially as described for restoring the speed-reducing devices to their original position on the shaft after each revolution of the mechanism through pressure exerted upon the finger-key.

18. A space-bar consisting of a wedge having parallel planes at one end and tapering to the other end, provided with a slot running longitudinally through substantially its entire length in proximity to its upper edge for the purposes set forth, and provided at its outer extremity upon its upper edge with a suitable surface, arranged to engage the removing hook.

19. The combination with the vertical plate and the line-holder, of a beveled plate, arranged to engage with the line-holder when the upper table rises, and cause it to assume the proper position thereon for being refilled.

20. The combination of a line-holder; wedge-shaped temporary space-bars inserted therein; a bar arranged to slide on the bed-plate of the machine and impinge against the end of the row of space-bars and drive the same in so as to expand the line to fill out the line-holder after insertion; a suitable spring which throws said bar constantly forward; a rotating shaft driven by suitable power; a cam upon said shaft engaging with a block on the bar for holding the bar normally out of operation by the compression of the spring, during the rotation of the shaft; and suitable tripping mechanism set in motion by the line-holder at the proper instant, for throwing the cam mechanism into operation.

21. The combination of a line-holder; wedge-shaped temporary space-bars inserted therein; a sliding bar sliding on the bed-plate of the machine impinging against the end of the row of space-bars and driving the same in after insertion, so as to expand the line to fill out the line-holder; a suitable spring which throws said bar constantly forward; a rotating shaft driven from the main driving-shaft of the machine; a ratchet-wheel on said shaft; an annular ring running loosely on said shaft surrounding the ratchet-wheel; a pivoted dog, controlled by a spring in the periphery of the ring, arranged to engage with the ratchet-wheel; a cam attached to said ring arranged to normally hold the bar out of operation by the compression of the spring during the rotation of the shaft; and a sliding rod for throwing the dog in and out of engagement actuated at the proper instant by means of suitable connections with the rack-driving mechanism.

22. The combination with the bed-plate, of a latch pivoted in a recess in the shuttle-way, provided with a hook arranged to engage the line-holder; a spring for constantly throwing
5 said latch forward; a sliding rod for actuating said latch, and compressing the spring; a trip-lever on the bed-plate, for actuating said rod; and a cam attached to the lug on the shaft which actuates the justifying mechanism, arranged to trip the lever, actuate the
10 latch at the proper moment, and hold the line-holder while the space-bars are being driven in by the justifying-bar.

23. The combination with the bottom of the upper shuttle-way, of spring-catches extending over the lower shuttle-way, for the purpose of holding the space-bars in proper position as they move upward upon the same.

24. The combination with the lower shuttle-way, of a longitudinal rod on which the space-bars are advanced, and spring-catches placed in the bottom of the upper shuttle-way and extending over the lower shuttle-way, for holding the space-bars in proper position as they move upward on the rod.

25. The combination of the frame-plate; shuttle-ways attached thereto; line-holders moving on the ways; a lowering-table at the lower end of the ways for lowering the emptied
30 line-holder from the upper to the lower shuttle-way; and means for actuating the table at the proper instant.

26. The combination of the frame-plate; shuttle-ways attached thereto; line-holders moving on the ways; a lifting-table at the upper end of the ways for raising the returning line-holder from the lower to the upper shuttle-way; a lowering-table at the lower end of the ways for lowering the emptied line-holder from the upper to the lower shuttle-way; and means for alternately raising and
40 lowering the tables at the proper instant.

27. The combination of an upper table arranged to slide in ways on a vertical side plate; a plate fastened to the lower face of the table; a lever-arm carrying a roller engaging with said plate, pivoted to the frame of the machine; a friction-roller at the end of the lever-arm; and an operating-cam engaging with the friction-roller, mounted upon the shaft which actuates the upper sprocket-wheel, for raising and lowering the table by the movement of the lever-arm.

28. The combination of a lower table arranged to slide in vertical ways upon a vertical side plate; a friction-roller on the lower face of said table; and an operating-cam engaging the friction-roller, mounted upon the shaft which actuates the lower sprocket-wheel, for raising and lowering the table.

29. The combination of an upper table arranged to slide in ways on a vertical side plate; a plate fastened to the lower face of the table; a lever-arm carrying a roller engaging with said plate, pivoted to the frame of the machine; a friction-roller at the end of the lever-arm; an operating-cam engaging

with the friction-roller, mounted upon the shaft which actuates the upper sprocket-wheel, for raising and lowering the table by
70 the movement of the lever-arm; a lower table arranged to slide in vertical ways upon a vertical side plate; a friction-roller on the lower face of lower table; and an operating-cam, engaging the friction-roller, mounted upon the shaft which actuates the lower sprocket-wheel for raising and lowering the lower table.

30. The combination of the frame-plate; shuttle-ways attached thereto; line-holders moving on the ways; a lifting-table at the upper end of the ways for raising the returning line-holder from the lower to the upper shuttle-way; the sprocket mechanism and means set in motion by the sprocket mechanism for actuating the table at the proper instant.

31. The combination of the frame-plate; shuttle-ways attached thereto; line-holders moving on the ways; a lowering-table at the lower end of the ways for lowering the emptied line-holder from the upper to the lower shuttle-way; the sprocket mechanism and means set in motion by the sprocket mechanism, for actuating the table at the proper instant.

32. The combination of the frame-plate; shuttle-ways attached thereto; line-holders moving on the ways; a lifting-table at the upper end of the ways, for raising the returning line-holder from the upper to the lower shuttle-way; a lowering-table at the lower end of the ways for lowering the emptied line-holder from the upper to the lower shuttle-way; the sprocket mechanism and means set in motion by the sprocket mechanism, for actuating the table independently at the proper instant.

33. The combination with the space-bar-driving mechanism; of a spring-latch pivoted in the bed-plate under the line-holder, provided with a hook arranged to engage the extremity of the line-holder and hold the same while the space-bars are being driven into the line to expand the line; and a rod sliding in the bed-plate impinging against the end of the pivoted bar arranged to be moved at the proper instant by the space-bar-driving mechanism, whereby the bar is released from the line-holder and the latter permitted to resume its travel after the line has been expanded.

34. The combination of an upper table arranged to slide in ways on the vertical side plate; a plate fastened to the lower face of the table; a lever-arm carrying a roller engaging with said plate, pivoted to the frame of the machine; a friction-roller at the end of the lever-arm; an operating-cam, engaging with the friction-roller, mounted upon the shaft which actuates the upper sprocket-wheel for raising and lowering the table by the movement of the lever-arm; a lower table arranged to slide in vertical ways upon a vertical side plate; a friction-roller, on the lower surface of said table; an operating-cam engaging the friction-roller mounted upon the

shaft which actuates the lower sprocket-wheel, for raising and lowering the table; and devices for alternately rotating the shafts in different directions whereby the tables are raised and lowered at the proper instant.

35. The combination of a bar arranged to slide on the bed-plate; a spring-hook mounted upon a block on the bar, arranged to move forward with said bar and engage the end of the foremost space-bar in the line-holder; a spring whereby the bar is constantly forced forward; a rotating shaft driven from a suitable source of power; a cam upon the shaft engaging with a block upon the bar arranged to hold the latter normally out of operation by the compression of the spring, except when the block is moved off of the cam by the rotation of the shaft; and means, substantially as described, actuated by the foremost space-bar in the line-holder, for throwing the cam mechanism in and out of engagement.

36. The combination of a bar arranged to slide on the bed-plate; a spring-hook mounted upon a block on the bar, arranged to move forward with said bar and to engage the end of the foremost space-bar in the line-holder; a spring whereby the bar is constantly forced forward; a rotating shaft driven from a suitable source of power; a ratchet-wheel on said shaft; an annular ring running loosely on said shaft surrounding said ratchet-wheel; a pivoted dog, controlled by a spring in the periphery of the ring, arranged to engage with the ratchet-wheel; a cam upon the shaft engaging with a block upon the bar, arranged to normally hold the bar out of operation, except when the block is moved off of the cam by the rotation of the shaft; and mechanism, actuated by the foremost space-bar in the line-holder, for throwing the dog in and out of engagement at the proper instant.

37. The combination of a bar arranged to slide on the bed-plate; a spring-hook mounted upon a block on the bar, arranged to move forward with said rod and to engage the end of the foremost space-bar in the line-holder; a spring whereby the bar is constantly forced forward; a rotating shaft driven from a suitable source of power; a ratchet-wheel on said shaft; an annular ring running loosely on said shaft surrounding said ratchet-wheel; a pivoted dog, controlled by a spring in the periphery of the ring, arranged to engage with the ratchet-wheel; a cam upon the shaft engaging with a block upon the bar, arranged to normally hold the bar out of operation, except when the block is moved off of the cam by the rotation of the shaft; a rod sliding in a suitable way in the bed-plate, arranged to be moved by the end of the foremost space-bar in the line-holder, as the latter descends; a rotating arm provided with a vertical depending rod at one end, arranged to be thrown forward by the sliding rod when the space-bar impinges against its foremost end, and an arm at the other end; a lever attached to the pivoted dog actuated by said arm; and

a spring for returning the rotating arm to its original position, and thereby moving the sliding rod to its original position ready to be moved by the next space-bar when it descends.

38. The combination with the space-bar-removing mechanism; of a latch pivoted to the bed-plate provided with a spring for throwing the same constantly forward, arranged to be opened by the edge of the space-bar-removing mechanism when the latter moves forward, and when the latter moves back, be released so as to impinge upon the space-bar which has been removed, and force it vertically downward on the shuttle-way, onto the lower table.

39. The combination of a bar arranged to slide on the bed-plate; a spring-hook mounted upon a block on the bar, arranged to move forward with said rod; a spring whereby the bar is constantly forced forward; a rotating shaft driven from a suitable source of power; a cam upon the shaft engaging with a block upon the rod, whereby through the rotation of the cam the spring is retracted, except when the block is moved off of the cam; means, substantially as described, actuated by the foremost space-bar in the line-holder for throwing the cam mechanism in and out of engagement; and a latch pivoted to the bed-plate provided with a spring for throwing the same constantly forward, arranged to be opened by the edge of the sliding bar when the latter moves forward, and when the latter moves back to impinge upon the space-bar which has been removed, and force it vertically downward onto the lower table.

40. The combination of a lower table; a plate provided with a horizontal shoulder at one end and pivoted at the other end in the upper surface of the table; and devices, substantially as described, actuated at the proper moment by the space-bar-removing mechanism, whereby the loose end of the plate is depressed at the proper instant and the space-bar permitted to pass over the vertical shoulder.

41. The combination of a lower table; a plate provided with a horizontal shoulder at one end and pivoted at the other end in the upper surface of the table; a rod sliding in the table under the free end of the said plate, provided on its upper surface with a beveled slot into which the loose end of the plate can drop; a spring for retracting the loose end of the plate and forcing it to drop into said beveled opening when it comes under it; a spring for holding the sliding rod in such position that the loose end of the plate is normally raised out of the beveled opening; pins at either end of the opening in which the rod slides for limiting its movement; a pivoted spring-latch engaging with the outer end of and arranged to move the sliding rod; and a suitable cam attached to the ring on the shaft which operates the space-bar-extracting mechanism, arranged to trip the latch and move

the sliding rod and cause the loose end of the plate to drop, at the proper instant for the purpose set forth.

42. The combination of a latch pivoted to the bed-plate; a spring for throwing the same constantly forward; arranged to be opened by the forward movement of the bar which drives the space-bars farther into the line-holder, before removal and when the latter moves back, to force the space-bar which has been removed downward onto the lower table; a lower table upon which the space-bars are received one by one, as they are withdrawn from the line-holder; a plate provided with a horizontal shoulder at one end and pivoted at the other end in the upper surface of the table; and devices, substantially as described, actuated by the space-bar-removing mechanism, whereby the loose end of the plate is depressed at the proper instant and the space-bar caused to pass over the vertical shoulder and onto the lower table by the action of the latch when the driving-bar moves backward.

43. The combination of a bar arranged to slide on the bed-plate; a spring-hook mounted upon a block on the bar, arranged to move forward with said rod and to engage the end of the foremost space-bar in the line-holder; a spring whereby the bar is constantly forced forward; a rotating shaft driven from a suitable source of power; a ratchet-wheel on said shaft; an annular ring running loosely on said shaft surrounding said ratchet-wheel; a pivoted dog, controlled by a spring in the periphery of the ring, arranged to engage with the ratchet-wheel; a cam upon the shaft engaging with a block upon the bar, arranged to normally hold the bar out of operation, except when the block is moved off of the cam by the rotation of the shaft; mechanism, actuated by the foremost space-bar in the line-holder, for throwing the dog in and out of engagement at the proper instant and causing the spring-hook to withdraw a space-bar; a latch pivoted to the bed-plate provided with a spring for throwing the same constantly forward, arranged to be opened by the edge of the sliding bar when the latter moves forward and when the latter moves backward to impinge upon the space-bar which has been removed by it; a lower table upon which the space-bars are received; a plate provided with a horizontal shoulder at one end pivoted at the other end in the upper surface of the table; a rod sliding in the table under the free end of the said plate, provided on its upper surface with a beveled slot into which the loose end of the plate can drop; a spring for retracting the loose end of the plate and forcing it to drop into said beveled opening when it comes under it; a spring for holding the sliding rod in such position that the loose end of the plate is normally raised out of the beveled opening; pins at either end of the opening in which the rod slides for limiting its movement; a pivoted spring-

latch engaging with the outer end of and arranged to move the sliding rod; and a suitable cam attached to the ring on the shaft which operates the space-bar-extracting mechanism, arranged to trip the latch and move the sliding rod and cause the loose end of the plate to drop for the purpose set forth.

44. The combination with the driving-bar of the space-bar-withdrawing mechanism; of the latch pivoted to the bed-plate for forcing the space-bars one by one downward upon the shuttle-way as they are withdrawn from the line-holder; means for actuating the latch substantially as described; a plate provided with a horizontal shoulder at one end and pivoted at the other end at the upper surface of the table; and devices substantially as described actuated by the space-bar-removing mechanism, whereby the loose end of the plate is depressed at the proper instant, and the space-bar is forced by the movement of the latch to pass over the vertical shoulder and onto the lower table when the driving-bar moves backward.

45. The combination of the space-holder sliding horizontally upon tracks in a suitable bed-plate; a spring for causing the space-holder to move forward; a suitable rotating driving-shaft; a bar sliding upon the bed-plate, arranged to drive in the space-bars in the line-holder, one by one, so as to fill out any looseness in the line; a hook, attached to said bar for removing the space-bars; devices substantially as described, connected with said sliding bar, for stopping and holding the space-holder with the appropriate space-compartment directly over the line-holder at the point where, and at the instant when, the space-bar is to be removed; a space-bar ejector, actuated at the proper instant by the rotating shaft, for discharging the appropriate space from the compartment into the line when the space-bar is withdrawn; and means, substantially as described, for releasing the mechanism which holds the line-holder, and permitting it to resume its original position after the withdrawal of each space-bar and the insertion of the space.

46. The combination of the space-holder sliding horizontally upon tracks in a suitable bed-plate; a spring for causing the space-holder to move forward; a suitable rotating driving-shaft; a bar sliding upon the bed-plate, arranged to drive in the space-bars in the line-holder, one by one, so as to fill out any looseness in the line; a hook, attached to said bar, for removing the space-bars; devices, substantially as described, connected with said sliding bar, for stopping and holding the space-holder with the appropriate space-compartment directly over the line-holder at the point where, and at the instant when, the space-bar is to be removed; a space-bar ejector, actuated at the proper instant by the rotating shaft, for discharging the appropriate space from the compartment into the line, when the space-bar is withdrawn; means,

substantially as described, for releasing the mechanism which holds the line-holder, and permitting it to resume its original position after the withdrawal of each space-bar and the insertion of the space; and means, substantially as described, for holding the line-holder stationary during the operation of removing the space-bars and inserting permanent spaces into the line.

47. The combination of a space-holder sliding horizontally on tracks in a suitable bed-plate; a spring for causing the space-holder to move forward; a suitable rotating driving-shaft; a bar sliding upon the bed-plate, arranged to drive in the space-bars in the line-holder, one by one, so as to fill out any looseness in the line; a spring for throwing forward the sliding bar; a cam on the driving-shaft for retracting the same at the proper instant; a hook attached to said bar, and moving forward with the same, for removing the space-bars; devices, substantially as described, connected with said sliding bar, for stopping and holding the space-holder with the appropriate space-compartment directly over the line-holder at the point where, and at the instant when, the space-bar is to be removed; a space-bar ejector, actuated at the proper instant by the rotating shaft, for discharging the appropriate space from the compartment into the line when the space-bar is withdrawn; and means, substantially as described, for releasing the mechanism which holds the line-holder, and permitting it to resume its original position after the withdrawal of each space-bar and the insertion of the space.

48. The combination of a space-holder sliding horizontally on tracks in a suitable bed-plate; a spring for causing the space-holder to move forward; a suitable rotating driving-shaft; a bar sliding upon the bed-plate, arranged to drive in the space-bars in the line-holder, one by one, so as to fill out any looseness in the line; a spring for throwing forward the sliding bar; a cam on the driving-shaft for retracting the same at the proper instant; a hook attached to said bar, and moving forward with the same, for removing the space-bars; an upright block attached to said bar carrying a lug at the top at one side; a rod pivoted to the space-holder at one end and provided with a shoulder at its other end, against which said lug strikes, whereby the pivoted bar and the space-holder are moved when the sliding bar moves forward to the point where a space-blank from the appropriate compartment can be inserted into the line, the relations being such that the space-holder will not begin to move until after the sliding bar has moved a certain distance; a second bar, pivoted at one end to the space-holder, and loose at the other end; a counter-shaft driven from the rotating shaft by suitable gear connections; a lug on the end of said shaft, arranged to trip the loose end of the second pivoted bar; a series of rotating con-

ical detent-stops formed upon said counter-shaft; a lug on said second sliding bar which forms a latch over and engaging with the detent-stops when the space-holder is moved forward to its appropriate position by the lug on the shoulder of the upright block; a trip-latch attached to the counter-shaft for raising the end of the first pivoted bar and releasing it from the shoulder on the block at the end of the revolution of the shaft and permitting the space-rack to be drawn back by the force of the spring to its original position; and a lug on the counter-shaft for raising the end of the second pivoted bar so as to lift it free from the detent-latch, at the instant that the space-holder is ready to be moved back to its original position by the spring.

49. The combination of a space-holder sliding horizontally on tracks in a suitable bed-plate; a spring for causing the space-holder to move forward; a suitable rotating driving-shaft; a bar sliding upon the bed-plate, arranged to drive in the space-bars in the line-holder, one by one, so as to fill out any looseness in the line; a spring for throwing forward the sliding bar; a cam on the driving-shaft for retracting the same at the proper instant; a hook attached to said bar, and moving forward with the same, for removing the space-bars; a block attached to said bar carrying a lug at the top at one side; a bar pivoted to the space-holder at one end and provided with a shoulder at its other end, against which said lug strikes, whereby the pivoted bar and the space-holder are moved when the sliding bar moves forward, to the point where a space-blank from the appropriate compartment can be inserted into the line; a second bar pivoted at one end to the space-holder, and loose at the other end; a counter-shaft driven from the shaft; a lug on the end of said shaft, arranged to trip the loose end of the second pivoted bar; a series of rotating detent-stops upon said counter-shaft; a lug on said second pivoted bar which forms a latch sliding over and engaging with the detent-stops, when the space-holder is moved forward to its appropriate position by the lug on the shoulder of the upright block; a trip-latch attached to the counter-shaft for raising the end of the first pivoted bar and releasing it from the shoulder at the end of the revolution of the shaft and permitting the space-holder to be drawn back by the force of the spring to its original position; a lug on the counter-shaft for raising the end of the second pivoted bar so as to lift it free from the detent-latch at the instant that the space-holder is ready to be moved back to its original position by the spring and a space-bar ejector, actuated at the proper instant by the rotating shaft, for discharging the appropriate space from the compartment into the line when the space-bar is withdrawn.

50. The combination of the line-holder; the space-bar-withdrawing mechanism; the space-

inserting mechanism; a sliding bar, one end of which is arranged to engage with and hold the line-holder; a cross-head at the end of the bar, to which a sliding motion is imparted by a second sliding rod; a cam-shoe on the second sliding rod; a spring whereby the mechanism is constantly thrown forward, and a projection upon the driving-ring of the space-inserting mechanism, whereby the sliding rod is released from the line-holder and the latter permitted to move forward during a single revolution of the space-inserting mechanism.

51. The combination of the space-holder sliding horizontally upon tracks in a suitable bed-plate; a spring for causing the space-holder to move forward; a suitable rotating driving-shaft; a bar sliding upon the bed-plate, arranged to drive in the space-bars in the line-holder, one by one, so as to fill out any looseness in the line; a hook, attached to said bar, for removing the same and devices substantially as described, connected with said sliding bar, for stopping and holding the space-holder with the appropriate space-compartment directly over the line-holder at the point where, and at the instant when, the space-bar is to be removed; a space-bar ejector, actuated at the proper instant by the rotating shaft, for discharging the appropriate space from the compartment into the line when the space-bar is withdrawn; means, substantially as described, for releasing the mechanism which holds the line-holder, and permitting it to resume its original position after the withdrawal of each space-bar and the insertion of the space; a bar sliding on the bed-plate, arranged to hold the line-holder stationary; a spring for causing it to constantly press forward against the line-holder; and a rod connecting with the bar carrying a block and a cam on the driving-shaft arranged to trip the block and slide the bar at the proper instant and release the line-holder and permit it to move forward.

52. The combination with the lower table, of a supporting mechanism arranged to be tripped by the bunter after the discharge of the line from the line-holder is effected, and the table permitted to fall with the empty line-holder.

53. The combination with the lower table and the bed-plate of a latch pivoted at one end to the bed-plate, arranged to engage and hold the table at its other end; a spring for constantly throwing the same forward into engagement with the table; a lever pivoted to the loose end of the latch at one end and having a hook at its other end; a lug upon the plate, upon which the bunter moves, arranged to trip the said hook when the latter moves back; and a stop upon the table arranged to lift the hook over the lug on the bunter when the bunter mechanism moves forward, and to prevent the tripping of the latch until the bunter is operated.

54. The combination of a line-holder containing a previously-justified line of type; a

plate sliding on the bed-plate; a bunter attached to one end of the frame, arranged to slide forward and enter the opening in the line-holder and discharge the type therefrom onto the galley; mechanism for causing said plate to slide forward and be returned at the proper instant; a latch pivoted in a bearing on the bunter, terminating at one end in a hook engaging with an opening in the edge of the line-holder, and provided at the other end with a spring arranged to come in contact with the inner surface of the line-holder when the latter moves downward; a rod connecting the hooked end of said latch with the bunter-actuating mechanism; and a spring for throwing the said hook end constantly forward, whereby, when the line-holder reaches the point where the hook can enter the opening, the bunter-operating mechanism is set in motion by the operation of the spring.

55. The combination of a line-holder containing a previously-justified line of type; a plate sliding on the bed-plate; a bunter attached to one end of the frame, arranged to slide forward and enter the opening in the line-holder and discharge the type therefrom onto the galley; a rotating driving-shaft; a disk rotating loosely on said shaft, provided with suitable channels; a clutch-ring provided with a projecting end fitted into said channels; a crank-shaft connecting said ring and the sliding plate; a collar provided with cog-teeth on its periphery attached to said shaft; springs for holding the clutch-ring normally out of engagement with the disk; an arm pivoted to the bed-plate provided with a retaining-pawl for throwing the clutch-ring in and out of engagement; a latch pivoted on a bearing on the bunter, terminating at one end in a hook engaging with an opening in the edge of the line-holder and provided at the other end with a spring arranged to come in contact with the inner surface of the line-holder when the latter moves downward; a rod connecting the hooked end of said latch with the pivoted arm carrying the retaining-pawl; and a spring for throwing the said hooked end constantly forward, whereby, when the line-holder reaches the point where the hook can enter the opening, the bunter-operating mechanism is set in motion by the operation of the spring.

56. The combination of a line-holder containing a line of type in which wedge-shaped temporary space-bars have been inserted and driven in uniformly to expand the line; mechanism which successively drives in the foremost space-bar in the line-holder as it advances farther into the line to expand it and take up any looseness that there may be therein; mechanism for removing such space-bar after having thus been driven in; and mechanism for inserting into the space left in the line by the withdrawal of the space-bar, an ordinary space of the nearest unit that will entirely fill the same, and after the removal of each space-bar, driving in the foremost re-

maintaining space-bar only, and successively repeating this operation upon the foremost space-bar until all the space-bars have been replaced by ordinary spaces.

5 57. The combination of a line-holder containing a line of type in which wedge-shaped temporary space-bars have been inserted and driven in uniformly to expand the line; a sliding bar which successively drives in the foremost
10 space-bar in the line-holder as it advances farther into the line to expand it and take up any looseness that there may be therein; a hook for engaging and withdrawing such space-bar after having thus been driven in;
15 and means for inserting into the space left in the line by the withdrawal of the space-bar, an ordinary space of the nearest unit that will entirely fill the same, and after the removal of each space-bar, driving in the foremost remaining space-bar only, and successively repeating this operation upon the foremost
20 space-bar until all the space-bars have been replaced by ordinary spaces.

25 58. The combination of a line-holder containing a line of type in which wedge-shaped temporary space-bars have been inserted and driven in uniformly to expand the line; a sliding bar actuated automatically, which successively drives in the foremost space-bar in
30 the line-holder as it advances farther into the line to expand it and take up any looseness that there may be therein; a hook which advances with said sliding bar and engages and removes such space-bar after having thus
35 been driven in; and means for inserting into the space left in the line by the withdrawal of the space-bar, an ordinary space of the nearest unit that will entirely fill the same and after the removal of each space-bar, driving
40 in the foremost remaining space-bar only, and successively repeating this operation upon the foremost space-bar until all the space-bars have been replaced by ordinary spaces.

45 59. The combination of the frame-plate; shuttle-ways attached thereto; line-holders moving on the shuttle-ways; devices connected with the frame-plate for driving the line-holder down the upper shuttle-way and permitting it to pause at the proper moment; devices
50 substantially as described for actuating the said driving devices at the proper instant and restoring them to their original position; a lowering-table at the lower end of the ways for lowering the emptied line-holder when
55 driven down by the rack from the upper to the lower shuttle-way; a lifting-table at the upper end of the ways for returning the line-holder from the lower to the upper shuttle-way; and means substantially as described,
60 set in motion at the proper moment by the line-holder-driving mechanism, for moving the empty line-holder along the lower shuttle-way, and for alternately raising and lowering
65 the tables at the proper instant.

60. The combination of the frame-plate; shuttle-ways attached thereto; line-holders

moving on the shuttle-ways; a rack arranged to slide in suitable ways in the frame-plate; a spring-latch upon the extremity of said
70 rack engaging with and arranged to drive the line-holder forward; a second rack arranged to slide upon suitable ways, and provided at its several extremities with a similar latch for driving the line-holder still farther,
75 devices substantially as described for actuating the said racks at the proper instant and restoring them to their original position; a lowering-table at the lower end of the ways, for lowering the emptied line-holder when
80 driven down by the rack, from the upper to the lower shuttle-way; a lifting-table at the upper end of the ways for returning the line-holder from the lower to the upper shuttle-way; and means substantially as described,
85 set in motion at the proper moment by the rack-driving mechanism, for moving the empty line-holder along the lower shuttle-way, and for alternately raising and lowering the tables at the proper instant.
90

61. The combination of a vertical bed-plate; a line-holder moving thereon; a rack arranged to slide in suitable ways therein; a spring-latch upon the extremity of said rack engaging with the line-holder; and devices,
95 substantially as described, for actuating the said rack and restoring it to its original position.

62. The combination of a vertical bed-plate; a line-holder moving thereon; a rack arranged to slide in suitable ways therein; a spring-latch upon the extremity of said rack engaging with and arranged to drive the line-holder
100 forward; and devices, substantially as described, for actuating the said rack and restoring it to its original position, and for retracting the spring-latch when the rack moves back to the starting-point.
105

63. The combination of a vertical bed-plate; a line-holder moving thereon; a second rack arranged to slide in suitable ways therein; a spring-latch upon the upper extremity of
110 said rack engaging with and arranged to drive the line-holder forward, and devices, substantially as described, for actuating the said rack and restoring it to its original position, when the line-holder has passed down onto the lower table.
115

64. The combination of a vertical bed-plate; a line-holder moving thereon; a rack arranged to slide in suitable ways therein; a spring-latch upon the extremity of said rack engaging with and arranged to drive the line-holder
120 forward; a second rack, arranged to slide upon suitable ways, and provided at its upper extremity with a similar latch for driving the line-holder still farther; and devices substantially as described, for actuating the said
125 racks and restoring them to their original position.

65. The combination of a vertical side plate; a line-holder moving thereon; an upper rack arranged to slide in suitable ways therein; a spring-latch upon the extremity of
130 said rack, arranged to engage with and drive

the line-holder a certain distance down the upper shuttle-way; a second rack arranged to slide upon suitable ways in the plate, provided, at its upper extremity, with a similar latch for driving the line-holder still farther down the upper shuttle-way; a rack-shaft rotating in the side plate, carrying at its inner extremity a cog-wheel driving the upper rack, and at its outer extremity a second cog-wheel; an oscillating rack sliding in suitable bearings and provided, at either end, with similar teeth on opposite sides arranged to mesh into the cog-wheel on the rack-shaft at one end; a driving-shaft rotated from the main driving-shaft, carrying cog-wheels arranged to engage with and move the oscillating rack when the latter is thrown forward; a spring-plunger for keeping the rack normally out of engagement with the cog-wheel; a second rack-shaft carried in bearings in the side plate; a cog-wheel at the end of said shaft which drives the lower rack; a cog-wheel at the other end of the shaft; an auxiliary shaft in the side plate carrying at one end a cog-wheel engaging with the cog-wheel at the end of the second rack-shaft, and at its other extremity a smaller cog-wheel; a second oscillating rack provided with teeth at either end upon opposite sides and arranged to engage with the smaller cog-wheel on the auxiliary shaft and thereby cause the lower rack to move in one direction; a sheave on said auxiliary shaft carrying a cord to which a weight is attached whereby the lower rack is constantly driven downward by the force of the weight; a bent arm provided on one arm with a stud arranged to slide in a groove upon the end of the second rack; and a second stud on the other end, arranged to enter a shoulder cut on the face of the first oscillating rack; a spring for keeping the end of the second oscillating rack out of engagement with the cog-wheel upon the driving-shaft; a locking device for preventing the first oscillating rack after being thrown into engagement, from escaping therefrom until it has moved its entire length; and a bent key-lever moving upon a rocking shaft, the bent end of which engages with the oscillating rack and throws it into engagement with the cog-wheel on the driving-shaft when the key is depressed and compresses the plunger, whereby when the key is depressed the arrangement of the parts is such that the upper rack moves downward and drives down the line-holder and the second rack is forced downward by the weight, and is held by the retracting mechanism during the operation of removing and inserting the space-bars, and is then moved back to its original position by the movement of the second oscillating rack, thereby driving up the upper rack and causing the first oscillating rack to move downward and be restored to its original position.

66. The combination of the driving-shaft 343, carrying the gear-wheel 342; the reciprocating rack 333, formed as shown; the reciprocating rack 341, also formed as shown, both arranged to engage with cog-wheels for driving them; a pivoted bent arm 347, provided with the studs 355 and 363, the former engaging with the shoulder 354 on the rack 333, and the latter with the groove 362 upon the rack 341; the plunger 357 for holding the rack 333 normally out of engagement with the cog-wheel 342; the spring 349 for holding the rack 341 normally out of engagement with the cog-wheel 342; the latch 364 for holding the rack 333 after being thrown into engagement with the cog-wheel 342, in engagement until it has finished its movement; the shoulder 356 for restoring the pin 355 to its position in the shoulder 354 of the rack 333, thereby releasing the rack 341 from engagement with the cog-wheel 342; and the lever 369 provided with a key H, for throwing the rack 333 into engagement with the cog-wheel 342, whereby the rack mechanism is caused to operate.

67. The combination of the sprocket mechanism for returning the line-holders; a rock-shaft which by suitable connections, throws the sprocket mechanism in and out of engagement; an arm attached to the rock-shaft, provided at its extremity with suitable studs; a latch pivoted to the end of said arm, limited in its movement by the position of the studs; an auxiliary rotating shaft, actuated by the principal driving mechanism, for operating the lower driving-rack, and a suitable pin, carried upon a disk upon the shaft or any other convenient manner so as to rotate with it, arranged to engage with the latch upon the rock-shaft and trip the latter when the auxiliary shaft rotates in one direction, and to pass over the latch without moving it or the rock-shaft when the auxiliary shaft rotates in the other direction; whereby the sprocket mechanism is thrown into operation when the lower rack has reached a certain point in its upward movement and the line-holder advanced up the lower shuttle-way.

68. The combination of the sprocket mechanism; gear-wheels arranged to be thrown in and out of gear for operating the mechanism alternately in opposite directions; and devices actuated by the line-holder-driving mechanism, for throwing the sprocket-mechanism-actuating devices in and out of operation at the proper instant.

69. The combination of the upper and lower parallel ways; the vertically-moving table at the lower end forming connection between them; the line-holder moving on the ways; mechanism for driving the line-holder downward on the upper way; mechanism for permitting the table to fall and carry with it the line-holder; the sprocket mechanism for moving the line-holder back over the lower way; and devices actuated by the driving mechanism at the proper instant, for setting the sprocket mechanism in motion.

70. The combination of the upper and lower parallel ways; the vertically-moving tables at either end for carrying the line-holder from

one way to the other; the line-holder moving on the ways; mechanism for driving the line-holder down the upper way; mechanism for alternately raising and lowering the tables; mechanism for returning the line-holder over the lower way; and devices actuated by the driving mechanism for setting the returning mechanism in motion at the proper instant.

71. The combination of the lower table; the line-holder moving thereon the sliding block arranged to be moved by the sprocket mechanism; the spring-latch in the end of said block; the sprocket mechanism; and means for actuating the same.

72. The combination of the lower table, cut away at the end to permit the passage of the latch; the line-holder moving thereon the sliding block for removing the line-holder and space-bars from one table to the other, arranged to be moved by the sprocket mechanism; the spring-latch in the end of said block; the sprocket mechanism engaging with the block; and means for actuating the same.

73. The combination of the tables; the line-holder moving thereon the sliding block for moving the line-holder and space-bars from one table to the other, arranged to be moved by the sprocket mechanism; the spring-latch in the end of said block; the sprocket mechanism; the cams upon the sprocket-shafts for raising the tables at the right moment; and the means for actuating the sprocket mechanism and the cams.

74. The combination of the lower table; a block arranged to slide upon suitable ways in the shuttle-way over the table and the shuttle-way for removing the space-bars from the table; a tripping device, actuated by a cam on the block, for depressing the plate upon the upper end of the table in order that the space-bars may pass over the same; a pivoted latch at the extremity of the block for moving the line-holder off of the table and carrying it up on the shuttle-way; a spring for holding said latch normally in an extended position; a chain-block attached to the sliding block arranged to engage with the sprocket-chain; and devices for actuating the sprocket-chain, substantially as described.

75. The combination of two rotating shafts; a sprocket-wheel attached to and carried upon the lower shaft; a chain passing over said sprocket-wheel; a block attached to the line-holder-returning mechanism engaging with said chain; a sprocket-wheel running loosely upon the upper shaft over which said chain travels; suitable gear-wheels carried upon the upper shaft; a driving-shaft carrying gear-wheels rotating in different directions, arranged to be thrown into engagement with the mechanism upon the upper shaft; and devices, substantially as described, for throwing the gear-wheels upon the upper shaft alternately into engagement with the gear-wheels on the driving-shaft, and releasing the same at the proper instant, whereby a reciprocating motion is imparted to the chain,

and the line-holder-raising mechanism is caused to travel from the lower table, to the upper table and to be returned at the proper instant.

76. The combination of two rotating shafts; a sprocket-wheel attached to and carried upon the lower shaft; a cam for raising the lower table attached to said shaft; a chain passing over said sprocket-wheel; a block attached to the line-holder-returning mechanism engaging with said chain; a sprocket-wheel running loosely upon the upper shaft over which said chain travels; a cam for raising the upper table arranged to rotate with said upper shaft; suitable gear-wheels carried upon the upper shaft; a driving-shaft carrying gear-wheels rotating in different directions arranged to be thrown into engagement with the mechanism upon the upper shaft; and devices, substantially as described, for throwing the gear-wheels upon the upper shaft alternately into engagement with the gear-wheels on the driving-shaft, and releasing the same at the proper instant, whereby a reciprocating motion is imparted to the sprocket-chain, and the line-holder-raising mechanism is caused to travel from the lower table to the upper table, and to be returned at the proper instant, and the tables are alternately raised and lowered at the proper intervals, by the action of the cams upon the shafts.

77. The combination of two rotating shafts; a sprocket-wheel attached to and carried upon the lower shaft; a cam for raising the lower table attached to said shaft; a chain passing over said sprocket-wheel; a block attached to the line-holder-returning mechanism engaging with said chain; a sleeve running loosely on said upper shaft; a cam for raising the upper table attached to said sleeve; a sprocket-wheel having teeth upon its periphery keyed to the sleeve in a suitable manner; two gear-wheels rotating loosely on said shaft on either side of the sprocket-wheel, one arranged to rotate in one direction and the other in the other direction; suitable intermediate gear-wheels connecting with the driving mechanism whereby this result is effected; disks on either side of the sprocket-wheel encircling the shaft, each provided, on their opposite sides, with suitable slots; a trip-lever in each slot, pivoted to the disk and provided on its outer surface with a stud; a toothed dog, pivoted to the outer face of each of the said disks, each provided with a tooth and notch engaging with the stud upon the trip-lever; a spring for holding each of said dogs in engagement with the stud upon the trip-lever; a sliding arm arranged to be moved by the return of the line-holder-driving mechanism for tripping the outer end of one of the trip-levers, throwing the same into engagement with one of the cog-wheels, and causing the sprocket mechanism to rotate in one direction; a stop for tripping the lever at the end of the revolution to its original

position and releasing the engagement with the driving mechanism; and a forked stop, one end of which is arranged to engage and trip the opposite lever at the end of the revolution and to cause the dog to engage with the gear-wheels rotating in the opposite direction, thereby causing the sprocket mechanism to revolve in the opposite direction for an equal distance, and the other end of which is arranged to trip the lever back to its original position, and to release the connection and cause the mechanism to stop, until such time as it is set in motion again by the return of the line-holder-driving mechanism.

78. The combination of an auxiliary driving-shaft; suitable intermediate connections whereby the same is operated from the driving-shaft; mechanism for actuating all of the separate parts of the machine attached to and carried by said auxiliary shaft; separate devices, substantially as described, for throwing said driving devices into operation automatically at the proper instant by means of the movement of the line-holder exerted through the line-holder-driving mechanism and its various parts; and a key for throwing the line-holder-driving mechanism into operation and through the same causing the various parts of the machine to operate automatically after a completed line, with the space-bars inserted therein, has been assembled in the line-holder.

79. The combination of a space-bar provided with a vertical opening on the lower edge; a shuttle upon which it moves, and a corresponding lug upon the extreme rear edge of the shuttle-way, arranged to pass through and into the opening or the lower surface of the space-bar, for the purpose of effecting proper alinement of the space-bars as they enter the shuttle-way.

80. The combination with the line-holder of the shoulders 6 and 7 for holding the space-bars when inserted therein, by the friction caused upon the rounded shoulder of the space-bar.

81. The combination with the vertical oscillating rack which moves the upper line-holder driving-rack, of the gate 368, actuated by the spring 366 pivoted at 365 to the frame, arranged to be tripped by the curved surface 367 upon the end of the rod whereby, when the rod moves upward it advances and holds the same in engagement with the driving-wheel until the oscillating rack 341 has returned and been released.

82. The combination of an auxiliary driving-shaft; suitable intermediate connections whereby the same is operated from the driving-shaft; mechanism for actuating all of the separate parts of the machine attached to and carried by said auxiliary shaft; separate devices, substantially as described, for throwing said driving devices into operation at the proper instant automatically, by means of the movement of the line-holder through the line-holder-driving mechanism and its various parts; and a key for throwing the line-holder-driving mechanism into operation and through the same causing the various parts of the machine to operate automatically, after the complete line has been assembled in the line-holder.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 3d day of June, 1898.

C. W. DICKINSON.

Witnesses:

HENRY THRUSH,
JOHN FRENCH.