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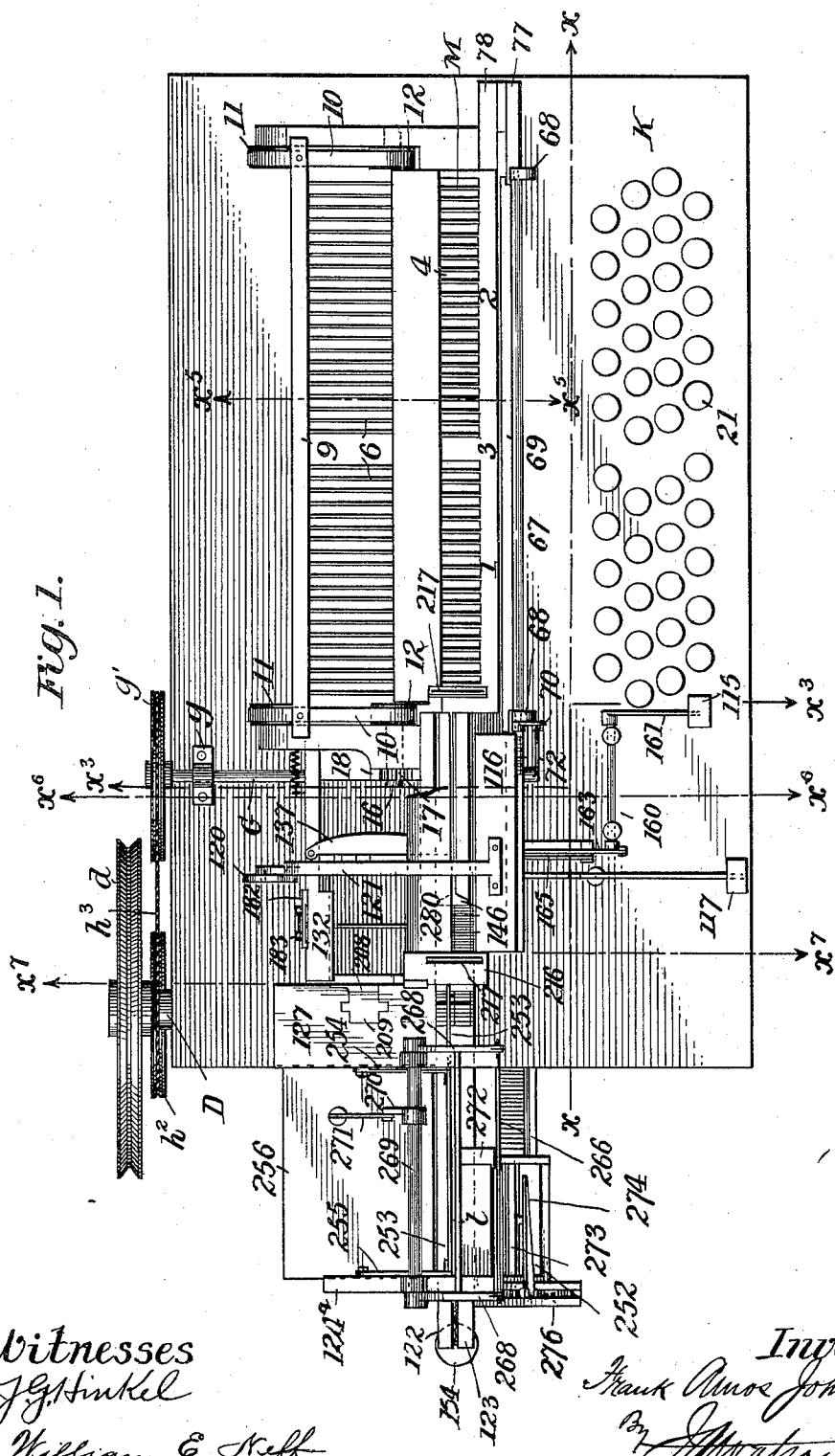
F. A. JOHNSON.

TYPE SETTING MACHINE.

No. 584,362. Patented June 15, 1897.

Fig. 1.



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F. A. JOHNSON.

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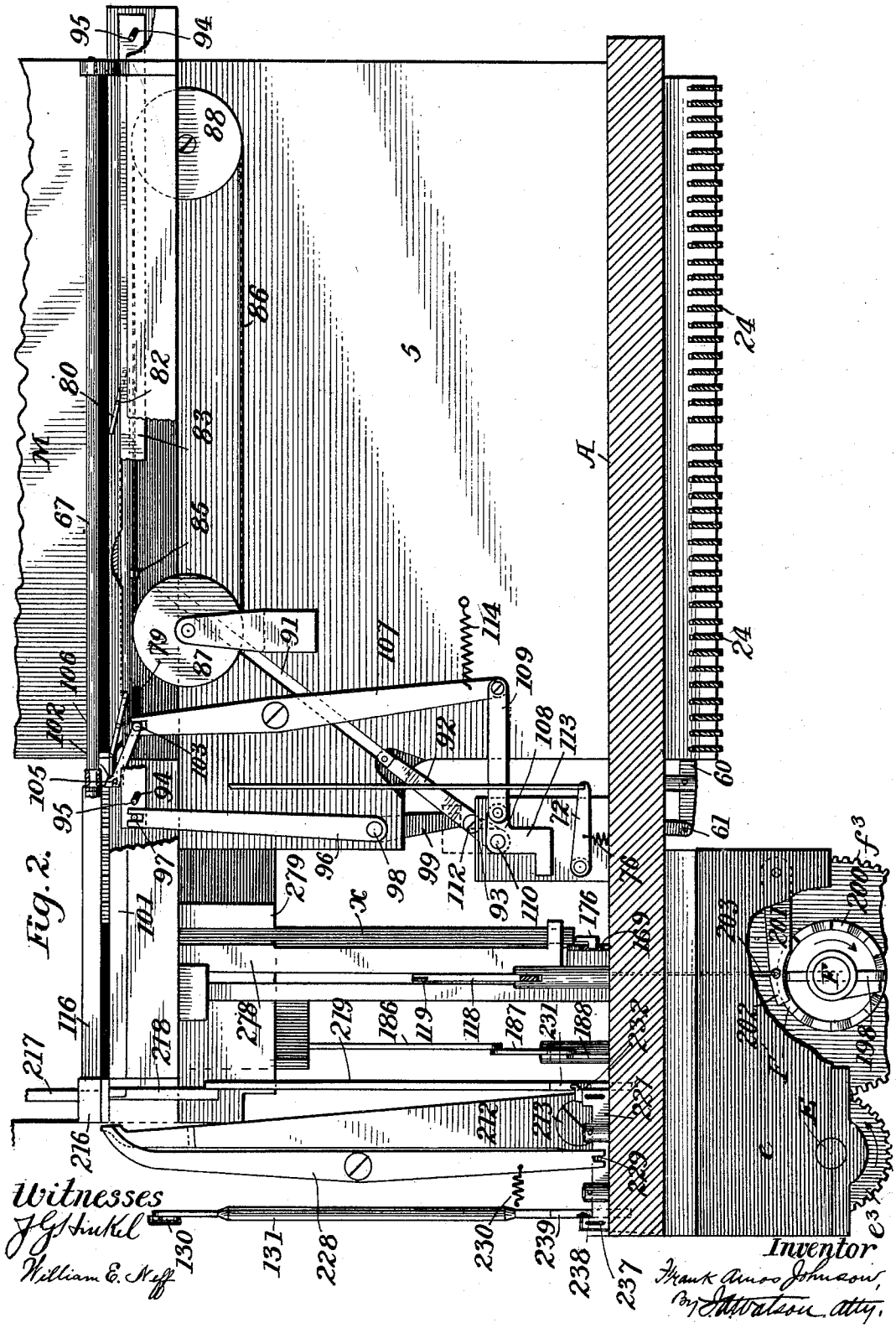

Fig. 2.

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Fig. 3.

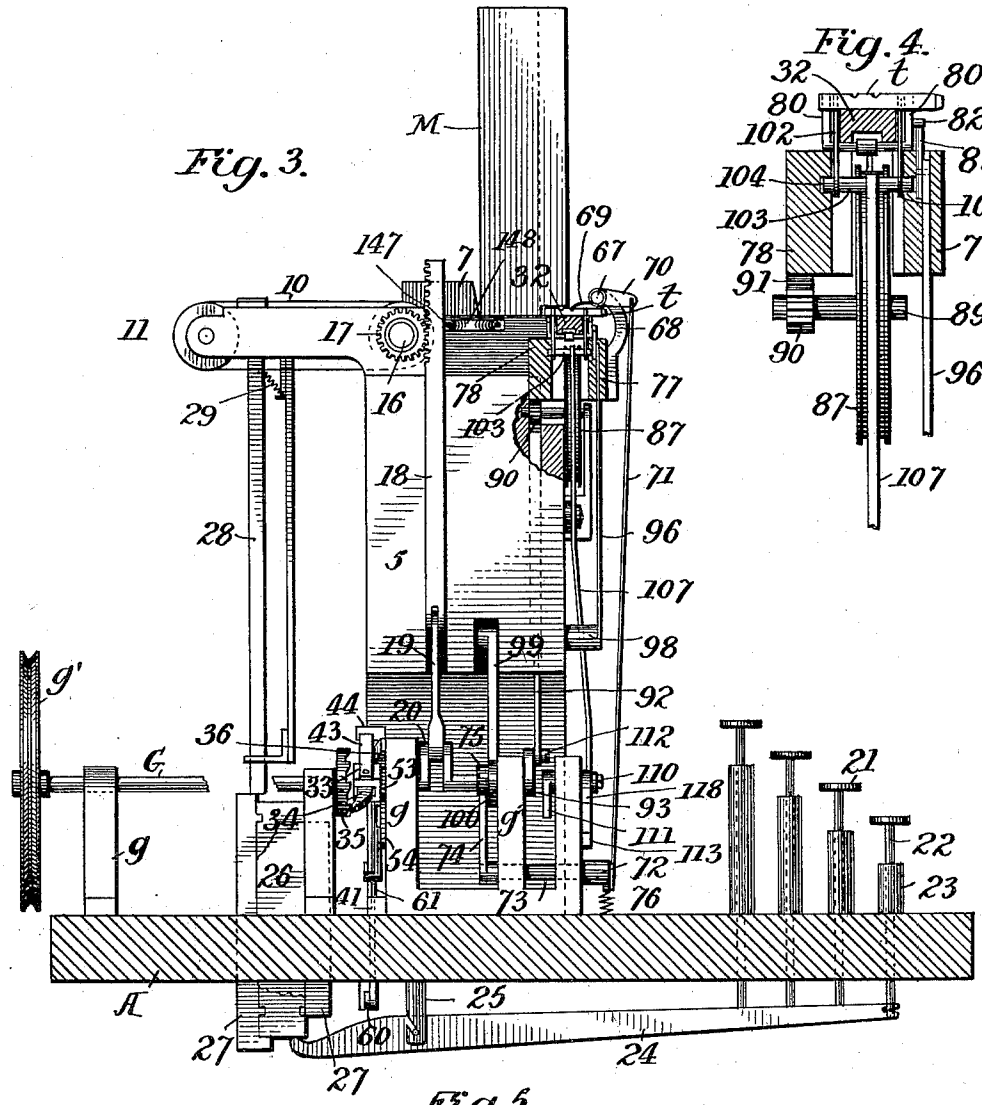

Fig. 4.

Fig. 5.

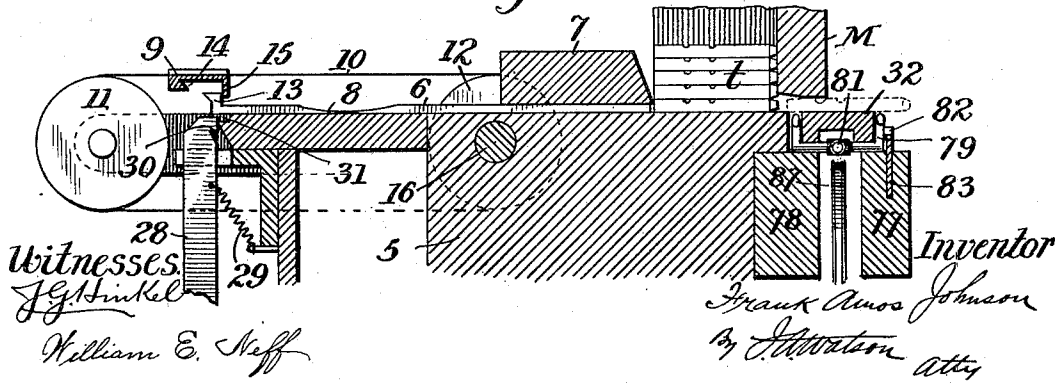

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Fig. 6.

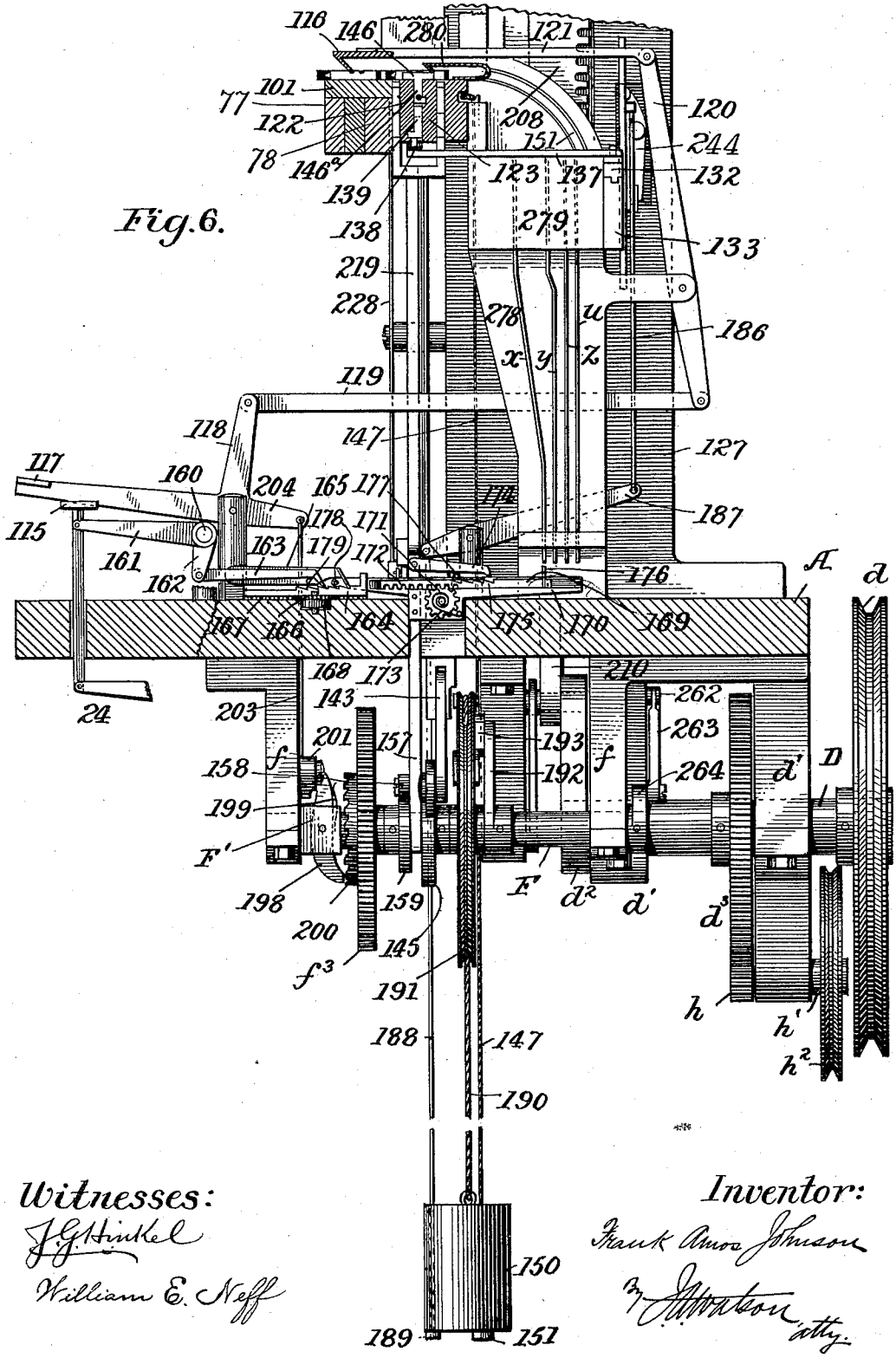

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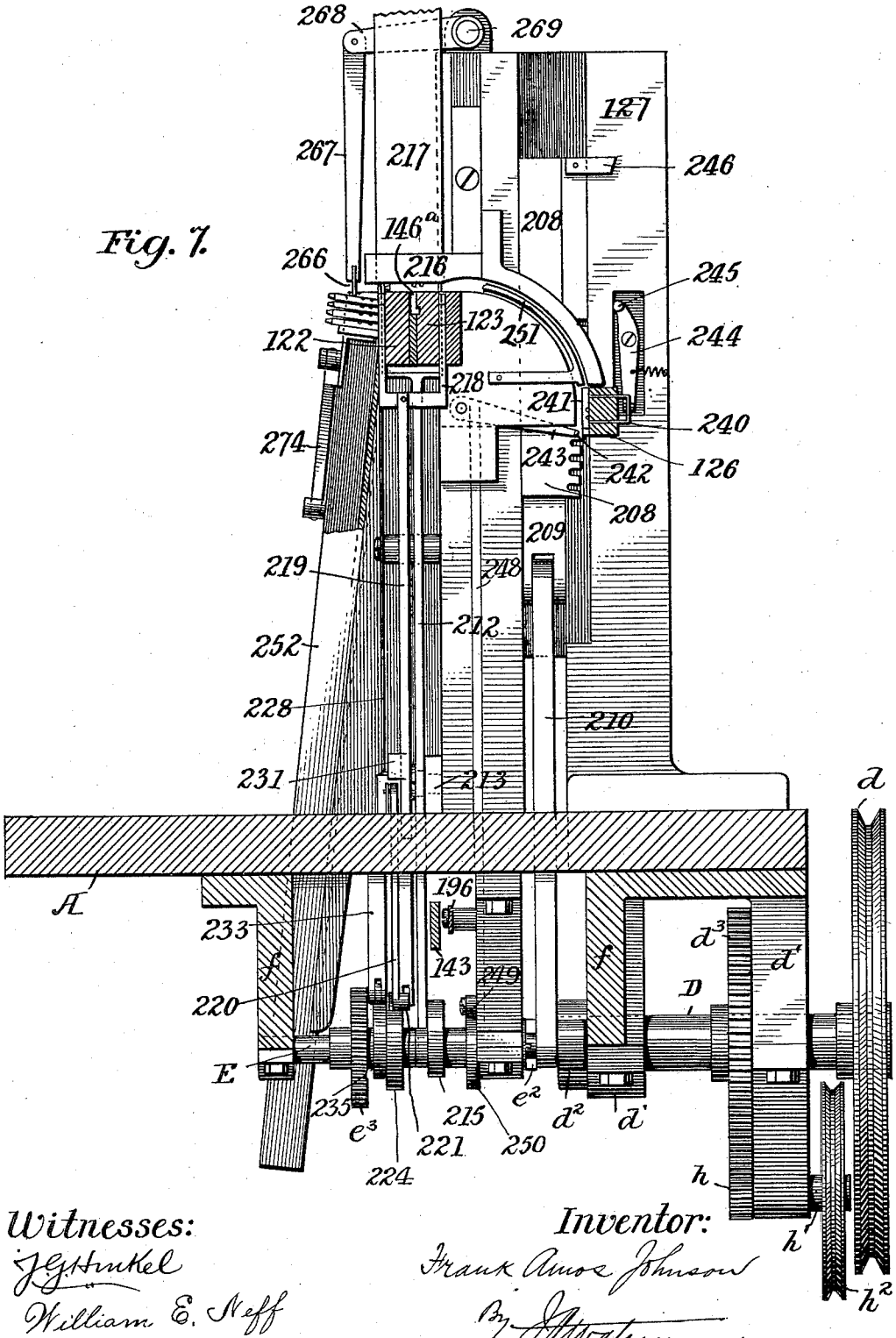
Fig. 7.



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TYPE SETTING MACHINE.

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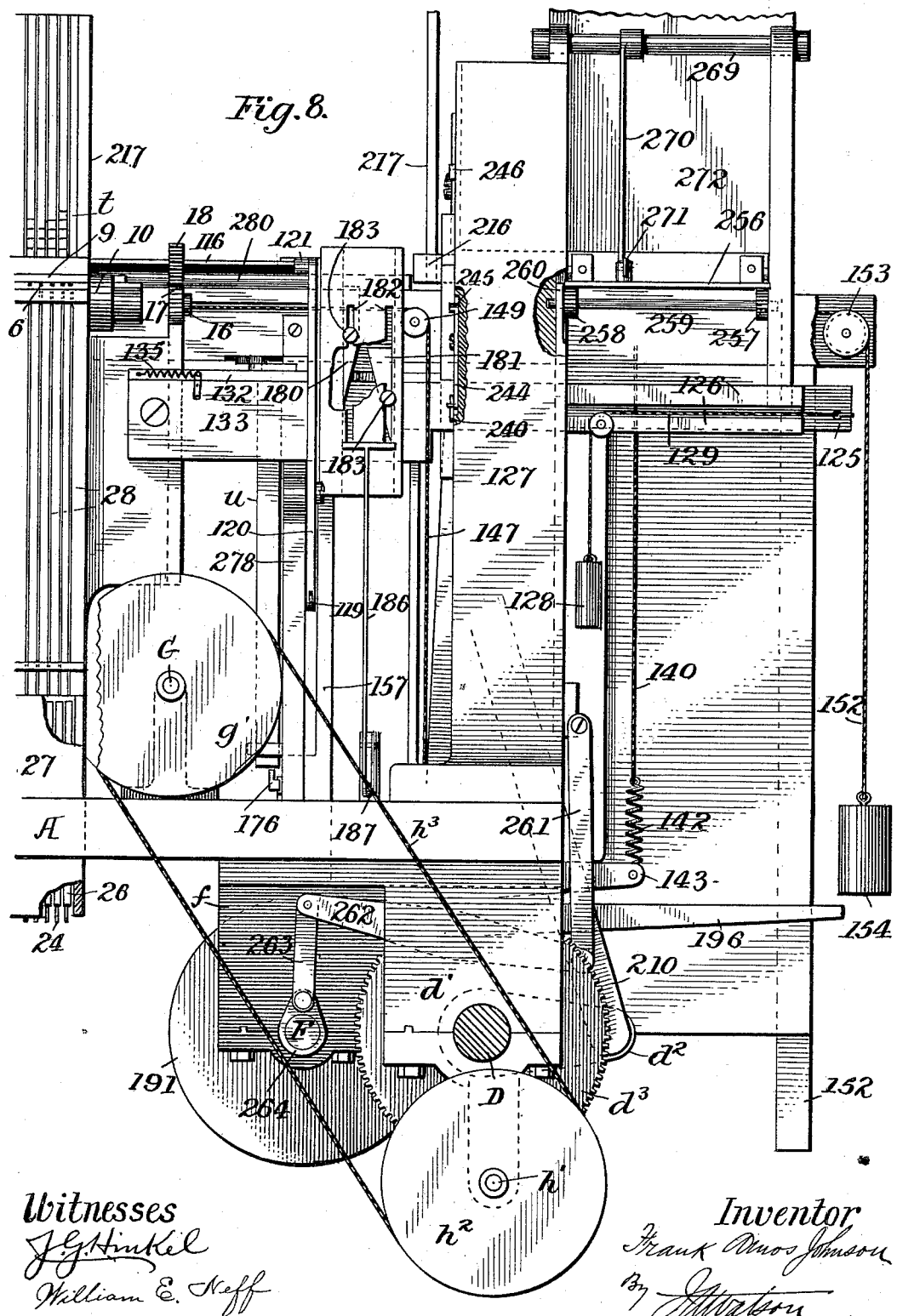
Fig. 8.



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TYPE SETTING MACHINE.

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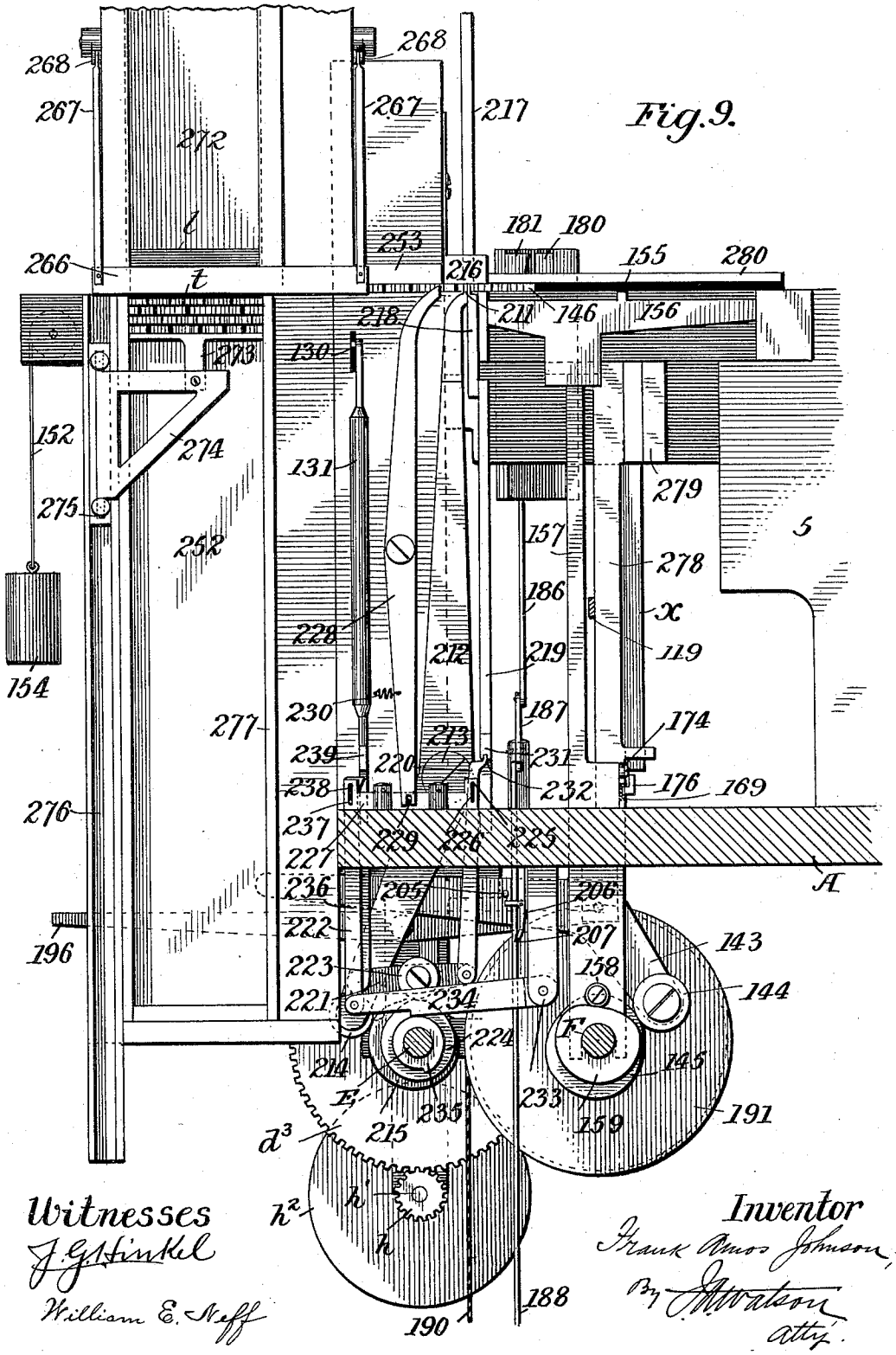
Fig. 9.



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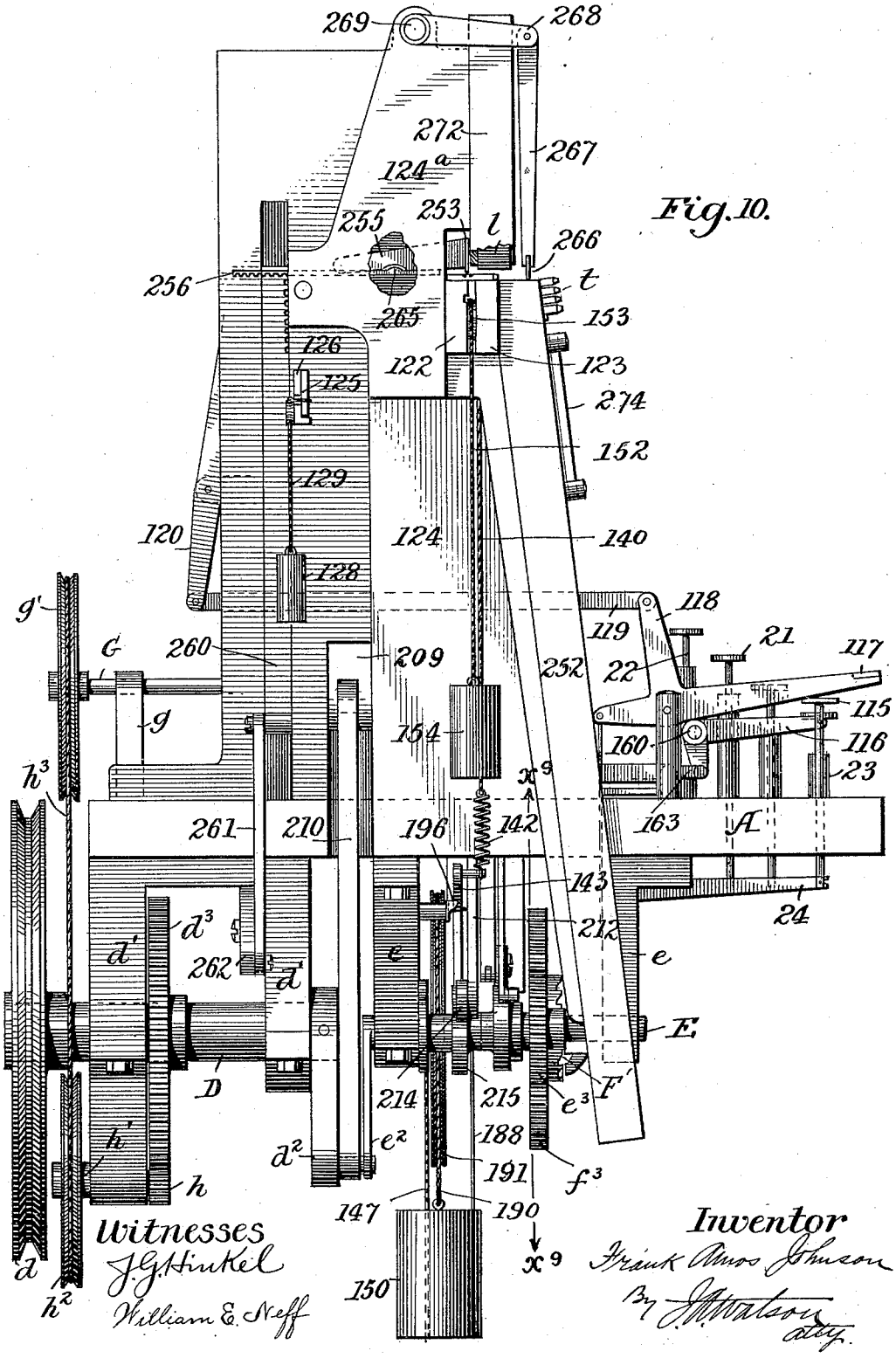

Fig. 10.

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Fig. 11.

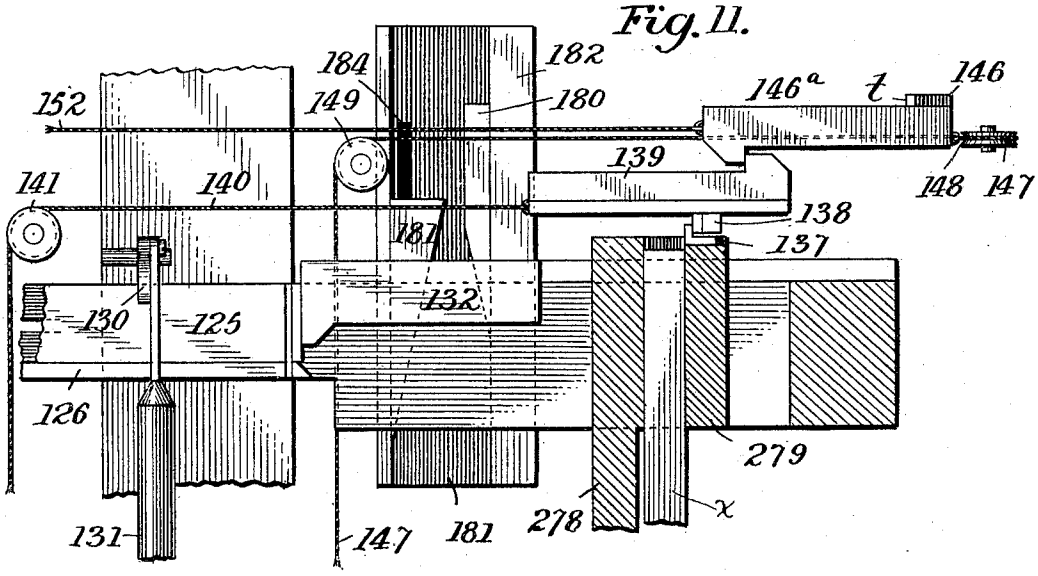
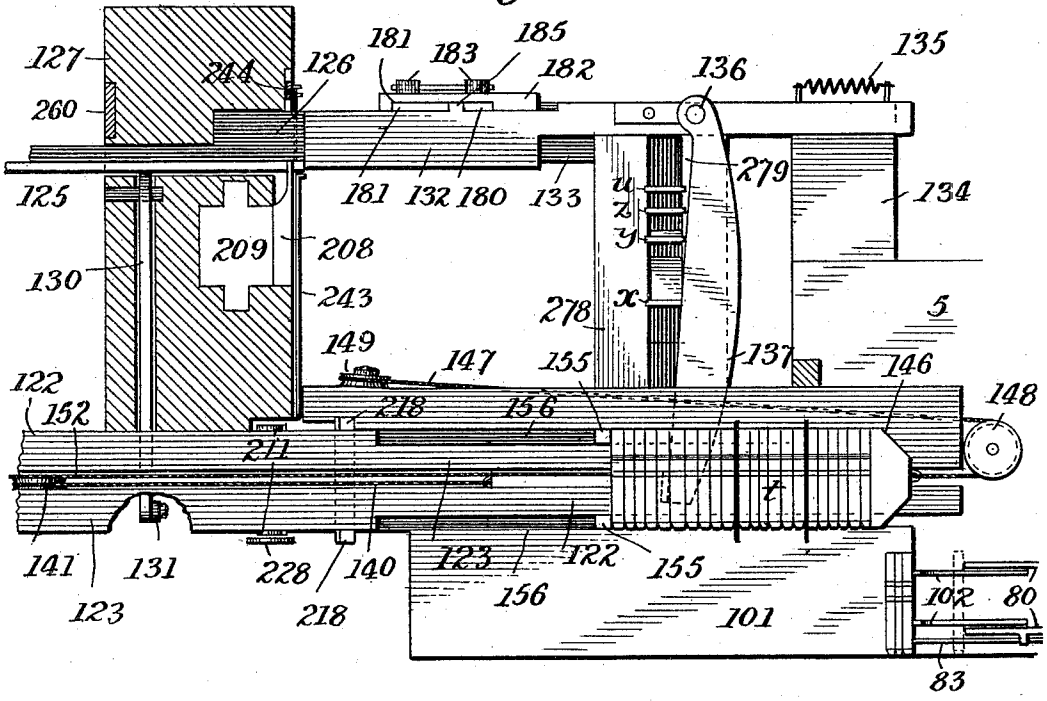


Fig. 12.



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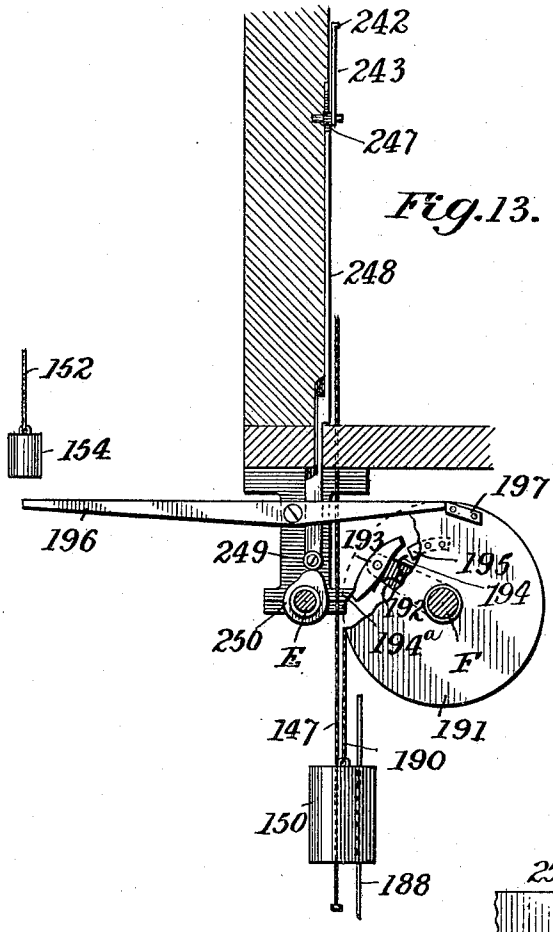

Fig. 13.

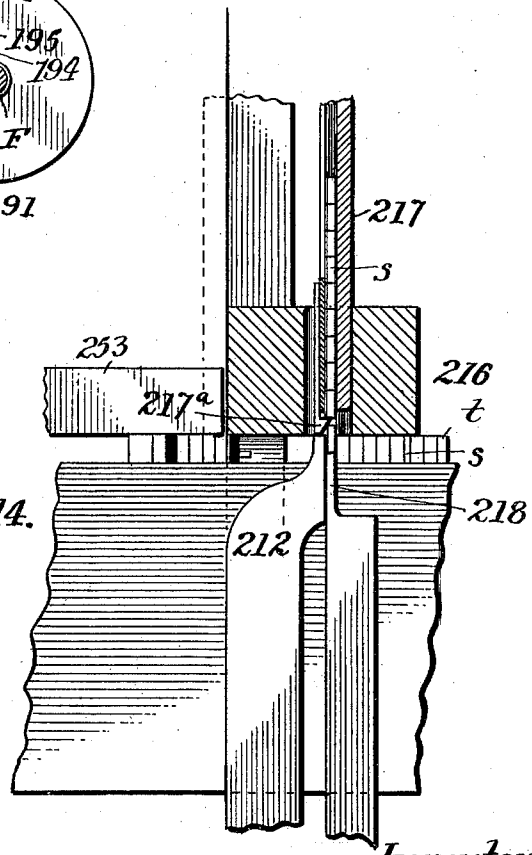

Fig. 14.

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(No Model.) 11 Sheets—Sheet 11.

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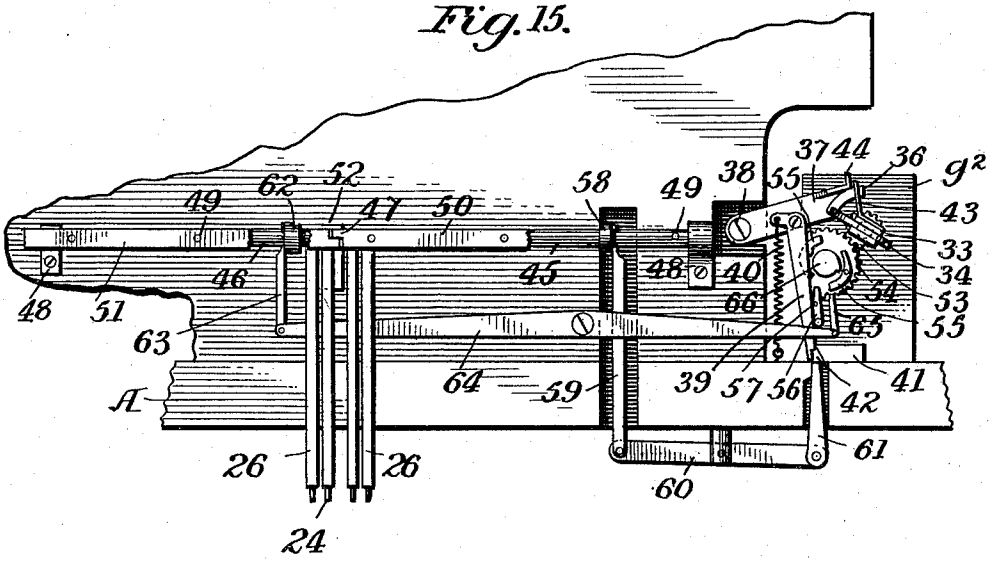
Fig. 15.



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UNITED STATES PATENT OFFICE.

FRANK AMOS JOHNSON, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE JOHNSON TYPESETTER COMPANY, OF PORTLAND, MAINE.

TYPE-SETTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 584,362, dated June 15, 1897.

Application filed November 30, 1896. Serial No. 613,973. (No model.)

To all whom it may concern:

Be it known that I, FRANK AMOS JOHNSON, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Type-Setting Machines, of which the following is a specification.

The present invention consists of two distinct mechanisms, which are embodied in a single organized machine, but which are susceptible of being used independently if desired.

The first mechanism selects type and spaces from a magazine and assembles them in lines, the spaces being of uniform size, and the second mechanism justifies the line by cutting spaces of proper size from a continuous strip or piece of "space-timber," inserts these spaces in the line in lieu of the temporary spaces, and then deposits the justified line in the galley.

The assembling mechanism, as shown, occupies the right half of the machine. In it there is a magazine having channels for the type and temporary spaces, the right half of the magazine having channels for upper-case letters and the left half having channels for lower-case letters. The space-channel is preferably placed at the extreme left. In the rear of the magazine are a series of type-pushers, one for each channel, and over the pushers is a reciprocating bar. In front of the magazine is a keyboard, the keys of which operate through suitable connections to engage the pushers with the reciprocating bar. Thus any selected key will engage its pusher with the bar and a corresponding type will be ejected onto ways in front of the magazine. The types are moved along the ways by two reciprocating carriers, one of which reciprocates opposite the lower-case type and the other opposite the upper-case type, the carriers standing normally to the right of their respective cases. The lower-case type and spaces will thus be carried by a single movement to the place of assemblage at the left of the magazine. Upper-case type will be carried by the first movement to the left of the upper case and by a succeeding movement the lower-case carrier will move the type to the place of assemblage. These carriers which move the type from the magazine operate rapidly, and to avoid the shock which they would receive if they were required to move the entire line a third carrier takes each type as it is delivered and moves it and the preceding types to the left out of the way. The type and temporary spaces are thus assembled immediately at the left of the magazine.

When sufficient type have been assembled to form a line, the line is taken and automatically justified by the second mechanism. The line is first moved bodily in between an abutment and a measuring-head and the head then moved against it. The movement of the measuring-head will be in proportion to the space to be filled in the line by justification. The movement of the measuring-head sets the gage which determines the width of the spaces to be cut for the line.

Between the gage and the head is a lever, one end of which is pivoted to the gage and the other end is in contact with a knife-edge which moves with the head. Along the lever are a series of fulcrums which are normally inoperative, one fulcrum being at the middle of the lever, the next at one-third its length from the gage, the next at one-fourth its length from the gage, &c. If there is one space in a line, the middle fulcrum will be rendered operative and the gage will be moved the same distance as the head, and the entire amount to be added to justify will be supplied in a single space. If there are two spaces in the line, the second fulcrum will be rendered operative and the gage will move only one-half as much as the head, thus dividing the space to be filled into two parts, and so on. When the gage is set, the space-timber is moved against it and a space cut off by a suitable cutter. It is then transferred into the line, which is automatically parted to receive it, and at the same time the corresponding temporary space is moved out of the line into a space-holder. This space-holder is preferably interchangeable with the space-holder of the magazine, and when one becomes filled and the other empty they can be substituted for each other. After the line is finished it is moved to the left opposite the galley and

then transferred to the galley, a lead being carried into the galley at the same time if it is desired to produce leaded matter.

The invention will now be described in detail, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view of the machine. Fig. 2 is a front view, partly on the line $x\,x$, Fig. 1, parts being broken away. Fig. 3 is a section on the line $x^3\,x^3$, Fig. 1, parts being broken away. Fig. 4 is an enlargement of a portion of Fig. 3. Fig. 5 is a partial section on the line $x^5\,x^5$, Fig. 1. Fig. 6 is a partial section on the line $x^6\,x^6$, Fig. 1. Fig. 7 is a sectional view taken about on the line $x^7\,x^7$, Fig. 1. Fig. 8 is a rear elevation of the left half of the machine, parts being broken away. Fig. 9 is a front elevation of the left half of the machine, partly in section, on the line $x^9\,x^9$, Fig. 10. Fig. 10 is an elevation of the left end of the machine. Fig. 11 is an enlarged side view of the principal parts of the justifying mechanism. Fig. 12 is an enlarged plan view of the same. Figs. 13, 14, and 15 are detail views of several parts of the mechanism detached.

General Features.

The various working parts of the machine are mounted upon a suitable frame consisting of a rectangular base-plate A and standards or brackets attached to said base-plate. The power is applied to a driving-pulley d upon a shaft D, which is mounted in hangers d'. From this shaft the power is communicated to several movement-shafts as follows: A movement-shaft E is supported directly in line with shaft D in hangers e. The shaft E is continuously rotated, being connected to the shaft D by means of cranks $d^2\,e^2$ and an intermediate crank-pin, Fig. 10.

A second movement-shaft F is supported in hangers f, and power is communicated to it through a pair of gears $e^3\,f^3$, the former being fixed on a shaft E and the latter running loosely on the shaft F. A periodic movement is given to the shaft F by the clutch F′, which will be referred to hereinafter.

A third movement-shaft G^2 is mounted above the base-plate in bearings g^2 in line with a constantly-running shaft G, mounted in bearings g. The shaft G^2 is operated intermittently by means of a clutch G′. The shaft G is connected to the driving-shaft by means of gear d^3, pinion h, shaft h', pulley h^2, band h^3, and pulley g'.

The Assembling Mechanism.

The type-magazine M is divided into two sections 1 2, the former containing lower-case type and the latter upper-case type. As shown, the magazine consists of a plate 3, having type-containing channels 4 in its front side. The magazine is supported upon a standard 5, Figs. 1 and 2. The type are ejected from their channels by a series of type-ejectors 6. These ejectors are small bars, which are guided in grooves in the under side of a cap-piece 7, resting on the standard 5, Fig. 5. These bars are reduced in section at 8, so that their rear ends can be sprung upward into engagement with a universal bar 9, which is carried backward and forward by a pair of bands 10, the bands being mounted on pulleys 11 12 at each end of the magazine, Figs. 1 and 5. The rear end of each ejector-bar has an upward extension 13, the rear part of which overhangs and engages with an undercut groove 14 in the bar 9 when the end of the ejector is raised and the bar 9 moves forward. The forward side of the projection 13 is engaged by a depending flange 15 on the universal bar when said bar moves backward. To move the universal bar forward and backward, the bands 10 are connected to the pulleys 12, and the shaft 16, to which said pulleys are attached, is rocked by a pinion 17, rack 18, pitman 19, and crank 20 on the escape-shaft G^2, Figs. 1 and 3.

In front of the machine is the keyboard K, having keys 21, mounted on stems 22, which are guided by tubes or barrels 23 upon the base plate, Figs. 1 and 3. The stems 22 extend through the base-plate and engage key-levers 24, which are fulcrumed in hangers 25. Upon the rear end of each key-lever rests a slide 26, which is free to move in vertical guides 27. These slides serve as counterpoises to hold the keys normally elevated, as shown in Fig. 3, and they also serve to raise push-rods 28, which stand under the rear ends of the ejectors 6. The push-rods are normally drawn down, so that their lower ends rest upon a fixed support, by means of springs 29. At the upper ends of the push-rods are shoulders 30, and when the rods are pushed upward they are drawn forward by the springs 29, and these shoulders engage with a seat 31, thus preventing the rods from falling until they are pushed backward off of the seat. When a key is depressed, the corresponding rod and type-ejector are raised, the push-rod remains elevated, and the universal bar 9 then moves forward, carrying with it the type-ejector. The type t is then pushed out onto a way 32 and the universal bar then moves backward, carrying the ejector to its normal position. As the ejector moves rearward it pushes the shoulder 30 of the push-rod off of its seat and said rod drops back to its normal position.

It is necessary that the movement-shaft G^2 should make a single revolution each time a lower-case key is depressed. This is effected by means of the clutch G′, Figs. 3 and 15, as follows: The shaft G^2 has an enlarged slotted end 33, in which is pivoted a pawl 34. Upon the adjacent end of the shaft G is a crown ratchet-wheel 35, with which the pawl tends to engage when released. The pawl is normally held out of engagement with the ratchet-wheel by a cam 36 upon an arm 37, which is pivoted to a fixed standard at 38. Pivoted to the arm 37 is a depending leg 39. A spring 40, connected to one side of this leg, tends to

draw the arm 37 down and to force the leg 39 to the right against a ledge 41. When the leg is raised, a notch 42 in the lower end of the leg engages the ledge and the arm 37 is thus held up until the arm is disengaged from the ledge. In order to stop the escape-shaft positively and always in the same position, a fixed arm 43 upon the head 33 is arranged to strike a projection 44 upon the arm 37 after the pawl 34 is released, Figs. 3 and 15.

In the rear of the standard 5 are two shafts 45 46, having a common middle bearing 47 and end bearings 48. The shafts 45 46 are connected by arms 49 to bails 50 and 51, respectively, which bails rest on top of the weighted slides 26. When a lower-case key is struck, the bail 50 will be raised and the shaft 45 rocked, and when an upper-case key is depressed the bail 51 will be raised and will carry with it the bail 50, the latter bail having a portion 52 which laps over the end of the former, Fig. 15. Upon the escape-shaft G^2 adjacent to the head 33 is a pinion 53, which meshes with a gear 54 upon a stud supported by the standard g^2, Figs. 2 and 15. The gear 54 carries a pair of levers 55, pivoted to it at diametrically opposite points. In the path of these levers is an interponent arm 56, having a pin 57, which engages the leg 39 when the arm 56 is moved rearward. The gear 54 has twice as many teeth as the pinion 53.

When a lower-case key is struck, the shaft 45 is rocked and an arm 58 on said shaft, through link 59, lever 60, and pawl 61, raises the leg 39 and arm 37. The leg 39 rests on the ledge 41, while the escape-pawl 34, released from the cam 36, engages the ratchet-wheel 35 of the running shaft and carries the escape-shaft G^2 around a single revolution. During this revolution the gear 54 is turned a half of a revolution, the lever 55 strikes the intermediate 57, which throws the leg 39 off the ledge 41 and permits the arm 37 to drop. Toward the end of the revolution of the escape-shaft the tail end of the pawl 34 rides up on the cam 36 and the forward end of the pawl is withdrawn from the ratchet-wheel. Immediately thereafter the arm 43 strikes the stop 44 and the escape-shaft comes to rest, having made a single complete revolution. It is necessary that the escape-shaft should make two revolutions each time an upper-case key is depressed, for reasons hereinafter stated. When an upper-case key is struck, the shafts 46 and 45 are both rocked and the escape-pawl 34 is released, as just described. At the same time an arm 62 on shaft 46, through link 63, lever 64, and pawl 65, raises the forward end of the lower lever 55 and prevents it from striking the interponent 56. The leg 39 therefore rests on the ledge 41 until the upper lever 55 strikes the interponent, and the escape-shaft is therefore permitted to make two revolutions. Upon the stud which carries the gear 54 is a small fixed cam 66, which moves the levers 55 out into their normal position after they have been pushed in by the pawl 65.

As previously stated, the type are ejected from the magazine onto a typeway 32. Adjacent to this way is a shaft 67, Figs. 2, 3, and 4, mounted in bearings 68, which shaft carries a curved spring-blade 69, the rear edge of which is adapted to fit in the forward nicks of the ejected types. The shaft 67 is rocked each time a type is ejected, so as to raise the blade as the type comes forward and then to lower the blade to engage the type. This rocking movement is imparted from the escape-shaft g^2 through arm 70, Figs. 1, 2, and 3, link 71, arm 72, rock-shaft 73, and arm 74, bearing upon cam 75 on said escape-shaft. A spring 76 presses the arm 72 upward and normally holds the blade 69 in engagement with the type on the runway 32.

Below the runway 32 are two rails 77 78, the former being slightly in front and the latter slightly in the rear of said runway. A pair of type-carriers 79 80 ride on top of the rails. These carriers consist of yokes, which are pivoted to a connecting-rod 81 and have arms embracing the typeway 32. These arms are free to move up and down. They are provided with projecting pins 82, which rest upon a vertically-moving blade 83. When the type-carriers are moved rearward or to the right, the blade 83 is lowered and the arms drop into the position shown in Fig. 5, in which position they do not interfere with type on the runway. As the carriers are moved forward or to the left the blade is raised and the arms of the carriers rise above the runway and carry any type which may have been ejected to the place of assemblage to the left of the magazine. As shown, the carriers 79 80 are connected by a rod 81, which is preferably a hollow tube. This rod is connected by a stud 85 to a band 86, which is attached to a pulley 87 and passes over an idle-pulley 88. In order to give the carriers sufficient movement, the band is carried twice around the pulley and is attached to it at a point which never tends to run off. The pulley 87, which is mounted on a shaft 89, is rotated back and forth by a pinion 90, rack 91, connecting-rod 92, and crank 93 upon the escape-shaft G^2, Figs. 2, 3, and 4.

The blade 83 is guided in a slot in the upper edge of rail 77. At each end it is formed with an inclined slot 94, through which passes a fixed pin 95, and the blade consequently rises and falls as it is reciprocated lengthwise. The blade is reciprocated at proper times by means of an arm 96, engaging a pin 97, Figs. 2 and 3, a rock-shaft 98, and an arm 99, which engages a cam 100 upon the escape-shaft G^2.

The type are assembled in a line upon a plate 101, Figs. 2 and 6, at the left of the magazine and in line with the typeway 32. As the carriers 79 and 80 move rapidly, it is desirable that they should only have to carry one type at a time and should not be com-

pelled to move the assembled line forward each time a type is added to it. A supplementary carrier 102 is therefore provided to receive the type after it is left by the carrier 79 and move it into the line, at the same time moving all of the previously-assembled type to the left. This carrier 102 is somewhat similar in form to the carriers 79 and 80. As shown in Figs. 2, 3, and 4, it consists of a pair of arms, which embrace the typeway 32, said arms being united to a cross-bar 103, which runs in grooves 104 in the rails 77 78, Fig. 4.

The upper end of one of the arms carries a pin 105, which runs in a cam-groove 106 on the face of the typeway 32, the effect of which groove is to draw the arms of the carrier down as they are moved to the right and to force them up as they are moved to the left. The cross-bar 103 is engaged by the forked upper end of a lever 107, the lower end of which is connected to a crank-piece 108 by a link 109. The crank 108, Figs. 2 and 3, is mounted on a shaft 110, the opposite end of which shaft has an arm 111, which extends into the path of the crank-pin 112 of crank 93 on the end of the escape-shaft. The shaft 110 is directly in line with the escape-shaft. It is necessary that the supplementary carrier 102 should move forward after the type-carrier 79 has delivered its type, and in order to accomplish this the shaft 110 is given a supplementary movement after the escape-shaft has come to rest. As shown, this is accomplished by providing the crank 108 with a weighted arm 113. When the escape-shaft comes to rest, the parts connected to shaft 110 are in position shown in dotted lines in Fig. 2, the carrier 102 being at the right. The inertia of arm 113, however, carries the shaft 110 forward, and the carrier 102 is thus moved forward in the position shown in full lines in Fig. 2. This movement is also aided by a spring 114, Fig. 2, and, if desired, the weighted arm may be dispensed with and the same object accomplished by means of the spring, in which case the crank 108 should be moved beyond the dead-center before escape-shaft comes to rest.

In the left-hand channel of the lower-case magazine are the spaces S, by means of which the words are temporarily separated. These spaces are longer than the type and when assembled in the line they project beyond the ends of the type in both directions. They are ejected from the magazine and assembled in the line in the same manner as the type, the space-key 115 being connected to one of the key-levers 24, as shown in Figs. 6 and 10.

The assembling mechanism thus far described constitutes a machine which will assemble lines of type provided with temporary spaces ready for justification, and these lines may be justified in various ways, and the particular justifying mechanism hereinafter described might be used in connection with different assembling mechanism. In other words, the assembling mechanism and the justifying mechanism are in a great measure independent machines, although in the present instance they have been arranged to cooperate and to be driven from the same source of power.

The operation of the assembling mechanism is as follows: On touching a lower-case key a corresponding weighted slide 26 will rise, carrying with it the push-rod 28, which rod will remain latched upon the seat 31. The rod 28 will raise the rear end 13 of the ejector 6 into the path of the universal bar 9. While these operations are taking place the shaft 45 is rocked, the leg 39 raised, and the clutch G′ operated to set in motion the movement-shaft G^2. As this shaft revolves, the universal bar 9 moves forward, carrying with it the type-ejector, and the selected type is moved onto the way 32. The bar 9 then moves backward, carrying with it the ejector-bar, and the rear end of the ejector-bar moves the push-rod off of its seat, permitting it to drop, the universal bar, the ejector, and the push-rod coming to rest in their normal positions. (Shown in Fig. 5.) As the type is being ejected the spring guide-blade 69 is raised and then lowered, so as to engage the forward nick in the type. This blade serves to guide the type as it is moved along the ways by the carriers. The carriers 79 80, which were moved to the right while the type was being ejected, are now raised and moved to the left, and the type is carried into the field of movement of the supplementary carrier 102. This supplementary carrier then rises and moves the type, together with the preceding types of the line, to the left into position to be taken by the justifier. When an upper-case type is selected, the above operations take place and an additional revolution is given to the movement-shaft, whereby the ejected type is first moved by the carrier 80 to the middle of the magazine, and then moved by the carrier 79 to the left and carried into the line in the same manner as the spaces and lower-case type are carried in. When a single upper-case type is selected, there should be a slight delay before striking the next key, just enough to enable the movement-shaft to make two revolutions, but when a number of upper-case type are to be selected consecutively there need be no delay in operating the keys and a type can be selected at each revolution of the shaft.

The Justifying Mechanism.

This mechanism is situated at the left of the assembling mechanism. As the types are moved onto the assemblage-platform 101 their forward nicks are engaged by the flange of an elongated transfer-hook 116, said flange bearing upon the type with sufficient friction to prevent them from being disarranged by the movements of the carrier 102, Figs. 2 and 6. When the proper amount of type has been assembled for a line, the line-key 117 is depressed, and by means of arm 118 upon

the key-lever, link 119, and lever 120 a rod 121 draws back the transfer-hook 116 and transfers the type onto ways 122 123, which extend from the magazine to the left end of the machine, at which point they are supported by a standard 124, Figs. 1, 2, and 6. The type are retained and guided on ways 122 123 by an elongated retaining-hook 280. While upon these ways the line is measured for justification, a gage is set to determine the width of the justifying-spaces, the spaces are cut from the strip of space-timber, the temporary steel spaces are removed from the line and the newly-cut spaces are inserted in their stead, and, finally, after all of the justifying-spaces have been inserted, the line is moved along the ways to the left end of the machine and transferred to the galley. The mechanism for performing these operations, which is entirely automatic, will now be described.

The space-timber 125, Figs. 8, 11, and 12, slides lengthwise in a cutting-block 126, which is supported in a heavy bracket or standard 127. This space-timber is free to move in the cutting-block, except when clamped, and it is propelled to the right by means of a weight 128 and cord 129, Fig. 8. While a space is being cut from the end of the timber the latter is clamped tightly in the cutting-block by means of an elbow-lever 130, one arm of which is adapted to bear on the timber, while the other and longer arm is connected to a weighted rod 131. At proper times the rod 131 is raised and the released timber moves over against the gage 132, and while in this position a cutter descends and severs a justifying-space from the end of the timber. The gage 132 slides upon a bar or support 133, one end of which is connected to the standard 127 and the other end supported by a projection 134 on the standard 5, Figs. 8, 11, and 12. The gage is normally drawn to the left by a spring 135.

At the beginning of each line the gage is set to regulate the cutting of the spaces of the line by the following mechanism: To pin 136 upon the gage, Fig. 12, is connected a lever 137, which lever draws the gage back a proper distance when fulcrumed upon one or other of a series of sliding rods $x\ y\ z\ u$, the particular fulcrum for each line being set from the space-key 115 by intermediate mechanism to be presently described. The forward end of the lever 137 bears against a knife-edged projection 138 upon a compacting-head 139, which slides between the ways 122 123 and has a flange which is guided in a groove in the way 123, Figs. 6 and 11. The compacting-head 139 is periodically drawn to the left to compact and measure the line by a cord 140, passing over pulley 141 and connected to a spring 142, which spring is connected to one end of the lever 143, Figs. 6, 9, 10, and 11, the opposite end of said lever carrying a roll 144, which bears on a cam 145 on the movement-shaft F.

Above the compacting-head 139 is a measuring-head 146, which rides upon the ways 122 and 123 and is connected to a slide 146^a between said ways, the slide 146^a having a flange which runs in a groove in the way 123, Figs. 1, 6, 7, 11, and 12. Measuring-head 146 is normally drawn backward or to the right by a cord 147, passing around pulleys 148 149 and loosely through a weight 150, the cord having a button 151 on its lower end by means of which it is drawn down when the weight descends. The measuring-head is drawn forward or to the left to move the line by means of a cord 152, passing over a pulley 153 and connected to a weight 154, Figs. 9, 10, 11, and 12.

The line is measured between the measuring-head 146 and a pair of stops 155, Figs. 9 and 12, carried by a yoke 156, which embraces the ways 122 123, said yoke being supported upon a vertically-moving slide 157, which has a roll 158 at its lower end riding upon a cam 159 upon the shaft F. The blades of the yoke 156 are set into the runways 122 123, and the stops 155 when elevated intercept the ends of the type.

The fulcrum-bars slide in guides 278 279, and they are selected by the following mechanism: Referring to Figs. 1, 6, 9, and 12, a rock-shaft 160 is connected to the space-key 115 by an arm 161, and to a second arm 162 upon the rock-shaft is connected a pawl 163, which moves a ratchet-bar 164, sliding in guides upon the base-plate A. The pawl 163 moves the rack forward one tooth each time the space-key is touched, and it is held by a retaining-pawl 165. When released, the ratchet-bar 164 is returned to its forward or normal position by a pinion 166, which meshes with a rack 167 upon the edge of the ratchet-bar, the pinion being operated by a coiled spring 168, Fig. 6. In the rear of and in line with the ratchet-bar 164 is a slide 169, mounted in a guide 170, which is carried by the vertically-moving slide 157. The guide 170 carries a pinion 171, which meshes with the rack 172 and a spring 173 to turn the pinion and throw the slide forward. To prevent it from moving forward, a holding-pawl 174 drops into notches 175. At the rear end of the slide 169 is an interponent 176, which is adapted to move up one or other of the fulcrum-bars $x\ y\ z\ u$ when the slide is raised.

The operation of setting one of the fulcrum-bars is as follows: The lower ends of the fulcrum-bars are spaced the same as the teeth of the ratchet 164. Each time the space-key is depressed the ratchet is moved rearward, and the slide 169, which normally rests against the ratchet, is also moved rearward, causing the interponent 176 to stand under the next fulcrum-bar to the rear. Thus if there is one space in the line the interponent will stand under the bar x; if two spaces, it will stand under the bar y, &c. When a line is finished, the line-key is depressed and the movement-shaft F makes a revolution, as

will be explained presently. When the shaft is started, the slide 157 immediately rises. After a slight movement of slide 157 the pawl 174, which normally rests on a fixed pin 177, will drop into one of the notches in the slide 169 and prevent it from moving. As the slide 157 continues to rise, a pin 178, carried by the guide 170, raises the holding-pawl 165, and a pin 179 on said holding-pawl raises the feed-pawl 163, thus releasing the ratchet 164 and permitting it to move forward to its normal position. The slide 157 moves upward until the interponent 176 raises the upper end of the selected fulcrum-bar into the plane of the justifying-lever 137.

Immediately after a fulcrum-bar is raised the gage 132 is set to regulate the width of spaces for the line, as will be presently explained. When set, the gage is locked and held immovable until all of the spaces for the line to be justified have been cut. As shown, the locking devices consist of a pair of wedges 180 181, Figs. 6, 8, 9, 11, and 12. These wedges slide in a vertical plate or housing 182, attached to the frame-piece 133, and they are provided with pins 183, which project rearwardly through slots 184 in plate 182. The wedges 181 182 engage a projection 185 upon the gage when they are lowered and lock it firmly against movement in either direction. Normally the wedges are held in an elevated position by a slide 186, connected to a lever 187, Figs. 6, 8, and 9, the opposite end of the lever being connected to a rod 188, which passes down through a perforation in weight 150 and is provided with a head 189 below the weight. When the weight is lowered, the wedges are raised, and when the weight is raised the wedges fall by gravity. As shown in Fig. 8, the pins 183 are arranged so that the wedge 180 will first take effect on the projection 185. If the wedge 181 were to take effect first, it would tend to throw the gage backward; but the other wedge is prevented from moving the gage by the knife-edge on the compacting-head, which holds the forward end of the lever 137.

To the weight 150 is connected a cord 190, which passes over a sheave 191, loose upon the shaft F. Fixed upon the shaft adjacent to the sheave is an arm 192, Figs. 6 and 13, said arm carrying a pawl 193, which is held by a spring 194^a in such position that it will engage a projection 195 on the sheave 191 and raise the weight 150 when the shaft F is rotated. When the weight is raised sufficiently, a retaining pawl or lever 196 drops in behind a projection 197 on the sheave, and simultaneously the tail of pawl 193 strikes a projection 194 on the bearing of shaft E, which throws the forward end of the pawl out of engagement with the projection 195 and permits the shaft F to complete its revolution without raising the weight farther. The opposite end of the lever 196 is in the path of weight 154, Figs. 10 and 13. As heretofore explained, the shaft F is engaged with the constantly-running gear f^3 each time the line-key is depressed. In a slot in the end of shaft F is a pawl 198, and a spring 199 normally tends to press one end of the pawl into engagement with a ratchet-wheel 200 upon the constantly-running gear f^3. The pawl 198 is normally held away from the ratchet 200 by a lever 201, pivoted to the bearing f, said lever having a cam or wedge surface 202 on its free end. The lever is raised to liberate the pawl by a connecting-link 203, attached to the rear end 204 of the line-key lever. When the line-key is depressed, the lever 201 is raised, the pawl 198 springs into engagement with the running ratchet-wheel 200, and the shaft F is carried through a single revolution, at the end of which the pawl 198 is thrown out of engagement with the ratchet-wheel by the cam on the end of lever 201.

The operation of measuring the line and setting the gage to produce justifying-spaces for the line is as follows: When sufficient matter has been assembled on the way 101, the line-key 117 is depressed and the assembled line is drawn onto the ways 122 123 to the left of the measuring-head 146. At the same time the shaft F is set in motion by the clutch F′ and it begins to make a revolution. The shaft runs slower than the driving-shaft, due to the difference in the gears e^3 f^3. As the shaft revolves, the slide 157 rises, carrying up the abutments 155, against which the line is compacted. At the same time the slide 157 raises the interponent 176 and the previously-selected fulcrum-bar. The compacting-lever 143 is then operated, drawing down the cord 140 and drawing the compacting-slide 139 and the measuring-head 146 to the left, thus compressing the assembled line between the abutments 155 and the measuring-head 146, as shown in Fig. 12. At the same time the knife-edge 138 draws the forward end of the justifying-lever to the left, and the lever being fulcrumed on the raised rod its rear end draws the gage 132 to the right. As the compacting-lever 143 reaches its lowest position a pin 205 on said lever strikes the tail of a pawl 206, throwing its forward end out of a notch 207 in the rod 188, thus permitting the sliding wedges to fall and lock the gage 132 in the position in which it has been set by the justifying-lever. While the gage remains locked the justifying-spaces are severed from the space-timber and inserted in the line in lieu of the temporary spaces, as will be hereinafter explained. After the gage is set and locked the abutments 155 are lowered out of the path of the line of type and the weight 154 draws the line to the left to the devices which insert the justifying-spaces. After the spaces are inserted the line is carried to the galley by weight 154, as will be explained later, and just before finishing its travel the said weight strikes the end of lever 196, releasing the sheave 191 and permitting weight 150 to fall. This latter weight through cord 147 draws back the measuring-head, and

through the rod 188 it raises the locking-wedges and releases the gage. The spring then returns the gage and justifying-lever to their initial positions. The weight 154 is raised by the weight 150, which is heavier. Before completing its revolution the shaft F again raises the weight 150, and the latter remains elevated until the next line is assembled.

The lines of type as originally assembled usually lack more or less of the measure of the column, which amount has to be added by increasing the width of the justifying-spaces over the width of the temporary spaces. When the line is compacted between the head 146 and the abutments 155, the forward end of the justifying-lever is moved an amount equal to the deficiency in the line. If the line had but one space, the deficiency would have to be supplied in that space, in which case the fulcrum-bar *x* at the middle of the lever would be raised and the rear end of the lever and the gage would move to the right an amount equal to the full deficiency. If there were two spaces in the line, the fulcrum-bar *y*, which is one-third the length of the lever from the pivot 136, would be raised and the gage would be moved one-half of the total deficiency. In like manner if there were three spaces the fulcrum-bar *z* would be raised and the gage would be moved one-third, and so on. In this manner the gage is set for each line, so that the spaces cut from the timber will exactly fill out the line to the measure of the column. The devices for cutting the spaces and inserting them in the line in lieu of the temporary spaces and for removing the temporary spaces and transferring the justified lines to the galley will now be described.

Space Cutting and Inserting Mechanism.

The devices for cutting and inserting the justifying-spaces are operated by the constantly-running shaft E, which is in line with the driving-shaft D. As shown in Figs. 6, 7, and 12, the space-cutting-off tool is an elongated toothed blade 208, attached to a slide 209, which moves vertically in ways formed in the standard 127. The toothed edge is inclined, so that each tooth cuts in deeper than the one below it, the last few teeth being designed to sever the space entirely from the strip of space-timber. The knife is driven continuously by a connecting-rod 210 and crank d^2 on driving-shaft D. As the line is moved to the left under the influence of weight 154 the projecting spaces encounter the prongs 211 of a constantly-vibrating push-back lever 212, which is pivoted at 213 and has a roll 214 bearing upon the cam 215 of shaft E, Figs. 7, 9, and 10. The prongs 211 move to the left and then push the space and the type in the rear of it to the right, thus parting the line under block 216, at which point the justifying-spaces are inserted. Upon the block 216 is supported a space-receiving magazine 217, having at its lower end a retaining-spring 217ª, Figs. 7, 11, and 14. Directly below and in line with the magazine 217 is an elevator 218, attached to slide 219. After a space has been pushed back by the prongs 211 into position over the elevator the elevator is raised by means of a pawl 220, attached to cam-lever 221, said cam-lever being pivoted to a depending post 222 and having a roll 223, which rests upon a cam 224. The pawl 220 usually plays up and down idly at the left of the elevator-slide, being guided by a pin 225, which enters a slot 226 in a horizontal slide 227. The forked end of a trigger-lever 228 engages a pin 229 on slide 227, and a light spring 230 normally draws the slide to the left and throws the upper end of the lever to the right, the lever being centrally pivoted, Figs. 7, 9, and 12. The upper end of the trigger-lever normally stands to the right of the left-hand position of the push-back prongs 211, and hence when the push-back prongs move to their left position the temporary space against them will move the trigger-lever to the left and throw the slide 227 to the right. This movement will bring the pawl 220 under a lug 231 of the elevator-slide 219. The lug 231 has a notch in which a projection 232 of the pawl engages, thus preventing the slide 227 from moving the pawl to the left until after it has raised and lowered the elevator.

The cam which operates the pawl 220 gives the pawl two movements, the first being sufficient to engage the projection with the notch in lug 231, and the second, which comes into operation after the space has been pushed back over the elevator, raises the elevator sufficiently to move the space into the magazine above spring-catch 217ª. Although the cutter is operating constantly, a space can be cut only when the space-timber is pushed forward, and this action only takes place when a temporary space operates the trigger-lever 228. To a depending post 233, Figs. 7 and 9, is pivoted a cam-lever 234, resting upon a cam 235 of shaft E. To the free end of the cam-lever is pivoted a slide or pawl 236, the upper end of which is guided by a pin 237 in a slot 238 at the left end of the slide 227. This pawl 236 normally plays idly up and down at the right of a shoulder 239 upon the lower end of the weighted clamp-rod 131. When the trigger-lever moves the slide to the right, this pawl operates to raise the weighted rod and release the space-timber, thus permitting it to move forward against the gage. This action takes place while the cutting-tool is raised, and immediately afterward the tool descends and cuts off a space. The parting of the line, the ejection of the temporary space, and the cutting of the new space are therefore controlled automatically by the temporary spaces, and only one justifying-space can be formed for each temporary space.

Sliding in the cutting-block opposite the newly-cut spaces is a yoke-shaped pusher

240, which pushes the newly-cut spaces into a curved channel 241, through which it is moved by an arm 242 on a vibrating lever 243 into the line, Figs. 7 and 9. The pusher 240 is operated by a lever 244, upon the upper end of which is a pin 245, which is struck by a cam-piece 246, carried by the knife-slide, lever 244 being moved as the slide reaches its lowest position and after the space has been severed from the bar. The arm 243 is moved by pinion 247, Figs. 7 and 13, rack 248, roll 249, and cam 250 on shaft E. The space is held in the guide-groove 241 by a spring-plate 251, and it is moved onto the ways 122 123 at the point where the line is parted—that is, under the block 216. The space-case 217 can be lifted out of the block 216 and exchanged for the space-case in the magazine when the former becomes filled and the latter empty.

After the last temporary space has been removed from a line the line is moved to the left under the influence of weight 154 until it is opposite the galley 252, Figs. 7, 8, 9, and 10. As the type moves to the position opposite the galley they travel under a friction-piece 253, carried by arms 254 255, pivoted, respectively, to standard 128 and a bracket 124^a, Figs. 1 and 10. Beneath these arms is a slide 256, which has racks on its lower surface and which is moved forward and back periodically by pinions 257 258 on a shaft 259. The pinion 258 is broad and it is engaged by a rack on slide 260, Figs. 8 and 10, which slide is operated by a link 261, lever 262, link 263, and crank 264 on the end of shaft F, Figs. 6 and 8. While a line is being assembled the preceding line is justified and brought opposite the galley, and when the line-key is next depressed the shaft F is rotated and the line is pushed into the galley by the slide 256. As this slide moves forward the plate 253 is raised to release the type by cams 265 upon the edges of the slide, Fig. 10. As the slide retreats the type in the galley are moved downward to make way for the next line by a plunger 266, Figs. 9 and 10, carried by side pieces 267 on the ends of arms 268 of a rock-shaft 269, which shaft is connected to the slide 256 by an arm 270 and link 271, Figs. 1 and 8. Above the galley is a lead-magazine 272, and as the lines of type are pushed to the galley a lead is fed with the line by the slide 256 if there are any leads in the magazine. If the magazine is not supplied with leads, the matter will be set solid.

The type are sustained in the galley by a T-shaped rest 273, which is carried by a bracket 274, attached to a friction-slide 275, which runs in a groove 276 at the side of the galley. As shown, the galley is provided with an adjustable side 277, which can be set for different column widths.

Operation of Justifying Mechanism.

The operation of the assembling mechanism, as heretofore described, results in assembling a line of type and temporary spaces under the transfer-hook 116, the lip of said hook resting in the forward nicks of the type. On depressing the line-key the type are drawn back until the rear nicks are engaged by the spring-hook 280, Figs. 1 and 6. These hooks serve as guides to the type, preserving their alinement, and also apply a slight frictional resistance which prevents the type from becoming separated in the line. The operation of the line-key sets in motion the movement-shaft F, which makes a single revolution and produces the following effects: The abutment-lugs 155 rise to intercept the line. The slide 157, which carries the abutment-lugs, also raises the interponent 176, which has been previously set from the space-key, and the interponent carries up the fulcrum-bar corresponding to the number of spaces in the line until the top of the bar is in the plane of the justifying-lever 137. The bar *y* is shown operative in Fig. 12. The arm 143 then descends, drawing down the cord 140 and compacting the line between the measuring-head 146 and the abutments 155. The amount that the line is short of the required measure is thus ascertained automatically, and this total amount is divided by the justifying-lever into halves, thirds, or quarters, as the case may be, depending upon the number of spaces in the line. While only four fulcrum-bars are shown in the drawings, it will be understood that in practice as many fulcrum-bars will be used as the maximum number of spaces likely to occur. The gage is so arranged in reference to the space-cutter that spaces of the normal size will be cut just equal to the temporary spaces if the line assembled should happen to be of the proper measure; but if the line is too short larger spaces will be cut, and if the line is too long hair-spaces or spaces smaller than the normal will be cut and substituted for the temporary spaces. It will be seen that this justifier will produce perfectly-justified lines regardless of the quality and kind of type used and that imperfections in the type, such as bends, burs, or adhering dirt, will not prevent perfect justification.

After the gage is set the lever 143 continues to move down, distending the spring 142, and at nearly the lowest point the pin 205 releases pawl 206, permitting the rod 188 to rise and the wedges 180 181 to fall by gravity, the wedge 180 taking effect first upon the gage projection 185 and locking the gage against backward movement and the wedge 181 taking effect immediately afterward and locking it against forward movement. During this time the space-timber is held by its clamp 130 and no spaces are cut. As soon as the gage is locked the abutments 155 are withdrawn from the line and the line is moved to the left by a cord 152 and weight 154.

The space cutting and inserting mechanism are constantly operating, being driven from the shafts D and E. The push-back or parting lever 212 intercepts each temporary space

in turn, permitting it to move to the left of the elevator and then pushing it back to the elevator. As it moves to the left it operates trigger 228, which throws the slide 227 to the right. The temporary space is then pushed back over the elevator and the elevator rises and forces it into the receiving-channel 217. While this is taking place the timber-clamp 130 is released, the timber moves forward, the cutter then severs a space from the end of the timber, the clamp holds the timber from further movement, the severed space is pushed into the path of the arm 243 and carried by said arm into the gap which is formed in the line to the left of lever 212. At this point the temporary space is forced out of the line and the weight 154 carries the line over until the next space is intercepted by the push-back lever. As each space comes along this cycle of operations takes place and the line is thus justified very rapidly. After the last temporary space has been removed from the line the weight 154 draws it to a position opposite the galley. As it reaches this position said weight strikes the end of lever 196, releasing sheave 191 and permitting the heavy weight 150 to fall. Through rod 188 and its connections this weight raises the gage-locking wedges, and through cord 147 it draws back the measuring-head 146 and raises the weight 154. During the first part of the succeeding movement of shaft F the weight 150 is raised by the sheave 191 and latched up by the lever 196.

It will be evident that various changes in the details of the above-described machine may be made without departing from the spirit of the invention and that equivalent devices within the scope of the invention may be substituted for many of those illustrated and described. Thus, for instance, springs may be substituted for some of the weights and a rotary cutter might be substituted for the longitudinally-moving cutting-off tool. Therefore, without limiting myself to the precise construction and arrangement of parts shown and described,

I claim—

1. In a composing-machine, the justifying device comprising a lever, a series of fulcra located at one-half, one-third, one-fourth, and other fractions of the full length of the lever from one of its ends, and means for rendering any one of said fulcra operative, depending upon the number of spaces in the line, substantially as described.

2. In a justifying device, the combination of a gage for determining the widths of justifying-spaces, a lever having one end operating on the gage, a device arranged to measure the line and to operate upon the other end of the lever, and means for applying different fulcra to said lever, depending upon the number of spaces in the line, substantially as described.

3. In a justifying device for composing-machines, a gage for determining the width of justifying-spaces, a device for measuring the line of matter, a justifying-lever having its ends operatively connected with said gage and said device respectively, a series of fulcra arranged at one-half, one-third, one-fourth, &c. of the length of the lever from its point of connection with the gage, and means for rendering any one of said fulcra operative, depending upon the number of spaces in the line, substantially as described.

4. In a justifying mechanism for type-setting machines, a movable device for measuring unjustified lines, a movable gage, intermediate mechanism by means of which the gage is set from the measuring device, and means for forming justifying-spaces and inserting them in the line, the width of said justifying-spaces being determined by the gage, substantially as described.

5. In a justifying mechanism for type-setting machines, a movable device for measuring unjustified lines, a movable gage, intermediate mechanism by means of which the gage is set from the measuring device, and a cutter adapted to sever justifying-spaces from suitable space-timber, the width of said justifying-spaces being determined by the gage, substantially as described.

6. In a justifying device for type-setting machines, the combination of a cutting-block, a cutter, a gage, means for automatically setting the gage relatively to the cutter for each line to be justified, and means for locking the gage while the justifying-spaces for the line are being cut, substantially as described.

7. In a justifying device for type-setting machines, the combination of a gage, wedges arranged to lock said gage immovable, and means for operating the wedges to lock and unlock the gage for each line, substantially as described.

8. In a justifying device for type-setting machines, the combination with the gage, the wedges to lock the gage, means for rendering one of said wedges operative in advance of the other, and means for releasing the wedges to unlock the gage, substantially as described.

9. In a justifying device for type-setting machines, the combination with the gage, of the wedges operating by gravity to lock the gage, means for lowering one of said wedges in advance of the other, and means for raising the wedges to unlock the gage, substantially as described.

10. In a justifying device for type-setting machines, the combination of a horizontally-sliding gage having a lateral projection, the vertically-sliding wedges adapted to engage said projection, the slide for elevating said wedges, and means for dropping said slide to permit the wedges to engage the lateral projection of the gage, substantially as described.

11. In a justifying mechanism for type-setting machines, the combination of means for feeding a strip of space-timber, a clamp normally holding said strip immovable, a cutter adapted to sever spaces from the strip, and

means for releasing the strip and moving it forward to the cutter at proper intervals, substantially as described.

12. In a justifying mechanism for composing-machines, the combination with a justifying-lever and a series of movable fulcra arranged as described and normally inoperative, of a space-key, an interponent, means for setting the interponent from the space-key to select a fulcrum, and means for rendering the selected fulcrum operative upon the lever, substantially as described.

13. In a justifying mechanism for composing-machines, the combination of a justifying-lever, a series of fulcrum-bars having ends adjacent to said lever and variably spaced and having their opposite ends uniformly spaced, a space-key, and devices controlled by the space-key for selecting the fulcrum-bars, substantially as described.

14. In a justifying mechanism for composing-machines, the combination with a justifying-lever movable horizontally, of a series of vertically-sliding fulcrum-bars having their upper ends adjacent to said lever and spaced as described and their lower ends uniformly spaced, an interponent upon a horizontal slide, a space-key and connections for setting the interponent beneath the lower ends of said bars, and a slide for raising the interponent to render a selected bar operative upon the lever, substantially as described.

15. The combination with means for assembling a line of type and temporary spaces, of automatic devices for compacting and measuring said line, mechanism for parting the line and removing the temporary spaces, a gage controlled by the measuring devices, and means for cutting justifying-spaces and inserting them in the parted line, substantially as described.

16. The combination with ways, of devices for measuring a line of type for justification consisting of an abutment movable in a plane transverse to the ways and arranged to be temporarily interposed in the path of said type, a sliding head movable in the direction of the ways and adapted to compact the type against said abutment, means for forcibly pressing the head against the line, and means for interposing the abutment before and for withdrawing the abutment after the line has been measured, substantially as described.

17. The combination with ways and means for transferring a line of type and temporary spaces to said ways, of a measuring-head sliding on said ways, an abutment adapted to be temporarily interposed in front of the line of type, and means connected to said head and arranged to draw the line of type toward a galley when the abutment is withdrawn, substantially as described.

18. In a type-justifying mechanism, the combination with ways and means for feeding a line of type and temporary spaces along said ways, of a vibrating device arranged to engage and push back each temporary space, thus parting the line, means for ejecting said space from the line, and means for inserting a justifying-space into the opening formed in the line, substantially as described.

19. In a type-justifying mechanism, the combination with the ways and means for feeding a line of type and temporary spaces along said ways, of an elevator or ejector for removing the temporary spaces, a device adapted to intercept the spaces and hold them opposite the elevator, and a trigger in the path of the temporary spaces adapted to render the elevator operative each time a space advances to it, substantially as described.

20. In a type-justifying mechanism, the combination with ways and means for feeding a line of type and elongated temporary spaces along said ways, of an elevator below the ways, a space-receiving channel above the elevator, a push-back or parting-lever arranged to intercept the temporary spaces and push them backward, thus parting the line, a trigger-lever adapted to be operated by a space in contact with the parting-lever as said lever moves forward, a constantly-moving pawl adjacent to the elevator and a connection between said pawl and the trigger-lever, whereby the pawl is rendered operative upon the elevator each time a space strikes the trigger, substantially as described.

21. In a type-justifying mechanism, the combination with ways and means for feeding a line of type and temporary spaces along said ways, a cutter, and means for feeding space-timber to the cutter, a clamp normally holding the space-timber stationary, a trigger in the path of the temporary spaces, and means for releasing the clamp each time a space strikes the trigger, substantially as described.

22. In a type-justifying mechanism, the combination with means for feeding a strip of space-timber, of a weighted clamp operating on said timber, and means for raising the weight and releasing the clamp at proper intervals, substantially as described.

23. In a type-justifying mechanism, the combination with ways and means for feeding a line of type and temporary spaces along said ways, of the push-back lever, the elevator, the space-timber clamp, the trigger-lever, and means controlled by the trigger-lever for operating the clamp and elevator, substantially as described.

24. In a type-setting machine, the ways in combination with the means for transferring a line of type laterally upon the ways consisting of the movable elongated hook 116 and the stationary spring-hook 280, substantially as described.

25. The combination with the line-key, and the ways of the elongated hook 116, connections between said key and said hook for operating the latter to draw back the line of

type, upon the ways and the retaining-hook 280 for holding said line, substantially as described.

26. The combination with ways and means for transferring a line of type along said ways to the galley, of the frictional guide-plate 253, the slide 256, and means for raising the guide-plate as the slide moves forward to transfer a line of type to the galley, substantially as described.

27. The combination with ways, of the frictional guide-plate 253 supported on pivoted arms, the slide 256, and the cams on said slide adapted to raise the arms and release the type from the guide-plate as the slide moves forward, substantially as described.

28. The combination with the galley, of the way opposite the galley, the slide for transferring lines of type laterally from the way to the galley, the depressing-plate 266 arranged to depress the type in said galley, and means for raising the depressing-plate as the slide moves forward and lowering said plate as the slide retreats, substantially as described.

29. In type-assembling mechanism, the combination with the type-ejectors, of the keys, the key-levers, the weighted slides resting upon the key-levers, and the push-rods for rendering the ejectors operative, said push-rods standing over the slides and normally resting upon a fixed support, substantially as described.

30. In type-assembling mechanism, the combination of the reciprocating universal bar, the type-ejectors adapted to be engaged with said bar, the push-rods for engaging the type-ejectors with the bar, and means for sustaining each push-rod in an elevated position while its corresponding ejector moves forward and returns, substantially as described.

31. In type-assembling mechanism, the combination with the universal bar, the type-ejectors adapted to engage said bar, the push-rods for elevating the type-ejectors into engagement with the bar, the shoulders on said push-rods, and the seat arranged to engage said shoulders when the push-rods are elevated, substantially as described.

32. In type-assembling mechanism, the combination with the magazine, having upper and lower case sections, ways upon which the type are delivered from the magazine, a pair of carriers reciprocating along said ways in front of the upper and lower case sections respectively, and means for lowering said carriers as they move backward and for raising them to engage type upon the ways as they move forward, substantially as described.

33. In type-assembling mechanism, the combination with the magazine and ways upon which the type are delivered from the magazine, of a carrier reciprocating along said ways, a vertically-movable bar upon which said carrier rests and means for holding the bar in its elevated position as the carrier moves forward and for depressing it as the carrier retreats, substantially as described.

34. The combination with the magazine, the ways upon which the type are delivered from the magazine, the carriers reciprocating along said ways, the escape-shaft and connections therefrom for moving the carriers, the packing-pawl also operated from said escape-shaft, and means for giving said pawl an additional movement after the escape-shaft comes to rest, substantially as described.

35. The combination with the magazine, the ways upon which the type are delivered from the magazine, and a pair of carriers movable along said ways in front of the magazine, the upper-case type being delivered primarily to one of said carriers and the lower-case type being delivered to the other, of means for giving the carriers a single reciprocation each time a lower-case type is selected and a double reciprocation each time an upper-case type is selected, substantially as described.

36. The combination with the magazine, the ways, and the pair of carriers reciprocating along the ways in front of the magazine, of the escape-shaft, the connections between said escape-shaft and the carriers, and means for giving the escape-shaft a single revolution for each lower-case type selected and two revolutions for each upper-case type selected, substantially as described.

37. The combination with the running ratchet-wheel 35, of the escape-shaft having pawl 34 and stop-arm 43, and the lever 37 having cam 36 and stop 44, substantially as described.

38. The combination with the running ratchet-wheel 35, of the escape-shaft, the clutch-pawl pivoted in the end of the shaft, the cam-lever 37, the leg 39 attached to said lever, the seat for said leg and the rotating pawls 55 adapted to throw the leg off of the seat, substantially as described.

39. The combination with the escape-shaft and means for engaging said shaft with a running shaft and normally permitting it to make a single revolution, of means brought into action by the upper-case keys whereby said escape-shaft is permitted to make two revolutions each time an upper-case key is depressed, substantially as described.

40. The combination with the escape-shaft and its clutch, of the gears 53, 54, the pawls 55 on said latter gear, the fixed cam 66, the stop-lever 37, the leg 39, the ledge upon which said leg rests when elevated, and the interponent arranged to be operated by said pawls and to throw the leg off of the ledge, substantially as described.

41. In a type-setting machine, the means for rapidly reciprocating a type-carrier consisting of a band to which the type-carrier is connected, pulleys upon which the band is mounted, an escape-shaft normally at rest, and connections between the escape-shaft and one of said pulleys, substantially as described.

42. The devices for rapidly reciprocating a carrier in type-composing machines consisting of a band or belt, a carrier attached to the belt, a driving-pulley to which the band is connected to prevent slip, an intermittently-running shaft, and a connection between the intermittently-running shaft and the drive-pulley arranged to turn said wheel backward and forward at each rotation of the shaft, substantially as described.

43. The devices for attaining a rapidly-reciprocating movement in type-composing machines consisting of a pair of pulleys, a band surrounding said pulleys and attached to one of them, a rack and pinion arranged to drive the pulley to which the band is connected, an escape-shaft, and a connection between the escape-shaft and the rack for reciprocating the latter, substantially as described.

44. The combination with the magazine and the ways upon which the type are delivered from the magazine, of a blade arranged above and parallel with the ways, and means for depressing the blade to engage and guide each type as it is ejected from the magazine, substantially as described.

45. The combination with the magazine and the ways upon which the type are delivered from the magazine, of a spring-depressed blade having its edge above and parallel with the ways, and means for raising the blade at the moment a type is ejected to permit the type to pass under and be engaged by the blade, substantially as described.

46. The combination with the magazine, the ways upon which type are delivered from the magazine and carriers for moving type along said ways to the place of assemblage, of a spring-depressed blade overhanging said ways, the edge of said blade being adapted to engage notches in the type to hold the type in proper position while they are being transferred by the carriers, substantially as described.

47. In a type-composing machine, the combination of ways, a push-head and weight for transferring a line of type along said ways to the galley, a counterweight, a movement-shaft for raising the counterweight, means for releasing the counterweight as the line of type reaches the galley and connections between the counterweight and the push-head whereby the latter is returned and its weight raised when the counterweight is released, substantially as described.

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

FRANK AMOS JOHNSON.

Witnesses:
CHARLES GREINER,
GEO. B. LINDEMAN.