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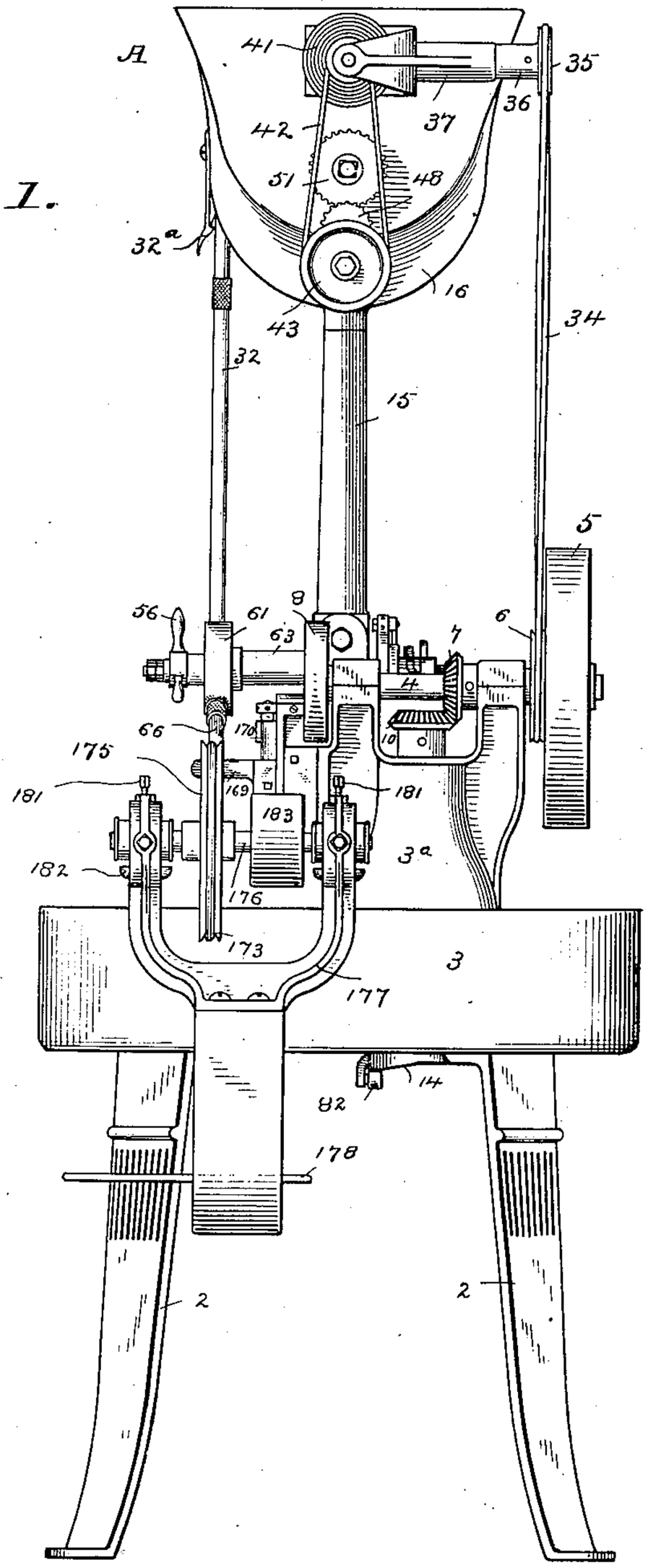
C. R. RICHARDS.

MACHINE FOR TRIMMING CARTRIDGE SHELLS.

No. 500,511. Patented June 27, 1893.

Fig. 1.



WITNESSES

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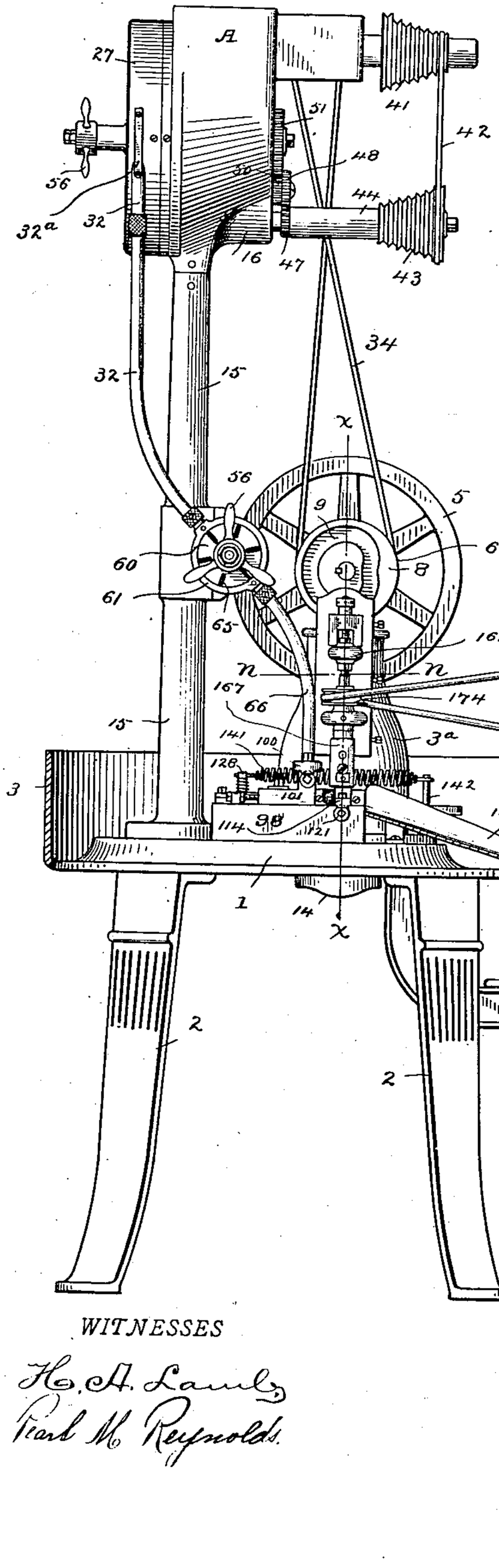

Fig. 2.

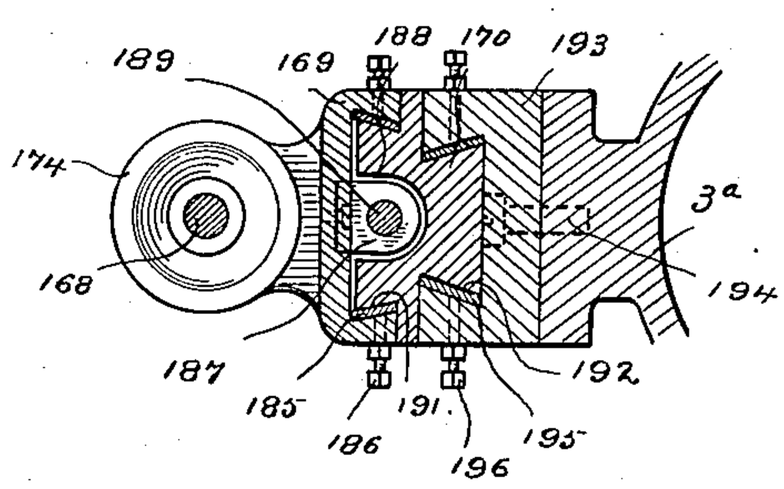

Fig. 2a.

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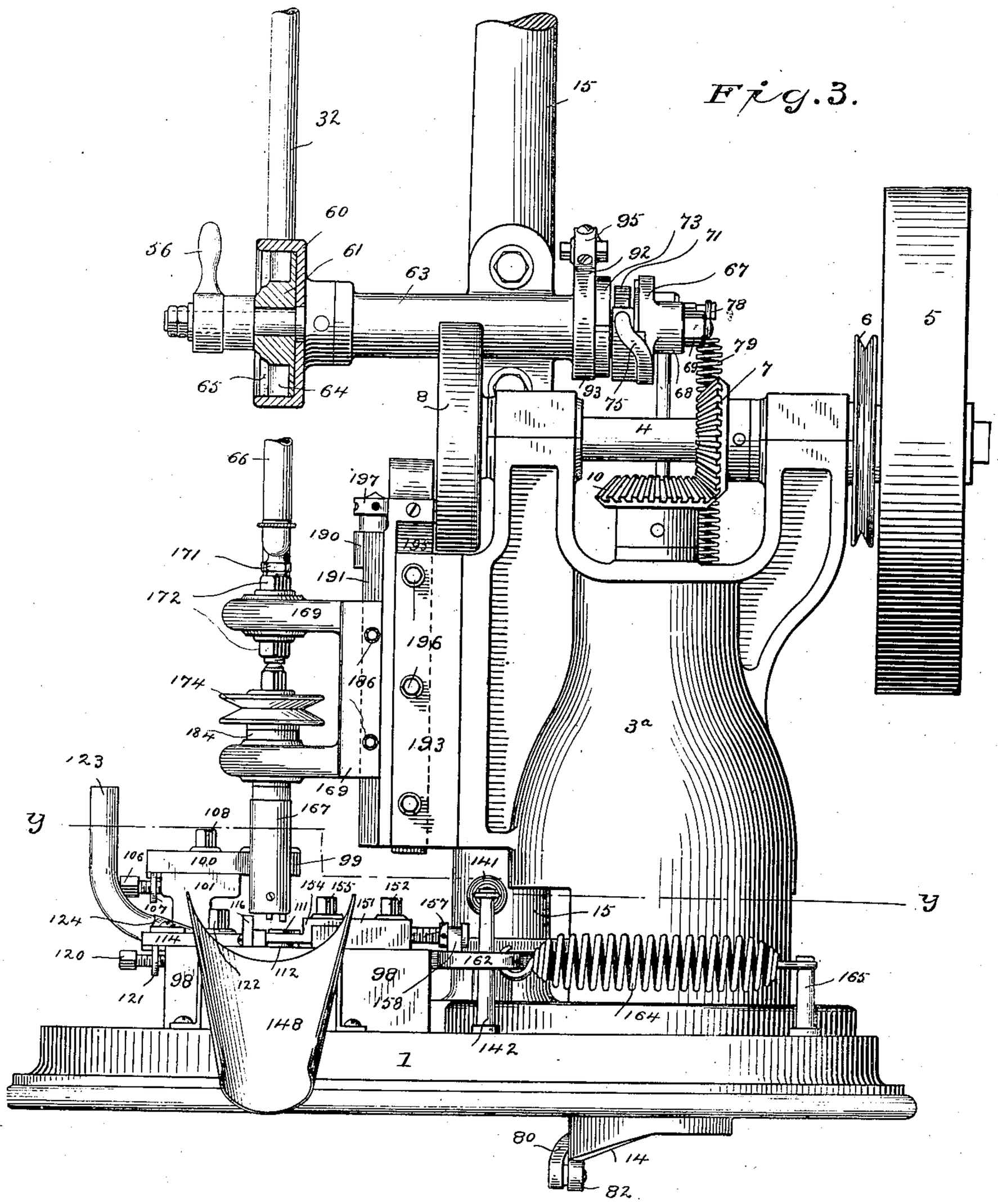
Fig. 3.



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MACHINE FOR TRIMMING CARTRIDGE SHELLS.

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Fig. 4.

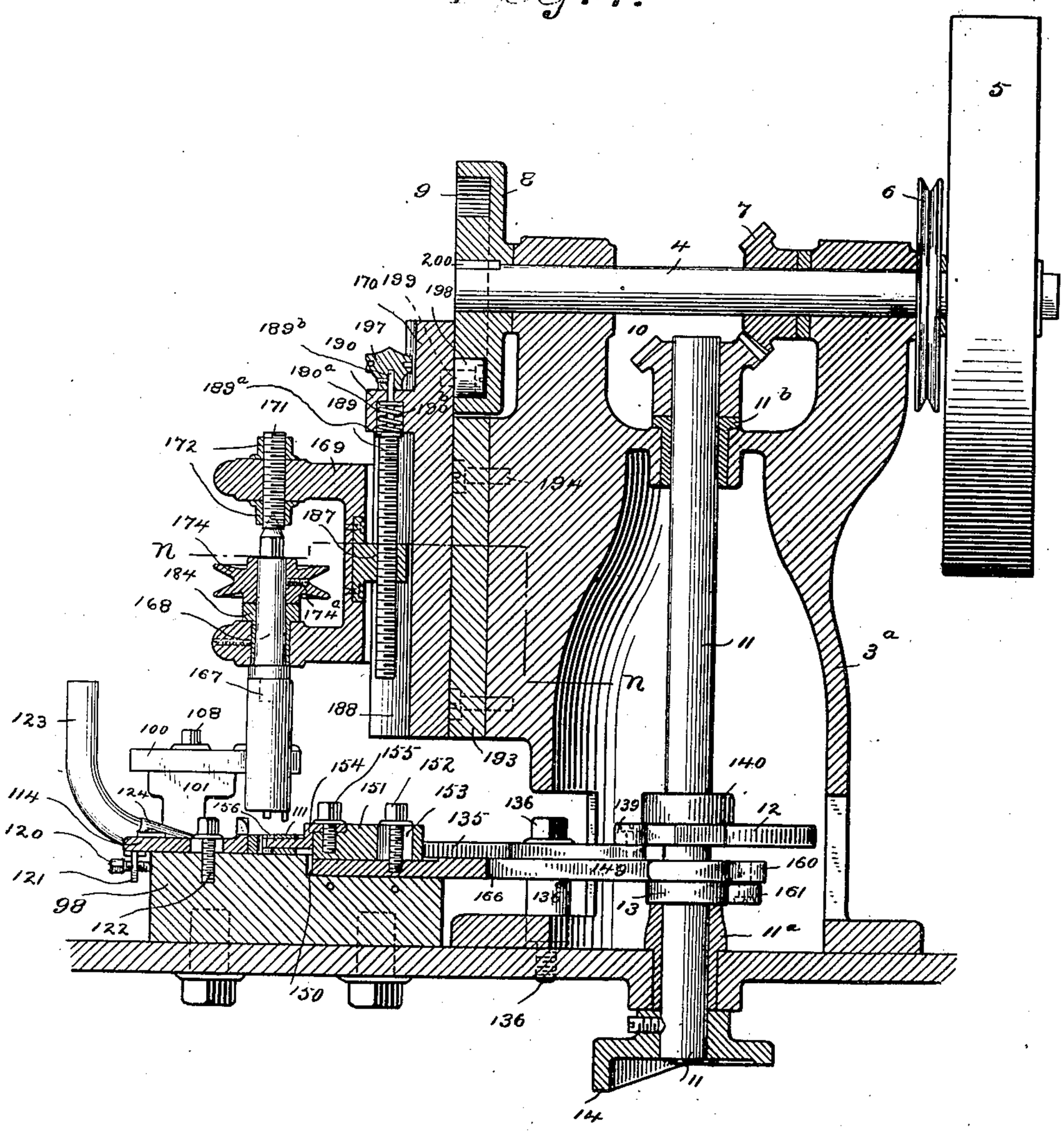

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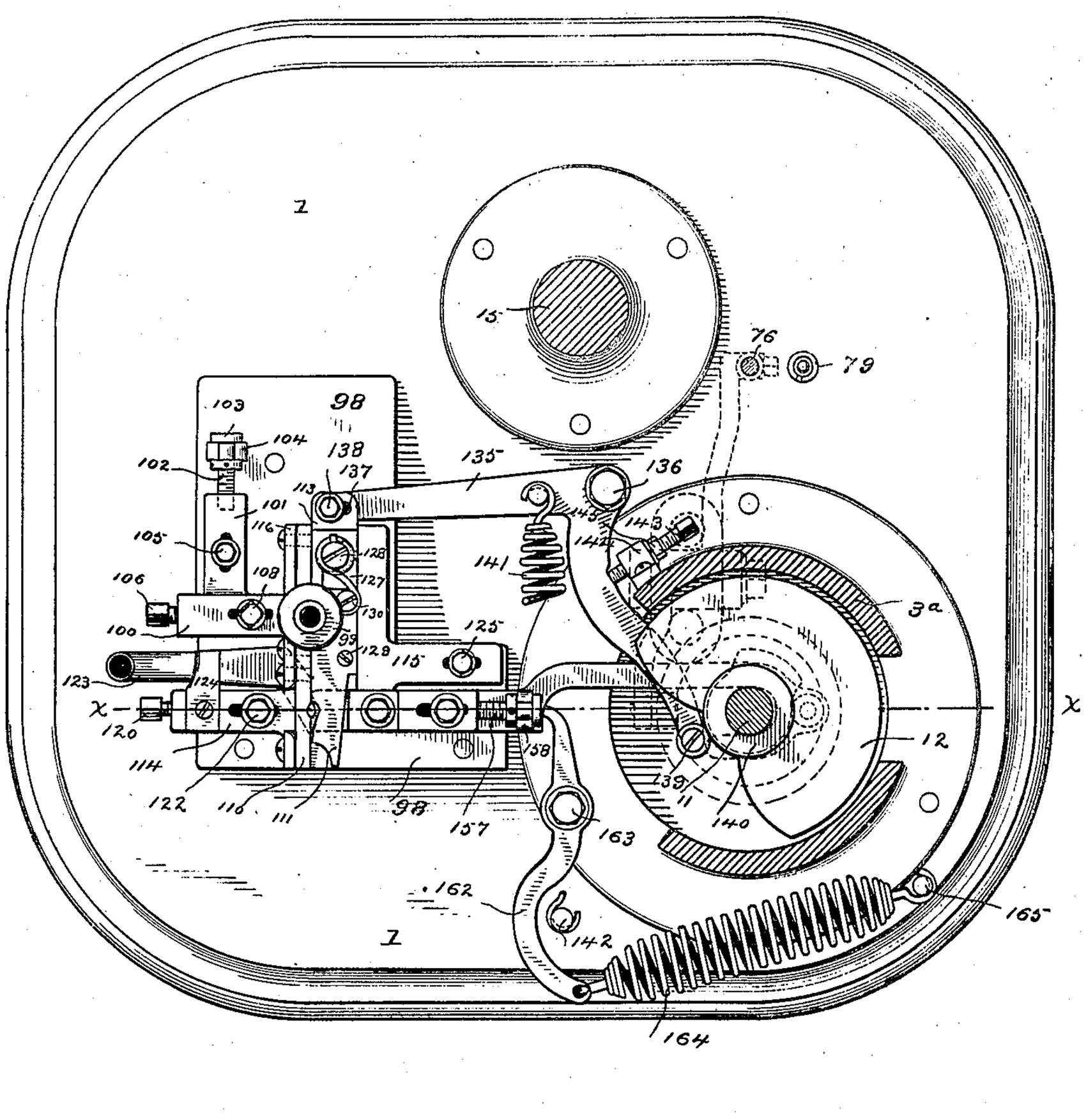
Fig. 5.



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MACHINE FOR TRIMMING CARTRIDGE SHELLS.

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Fig. 6.

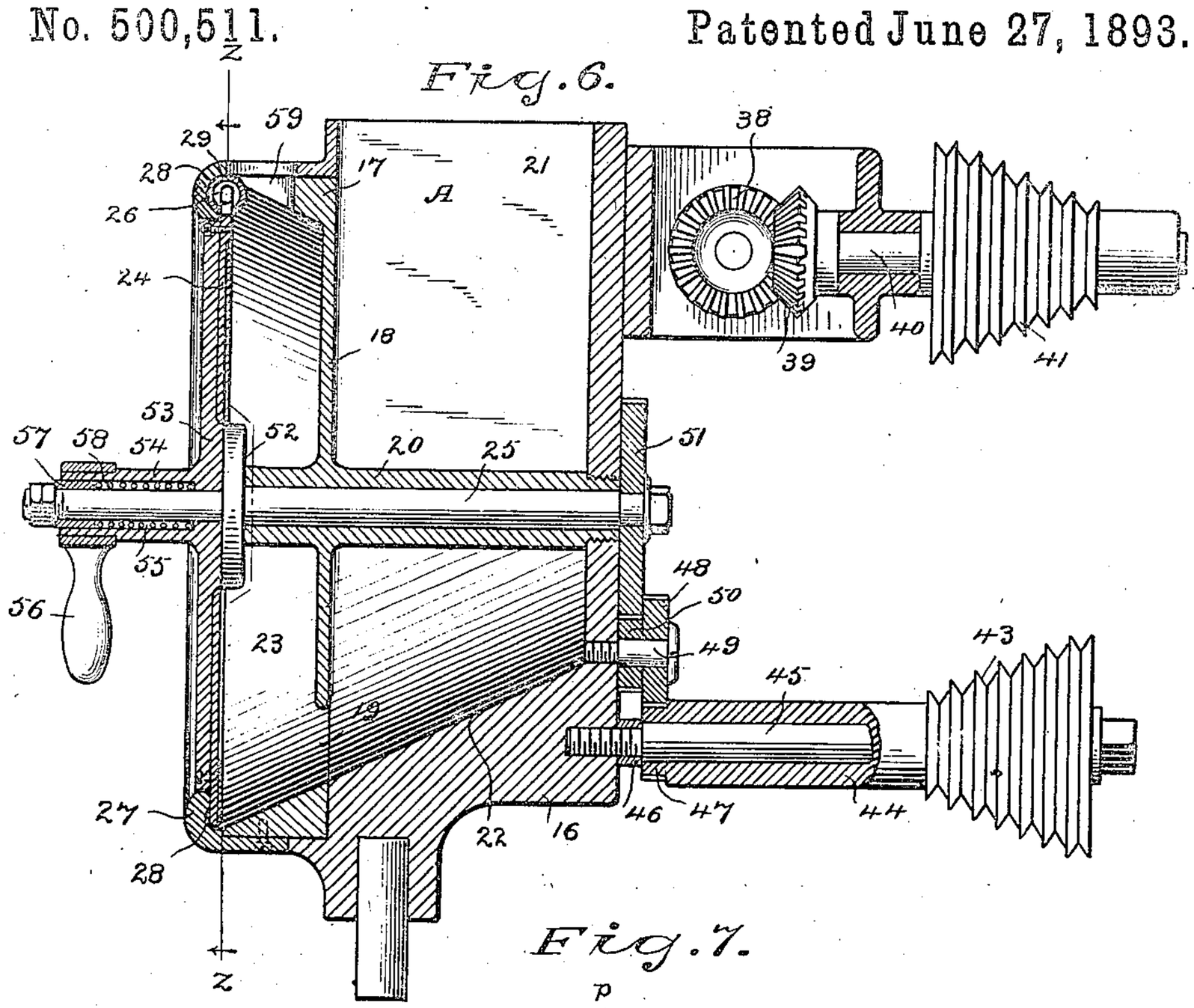
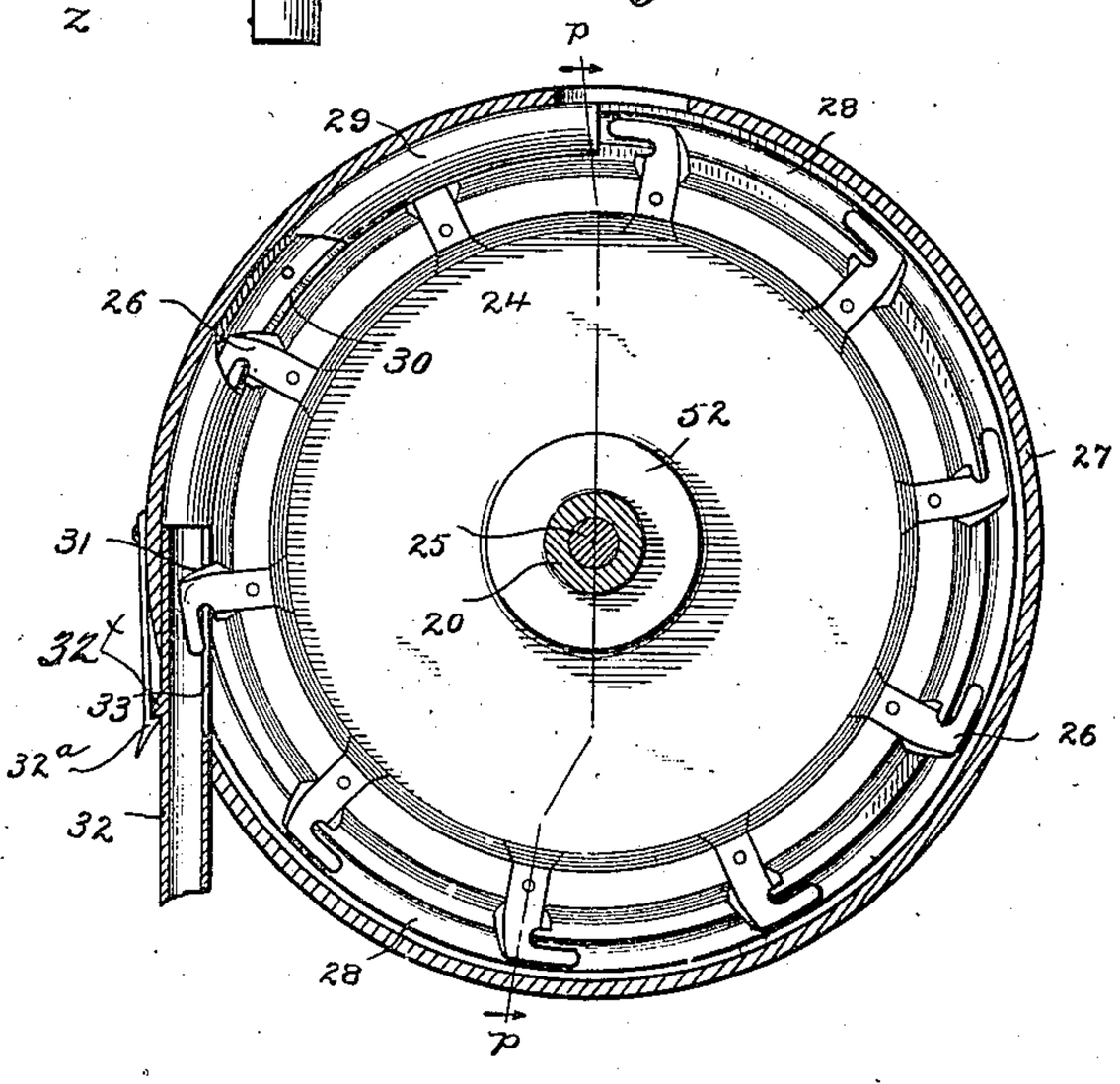


Fig. 7.



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MACHINE FOR TRIMMING CARTRIDGE SHELLS.

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Fig. 9.

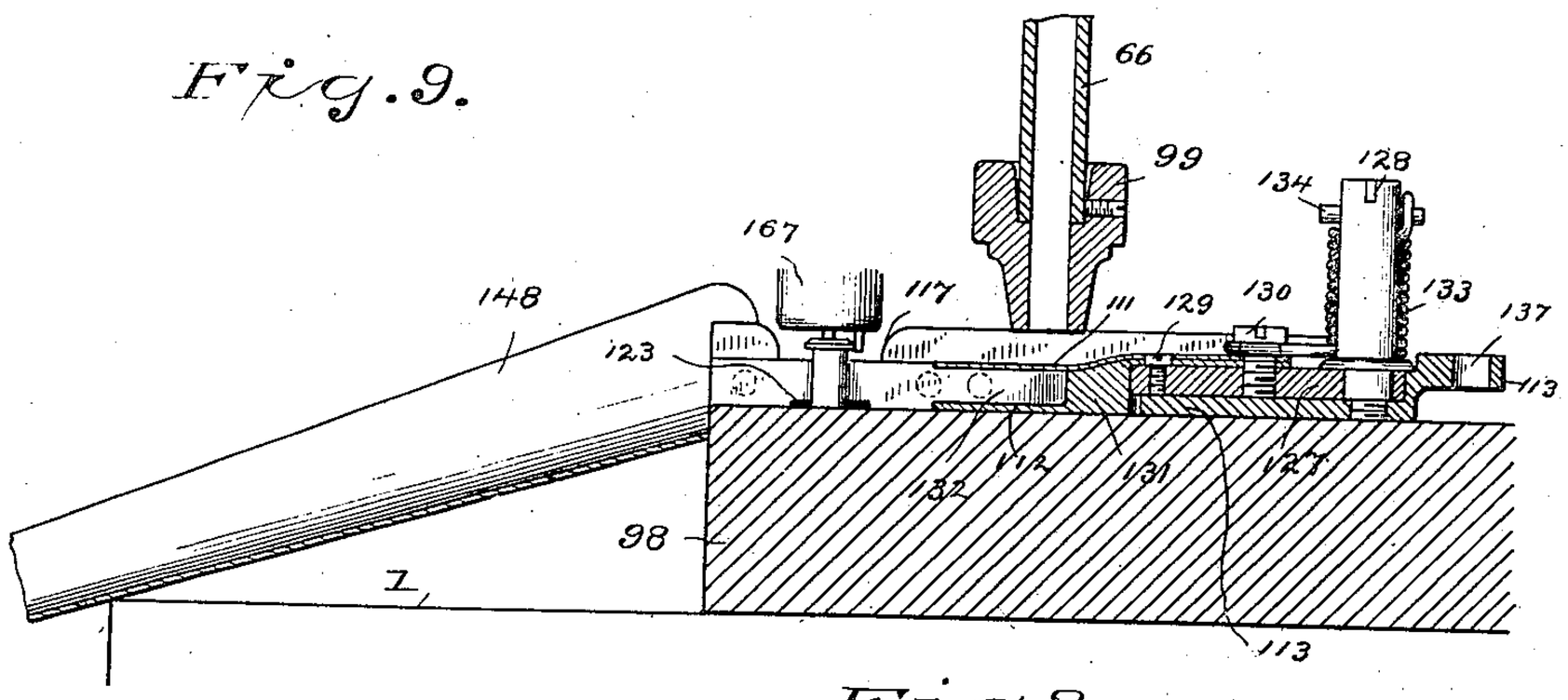

Fig. 8.

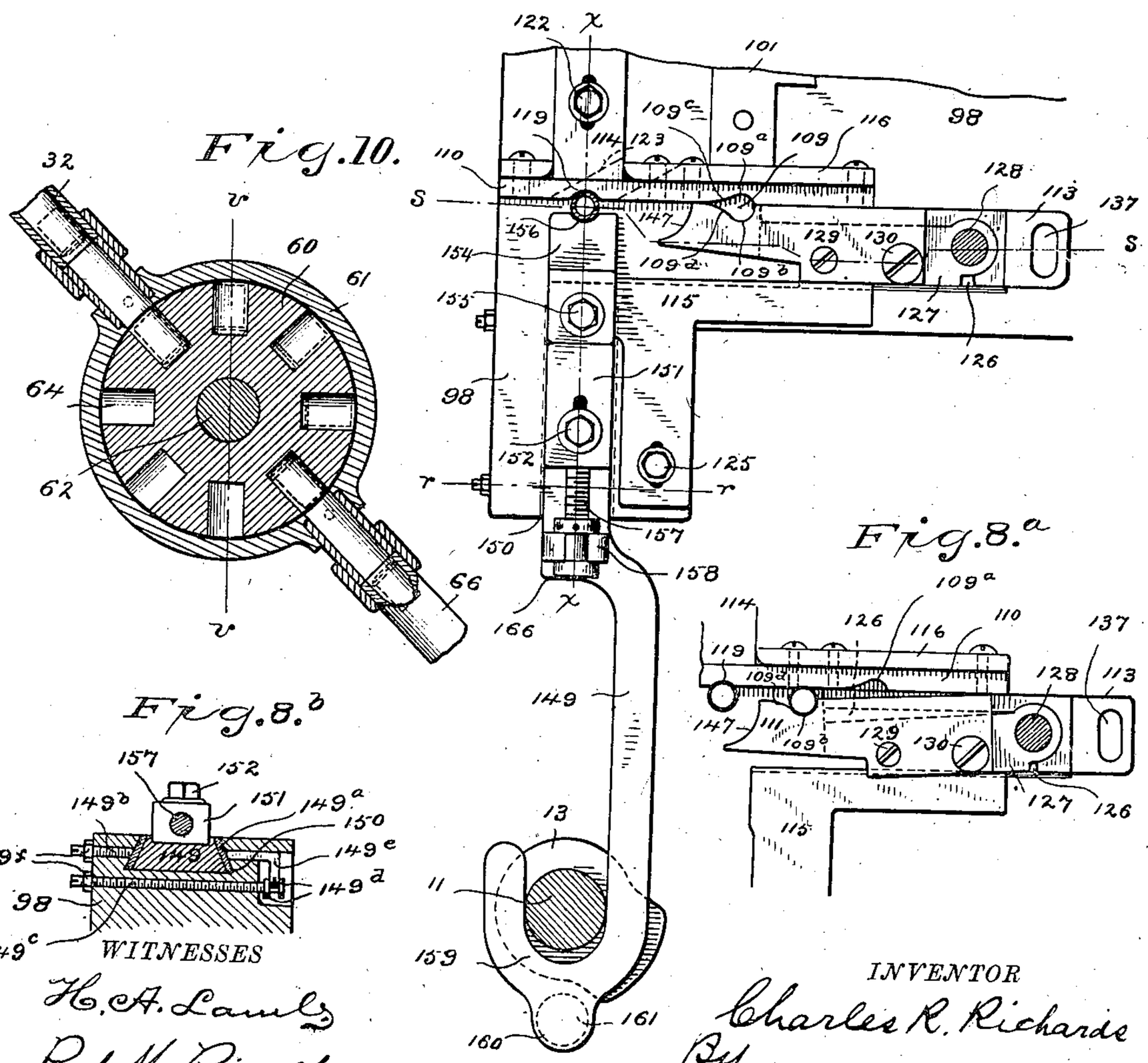

Fig. 10.

Fig. 8.b

Fig. 8.a

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Fig. 13.

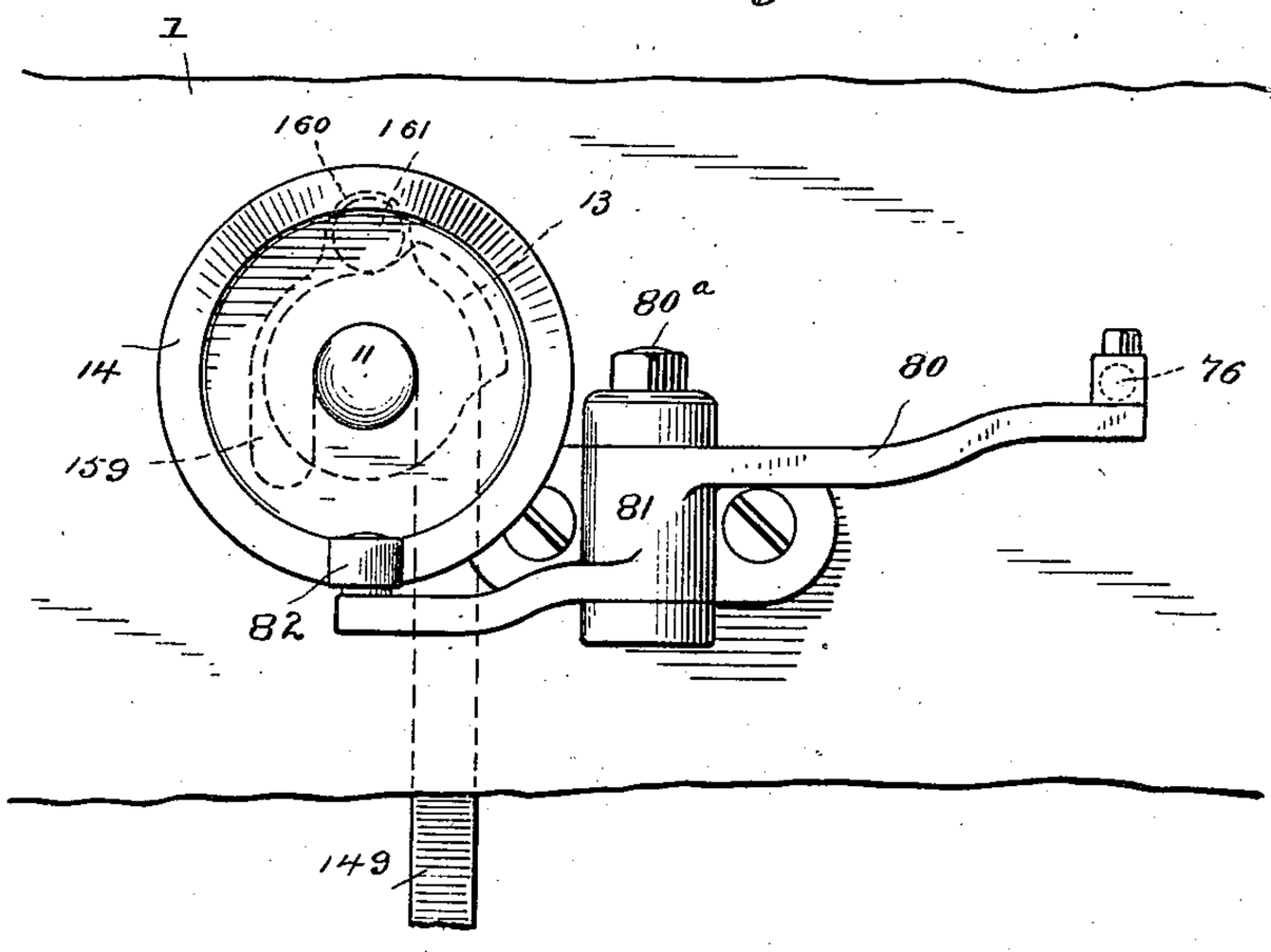


Fig. 11.

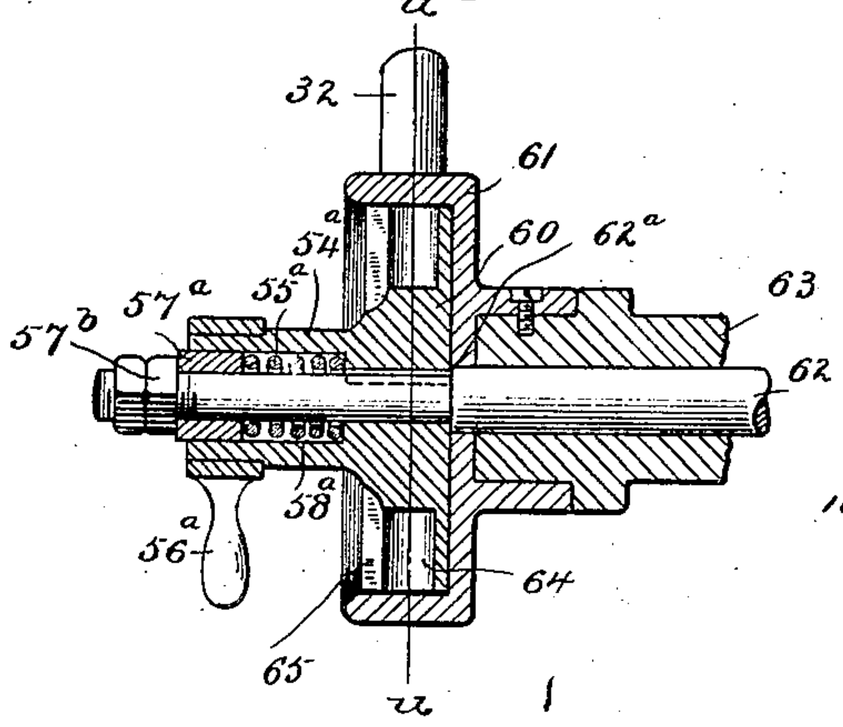
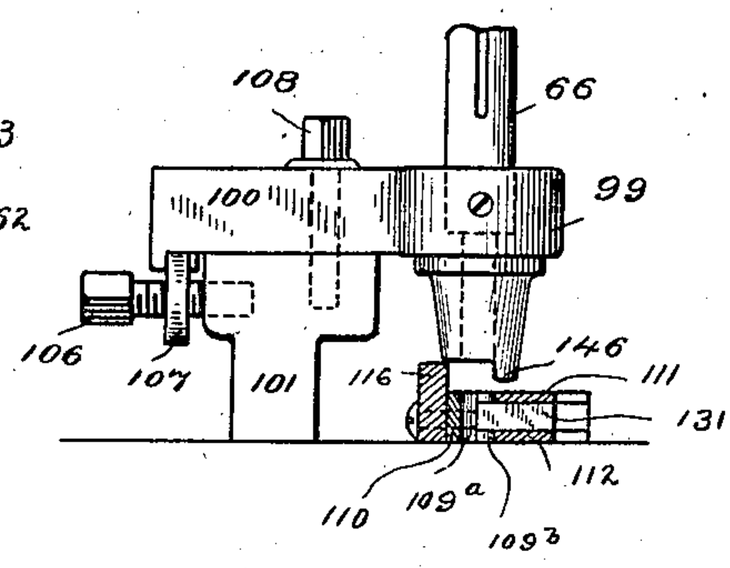


Fig. 12.



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MACHINE FOR TRIMMING CARTRIDGE SHELLS.

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Fig. 16.

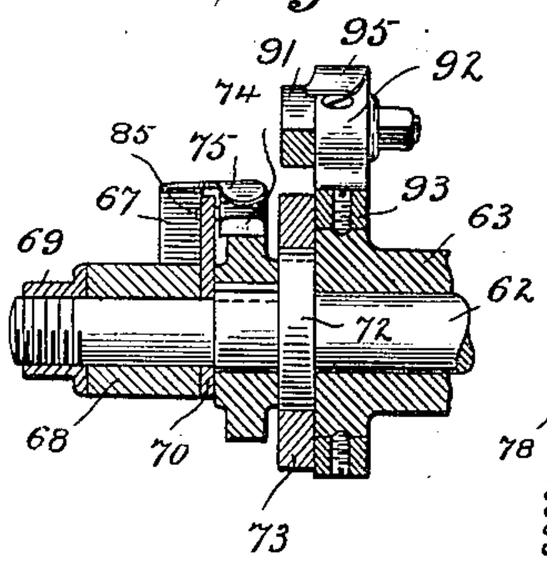


Fig. 15.

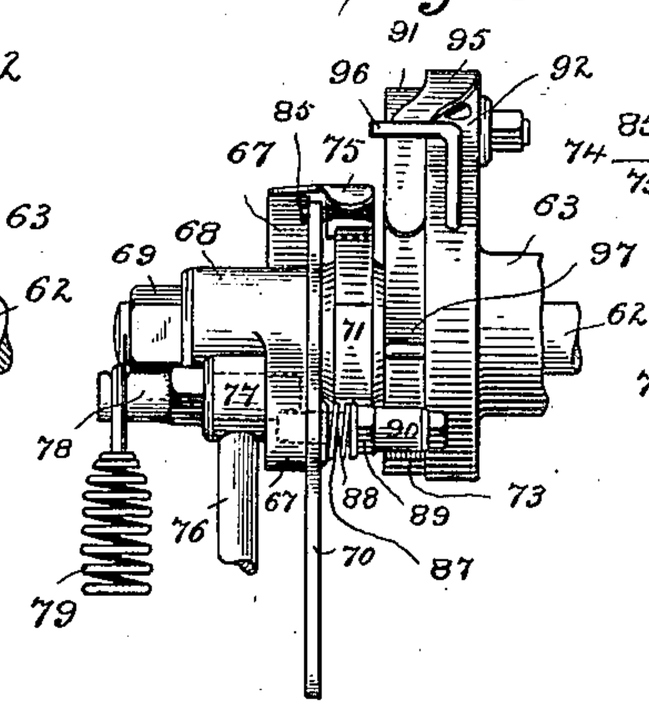


Fig. 14.

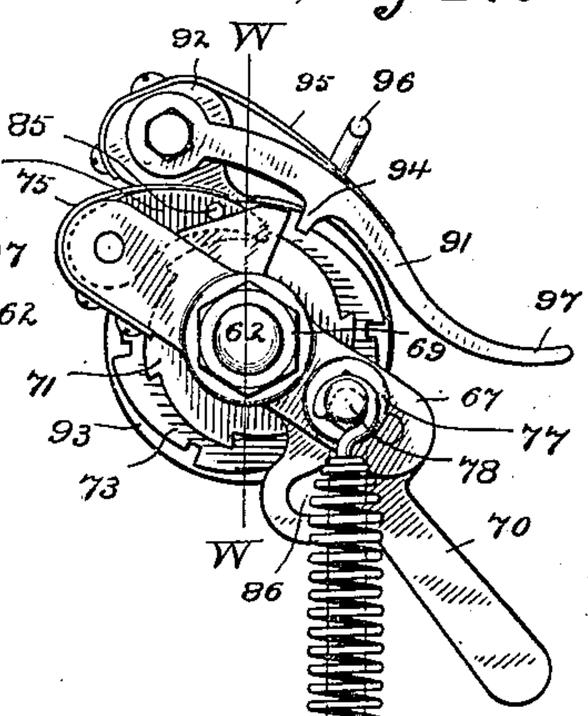


Fig. 17.

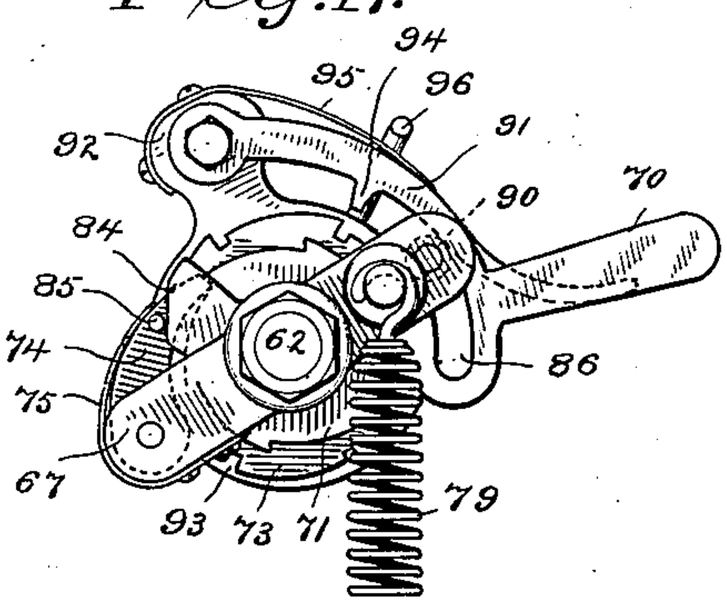
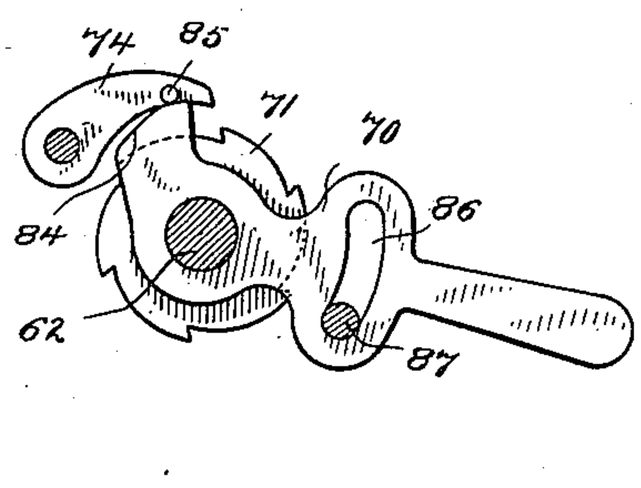
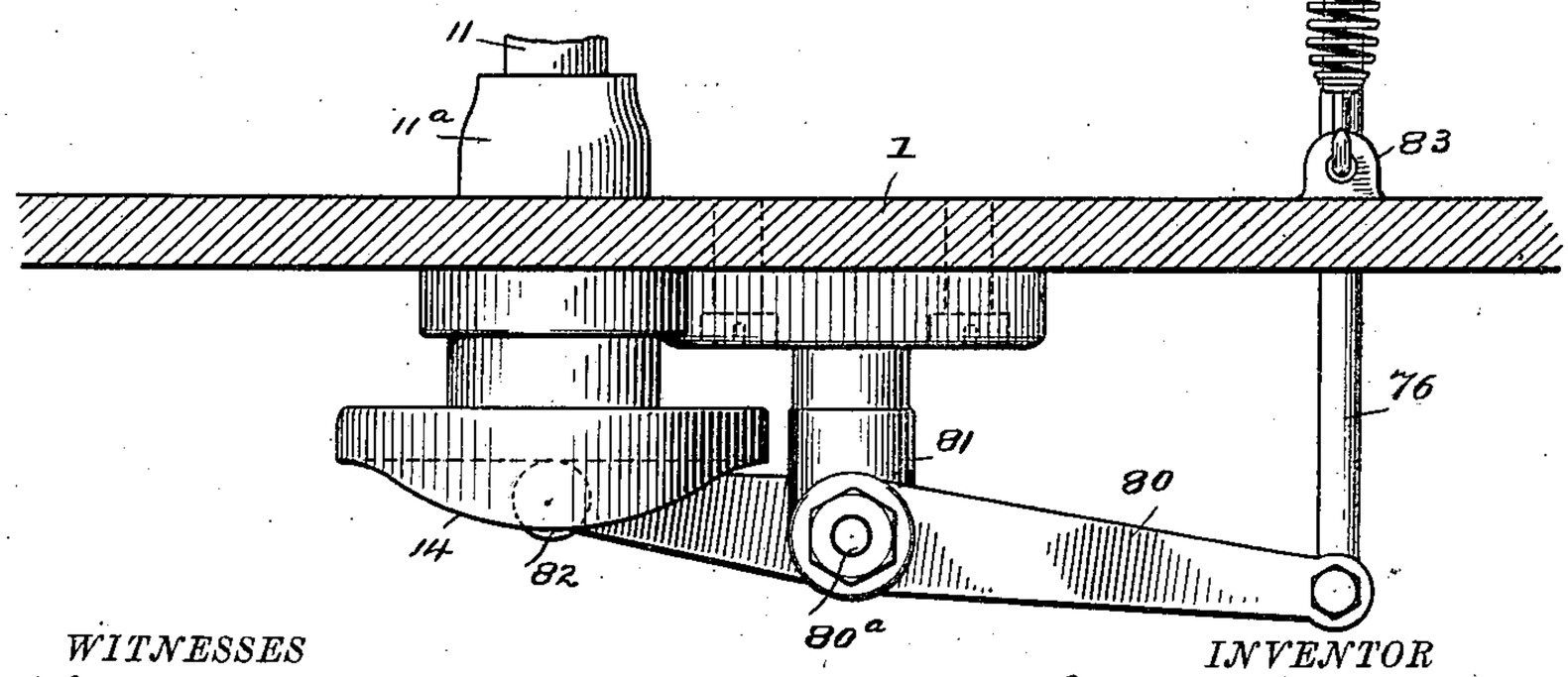


Fig. 18.





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UNITED STATES PATENT OFFICE.

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MACHINE FOR TRIMMING CARTRIDGE-SHELLS.

SPECIFICATION forming part of Letters Patent No. 500,511, dated June 27, 1893.

Application filed September 28, 1892. Serial No. 447,156. (No model.)

To all whom it may concern:

Be it known that I, CHARLES R. RICHARDS, a citizen of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Machines for Trimming Cartridge-Shells; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has for its object to produce an automatic machine for trimming cartridge shells, my novel machine being adapted to manipulate the shells to be operated upon by any ordinary or preferred style of trimming or cutting tool, for example a tool for cutting off the end of a shell and for chamfering out the inner edge thereof as shown in patent to Gilbert and Thomas, No. 476,009, dated May 31, 1892, or a tool for trimming the heads of shells as shown in my former Patent No. 479,125, dated July 19, 1892, or any of the various other tools for trimming or finishing the ends or heads of metallic shells.

With these ends in view I have devised the novel machine of which the following description in connection with the accompanying drawings is a specification.

Figure 1 is a rear elevation of the machine complete; Fig. 2 an end elevation, the guard being in section; Fig. 2^a a detail sectional view on the line *n n* in Figs. 2 and 4; Fig. 3 an elevation on an enlarged scale the position of the parts being the same as in Fig. 1 and the reversing disk in section; Fig. 4 a section corresponding therewith the reversing mechanism being removed, and the section line being indicated by *x x* in Figs. 2, 5 and 8; Fig. 5 a section on the line *y y* in Fig. 3 looking down, the feed slide having just expelled a finished shell; Fig. 6 an enlarged sectional view of the hopper and the operating mechanism therefor, on the line *p p* in Fig. 7 looking toward the right; Fig. 7 a section on the line *z z* in Fig. 6 looking toward the left; Fig. 8 an enlarged detail view corresponding with Fig. 5 except that the feed slide is in the receiving position, the shell just fed forward being clamped in the position in which it is operated upon by the trimming tool; Fig. 8^a a similar view, the feed slide being shown as carrying a shell forward into position to be operated upon; Fig. 8^b a detail sectional view on the line *r r* in Fig. 8; Fig. 9 a section on the line *s s* in Fig. 8; Fig. 10 an enlarged sectional view of the reversing disk and case, the plane of the section being at right angles to the plane of the section in Fig. 3; Fig. 11 an enlarged sectional view on the line *t t* in Fig. 10, the plane of the section being the same as in Fig. 3; Fig. 12 a detail view of the lower end of the delivery tube, showing the manner in which the shells are delivered to the feeding mechanism, the fingers being in section; Fig. 13 an inverted plan view corresponding with Fig. 14 illustrating the cam for operating the reversing mechanism; Fig. 14 an end elevation of the reversing mechanism showing the cam by which the reversing mechanism is operated, the parts being shown in the locked position; Fig. 15 an elevation as seen from the right in Fig. 14; Fig. 16 a section on the line *w w* in Fig. 14; looking toward the left; Fig. 17 an end elevation of the reversing mechanism corresponding with Fig. 14 except that the parts are shown in the released position, and Fig. 18 is a detail view illustrating mechanism for throwing the pawl which operates the reversing mechanism out of operative position and retaining it there.

1 denotes the bed which is supported by suitable legs 2 and is ordinarily provided with a guard 3 around its edge.

All of the different movements of the machine with the exception of the rotary movement of the trimming tool are communicated by a shaft 4 which receives motion from a belt, not shown, running over a belt wheel 5, and which carries a belt wheel 6, a bevel gear 7 and a disk 8 having a cam groove 9 in its face by which vertical reciprocatory movement is imparted to the carrier for the trimming tool. Bevel gear 7 meshes with a bevel gear 10 on a vertical shaft 11 which carries a cam 12 by which motion is imparted to the feed slide, a cam 13 which operates the clamping slide and a face cam 14 which operates the reversing mechanism. Shafts 4 and 11 are journaled in a heavy casting 3^a which is rigidly secured to the bed, the lower end of shaft 11 turning in a bushing 11^a, which ex-

tends through and is rigidly secured to the bed, and the upper end turning in a bushing 11^b secured in the casting.

In the drawings I have illustrated a construction especially adapted to operate in connection with a tool for trimming the heads of shells as for instance the tool described and claimed in my said former Patent No. 479,125. It will be understood as the description proceeds that in order to place the shells in position to have the heads operated upon, reversing mechanism is necessary, but if the open ends of shells are to be operated upon the reversing mechanism is not used. The shells to be operated upon are placed loosely in a hopper which as a whole is designated by A. This hopper is supported by a standard 15 which extends upward from the bed. The body of the hopper comprises a casting 16 which is rigidly secured to the standard and a casting 17 which is rigidly secured to casting 16, said casting 17 comprising a diaphragm 18 having an opening 19 at its lower end through which the shells pass, and a sleeve 20 extending entirely through the hopper. The portion of the hopper back of the diaphragm I term the receiving chamber and designate by 21. The bottom of the hopper is inclined as at 22 which causes the shells to feed through opening 19 by gravity. In front of the diaphragm is a chamber 23 in which is a feed wheel 24 carried by a shaft 25 journaled in sleeve 20. The feed wheel is provided with a series of arms 26 which extend outward from the periphery thereof and are adapted to enter the open ends of the shells which have passed through opening 19 into chamber 23. These arms necessarily act to agitate the shells that do not lie in the right position to be picked up, and can of course only pick up shells which lie with their open ends toward the arms.

27 denotes a rim which is secured to the outer face of casting 17. In the inner side of this rim is a groove 28 which is of sufficient size to permit the arms to carry around the shells which have been picked up. It will be seen in Fig. 7 that the feed wheel rotates from left to right. At the top of chamber 23 the shells that have been picked up by the arms are delivered into a tube 29 the inner face of which is provided with a slot 30 which permits the arms to pass freely but will not allow the shells to drop out. The backs of the arms are provided with inclines 31 which render it impossible for the shells to clog in tube 29, but insure that the shells will pass into a vertical tube 32 which abuts against tube 29, said tube 29 being curved to correspond with the curvature of the feed wheel and extending about one fourth around the hopper. Tube 32 is provided with a slot 33 which registers with the slot in tube 29 and permits the arms to pass out. It of course follows that when shells have been carried past the top of tube 29 they will drop away from the arms by which they are carried and their forward ends will rest upon the inclines of the arms below them. As the arms pass out through slot 33 the shells drop down into vertical tube 32 and are next operated upon by the reversing mechanism which I shall presently describe. The shells as they fall by gravity from the arms 26 might tip over so as to lie crosswise in the tube which is made slightly larger in diameter than the shells. This action of the shells would tend to clog the tube but by reason of the incline 31 the shell as it falls thereon is caused to slide sidewise and thus rest against the outer wall of the tube without tilting from its proper position.

Motion is imparted to the feed wheel by means of a crossed belt 34 (Fig. 1) extending from belt wheel 6 on shaft 4 to a belt wheel 35 on a shaft 36 journaled in a bracket 37 upon the hopper. At the other end of this shaft is a bevel gear 38 Fig. 6 which meshes with a bevel gear 39 on a shaft 40 also journaled in bracket 37.

41 denotes a cone belt pulley on shaft 40, and 42 a belt extending from belt pulley 41 to a reversed cone belt pulley 43 on a shaft 44 which turns on a rod 45, the inner end of which is threaded and passes through a block 46 and engages casting 16. Shaft 44 is provided with a pinion 47 which meshes with a pinion 48 on a stud 49, the inner end of which is threaded and engages casting 16.

50 denotes another pinion turning on stud 49 and made integral with or rigidly secured to pinion 48. Pinion 50 meshes with a pinion 51 on shaft 25 which carries the feed wheel. Shaft 25 is provided with a collar 52, against which a boss 53, on the feed wheel bears, for a purpose presently to be explained. On the outer face of the feed wheel is a hub 54 in which is a socket 55. At the outer end of this hub and rigidly secured thereto are handles 56. At the outer end of shaft 25 and within socket 55 is a collar 57. This collar is free to turn on the shaft and is also adapted to turn within the socket.

58 is a spring one end of which bears against the base of the socket the other against the inner end of collar 57, thereby forcing boss 53 against the collar and forming a frictional connection between the feed wheel and the shaft. The object of this construction is to permit the operator to hold the feed wheel stationary by grasping one of the handles should the machine be feeding too fast, but without stopping any portion of the machine except the feed wheel, shaft 25 by which the feed wheel is carried rotating as before, and the friction of the spring being sufficient to cause the feed wheel to rotate with the shaft as soon as the operator lets go of the handle. Should a shell become clogged or fail from any cause to drop off from the arm of the feed wheel, the operator can ordinarily loosen it by oscillating the feed wheel by means of the handles.

59, see Fig. 6, denotes an opening in the

top of the hopper through casting 17 and rim 27. This opening enables the operator to look into chamber 23 and to remove the shells from the feed wheel should they become clogged from any cause whatever.

Turning now to Figs. 3, 10, 11 and 14 to 18 I will describe what I term the reversing mechanism, that is mechanism for changing ends with the shells so that instead of passing to the feeding mechanism with the head ends downward they will be fed into position to be operated upon by the trimming tool with the head ends up. 60 denotes the reversing disk lying within a case 61 and keyed to a shaft 62 journaled in a sleeve 63 which is rigidly secured to the standard, the case being rigidly secured to the sleeve as shown in Fig. 11. The reversing disk is provided with sockets 64 of suitable size to receive the shells, each socket being preferably provided with a slot 65 which permits the operator to see the shells in the sockets at all times. The outer face of the reversing disk is provided with a hub 54^a within which is a socket 55^a. At the outer end of the hub are secured handles 56^a. At the outer end of the shaft is a collar 57^a loose on the shaft and adapted to turn within the socket, said collar being held in position by nuts 57^b. A coil spring 58^a bears against the base of the socket and against the collar. This spring acts to hold the reversing disk in position in the case against a shoulder 62^a on shaft 62 but permits it to yield outward should clogging of the shells take place, as will presently be more fully explained. The disk being keyed to shaft 62, must necessarily turn with it, but is free to slide longitudinally thereon against the power of the spring. Vertical tube 32 has a lip 32^x and is connected to the upper part of case 61 by a spring catch 32^a engaging said lip and a delivery tube 66 connects with the lower side of the case as clearly shown in Fig. 2. The shells pass down tube 32 and as soon as one of the sockets 64 in the reversing disk comes in line with the tube the lowest shell will drop into the socket the head end being downward. When the reversing disk has made a half revolution the socket just referred to will register with tube 66 and the shell will pass out of the socket by gravity and down into the tube, the shell having been caused to change ends by the reversing disk and passing into tube 66 with the head end up.

Motion is imparted to shaft 62 carrying the reversing disk in the manner which I will now describe. Turning to Figs. 14 to 18, at the opposite end of shaft 62 from that carrying the reversing disk is an arm 67 having a hub 68 adapted to turn on the shaft, said hub being held in position by a nut 69. Just within the hub and also pivoted on the shaft and adapted to be turned thereon is a lever 70 the purpose of which will presently be explained. Just within the lever is a feed ratchet 71 keyed to the shaft, and just within the feed ratchet and keyed to a collar 72 is a stop ratchet 73. 74 denotes the feed pawl pivoted to arm 67, and 75 a spring acting to hold said pawl in engagement with feed ratchet 71. 76 denotes the feed operating rod at the upper end of which is a head 77 which is pivoted to arm 67 at the opposite end from the pivotal point of the feed pawl, by means of a pin 78 which passes through the head and the inner end of which is threaded to engage arm 67. This pin extends outward some distance from the head as clearly shown in Fig. 15, in order to provide a point of attachment for a strong spring 79 the purpose of which will presently be explained. Rod 76 extends downward through the bed and the lower end thereof is pivoted to a lever 80 fulcrumed on a pin 80^a in a stud 81 rigidly secured to the under side of the bed, see Figs. 13 and 14. At the opposite end of lever 80 is a roller 82 which engages face cam 14 at the lower end of shaft 11. The shape of this cam and the movement it imparts to lever 80 and rod 76 will be clearly understood from Figs. 3, 4 and 14. It will furthermore be clearly understood from Fig. 14 that each upward movement of the rod will cause arm 67 to oscillate on shaft 62 and will cause the feed pawl to be carried backward over the face of ratchet 71 sufficient distance to cause said pawl to engage another tooth. It will furthermore be seen from the shape of the incline of cam 14 that the upward and downward movements of the rod are both made quickly so that as soon as the downward movement of the rod commences, arm 67 is free to be acted upon by spring 79 the lower end of which is connected to an ear 83 on the bed. This spring is strong enough to draw arm 67 downward again, oscillating it on the shaft thereby causing a forward movement of the feed ratchet by means of the pawl and consequently of shaft 62 and the reversing disk. It will thus be seen that the movement which places the feed pawl in the position to operate is positive, but the operation of the feed pawl is produced by a spring and is therefore yielding. This is in order to insure that should there be clogging of the shells for any reason whatever no damage can be done to the machine as the spring will yield. Should it be required at at any time to stop the passage of shells to the feeding mechanism or should shells become clogged in the reversing mechanism I have provided a stop motion for the reversing mechanism which I will now describe. Lever 70 which has already been described as adapted to be turned on shaft 62, is provided with an incline 84 which is adapted to engage a pin 85 extending outward from the feed pawl, see Fig. 18 whereby the feed pawl is lifted entirely out of engagement with the feed ratchet. The handle end of this lever is provided with a curved slot 86 through which a pin 87 passes, the inner end of said pin being threaded and engaging arm 67. 88 is a coil spring surrounding pin 87 the ends of which bear against an enlargement 89 on pin 87 and against le-

ver 70, washers being interposed between the enlargement and the lever. The action of this spring is to hold the lever by friction in any position in which it may be placed, that is to say to retain said lever in its normal position as shown in Figs. 14, 15, 16 and 17, or to retain it in a locking position as in Fig. 18, said lever oscillating with the shaft in either position in which it may be placed until it is shifted by hand to the other position and then remaining in that position oscillating with the shaft until it is shifted back again. It will be seen that when the lever is in the position illustrated in Fig. 18 arm 67 will oscillate as usual but the feed pawl will not come in contact with the feed ratchet. Pin 85 will simply ride up and down on incline 84 holding the pawl out of contact with the ratchet. Should the shells become clogged in the reversing mechanism they may ordinarily be loosened so as to drop out into tube 66 by a quick oscillation of the reversing disk by means of the handles or by moving the disk in or out in the case against the power of spring 58, it being understood of course that the shaft oscillates with the disk, but that the disk may be moved longitudinally thereon against the power of the spring. It should furthermore be understood that accidents of this class rarely happen with this machine, but I have so constructed it as to prevent injury thereto under any circumstances, and to provide for the convenient removal of defective shells at any time. Pin 87 extends outward from enlargement 89 and carries a roller 90 see Fig. 15, which is adapted to engage locking pawl 91 and lift it each time arm 67 moves upward. The locking pawl is pivoted to an arm 92 provided with a sleeve 93 which is rigidly secured to sleeve 63, see Fig. 16. 94 denotes a tooth on the locking pawl which is adapted to engage either of the notches in the locking ratchet. A spring 95 acts to hold the locking pawl in contact with the ratchet until it is raised, and a guard 96 acts to prevent the locking pawl from being under any circumstances thrown backward out of operative position. The object of this locking pawl and ratchet is to insure that at each forward movement of the feed ratchet, shaft 62 and the reversing disk, said parts shall be stopped at the exact position required to place one of the sockets in the reversing disk in position to receive a shell from tube 32. It will be seen that the upward movement of arm 67 in addition to moving the feed pawl backward from the face of the ratchet lifts the locking pawl and disengages its tooth from the locking ratchet. The instant the forward movement of the feed ratchet commences the tooth of the locking pawl drops down upon the surface of the locking ratchet but cannot lock said ratchet until the next notch is reached at which instant spring 95 will force tooth 94 into engagement with the notch and will lock the shaft, ratchets and reversing disk at the exact position required. The locking pawl is provided with a handle 97 by which said locking pawl may be conveniently lifted out of engagement with the locking ratchet by hand.

Turning now to Figs. 4, 5, 8, 9 and 12 I will describe the feeding and clamping mechanism, *i. e.* the mechanism which receives the shells from the delivery tube and carries them into position and holds them while being operated upon by the trimming tool. All of these parts are carried by a block 98 Fig. 4 which is rigidly secured to the bed. The lower end of the delivery tube extends into and is rigidly secured to a holder 99 at the end of a plate 100 lying at right angles to and secured to a plate 101 which is itself adjustably secured to block 98. Plate 101 Fig. 5 is adjusted by means of a screw 102 which engages the rear end of the plate and is provided with a double head 103 engaging a yoke 104 extending upward from block 98, from which view it will be apparent that rotation of screw 102 will move plate 101 in or out as may be required. The plate is locked in position after adjustment by means of a bolt 105 which passes through a slot in said plate. Plate 100 and with it holder 99 are adjusted by means of a screw 106 which engages plate 101 and is provided with a rigid collar 107 engaging plate 100, see Fig. 12. It will be apparent from this figure that rotation of screw 106 will move plate 100 in either direction as may be required transversely to plate 101. Plate 100 is locked in position after adjustment by means of a bolt 108 passing through a slot in plate 100 and engaging plate 101. These adjustments enable me to insure that the shells shall pass with absolute certainty and uniformity to the feeding mechanism which I shall presently describe, and also require to be changed when the size of the shells being operated upon is changed. As the shells pass out from the holder, see Figs. 8 and 12 they drop into a recess 109 Fig. 8 one side of which is formed in a wearing plate 110 the other side of said recess being formed in upper and lower fingers 111 and 112 Fig. 12 which are pivoted to a feed slide 113 which moves upon the top of block 98. The feed slide is held in position by means of adjustable plates 114 and 115, Fig. 8ª. Plate 114 is provided with a flange 116 cut away at 117 so as not to interfere with the trimming tool, see Fig. 9, and to which wearing plate 110 Fig. 8ª, is attached, this wearing plate acting as one of the side guides for the feed slide and being provided with a recess 109ª which forms a portion of shell receiving recess 109 and with another recess 119 which acts in connection with the clamping slide presently to be described to hold the shell while being acted upon by the trimming tool. When the size of shells to be operated upon is changed wearing plate 110 is removed and another one attached in its place. Slide 114 and the wearing plate are adjusted by means of a screw 120 Fig. 4 which engages block 98 and is provided with a collar 121 rigidly se-

cured thereto which engages the under side of plate 114 so as to move said plate in or out when the screw is turned. After adjustment plate 114 is locked in position by means of a bolt 122 which passes through a slot in said plate, see Figs. 3, 5 and 8.

123, see Figs. 3, 5, 8 and 9, denotes an air tube which is connected with a suitable blower, not shown. The position of the end of this tube is indicated by dotted lines in Figs. 5 and 8. It is provided in order to blow away the chips of metal made by the trimming tool. I have shown the air tube as held in place by means of a metallic strap 124 which is secured to plate 114. Plate 115 which forms the other side bearing for the feed slide is simply set up in position by hand and locked there by a screw 125 passing through a slot in said plate. Feed slide 113 is provided with a recess 126 in which is a plate 127 pivoted upon a stud 128. Fingers 111 and 112 are secured to plate 127 by means of screws 129 and 130. The exact shape of these fingers is of course not of the essence of my invention. A form in which I have constructed and used them will be clearly understood from Figs. 8, 8ª and 9. Back of the operative portion of the lower finger, denoted by 112, and in front of plate 127 is a block 131 formed integral with the rest of said fingers upon which the upper finger 111 rests. Between the fingers is a space 132 the purpose of which will presently be explained, in connection with the clamping finger. 133 is a coil spring surrounding stud 128, the upper end of said spring bearing against a pin 134 in said stud and the lower end extending outward and being coiled around screw 130, the action of said spring being to force plate 127 against the back of recess 126, see dotted line Fig. 8, and to hold the fingers in operative position as in Figs. 5 and 8. The shape of the recess in the feed slide in which plate 127 lies will be clearly understood from Fig. 8ª. Reciprocatory motion is imparted to the feed slide by means of a bell crank lever 135 pivoted on a stud 136 extending through a sleeve 136ª on the under side of the lever, see Figs. 4 and 5. At the rear end of the feed slide is a slot 137. One arm of the bell crank lever is connected to the feed slide by means of a stud 138 which passes through this slot and engages said arm of the lever. At the other end of the bell crank lever is a roller 139 which bears against cam 12 on shaft 11, said cam being formed integral with or rigidly secured to a collar 140 on shaft 11. 141 denotes a strong spring one end of which is connected to the bell crank lever and the other to an arm 142 extending upward from the bed. The action of this spring is to hold roller 139 closely in contact with cam 12. 143 denotes a set screw in a hub 144 which is rigidly secured to casting 3ª, see Fig. 5. 145 is a lock nut by which the set screw is held in place after adjustment. The action of this set screw is to check the inward movement of the arm of the bell crank lever carrying the roller, caused by spring 141 and consequently to limit the forward movement of the feed slide.

The operation of the feeding mechanism will be clearly understood from Figs. 5, 8ª, 8 and 12. It will be seen in Fig. 12 that one edge of holder 99 to which delivery tube 66 is connected rests upon flange 116 and that the opposite side of the holder is provided with a lip 146 which renders it impossible for the shells to get out and insures that they drop down into recess 109 as they pass from the delivery tube and holder. At the instant a shell is received in recess 109 the forward movement of the feed slide commences. For convenience in description I will term the recesses in the upper and lower fingers which assist recess 109ª in wearing plate 110 to form shell receiving recess 109, as 109ᵇ, the recesses in the two fingers being identical in shape. The shape of recess 109 is clearly shown in Fig. 8, said recess being preferably made pear shape as shown in said figure, that is to say the forward end of the recess is extended outward forming inclines 109ᶜ in wearing plate 110, and 109ᵈ, in the fingers so as to permit the shell to be forced out of recess 109 and along incline 109ᶜ, when the feed slide moves forward as clearly shown in Fig. 8ª, in which the shell is shown as being held in the recesses formed in the fingers and which I have designated as 109ᵇ and between the fingers and the wearing plate, the plate 127 and the fingers yielding outward as shown against the power of spring 133, and the rear ends of recesses 109ᵇ holding the shell and acting to force it forward. The feed slide continues to move forward the shell being held as in Fig. 8ª until it reaches recess 119 in the wearing plate into which it is forced by spring 133 acting upon plate 127 which carries the fingers. At this instant the forward movement of the feed slide ceases. The fingers will now be in the position shown in Fig. 5. At this instant the shell is clamped by the clamping finger acting in connection with recess 119 as will presently be more fully explained. At the forward end of the fingers are concave curves 147 which as the feed slide moves forward in the position shown in Fig. 8ª engage the shell that has last been acted upon by the trimming tool and expel it from the machine, a trough 148 being provided into which the trimmed shells are forced by the fingers.

149 denotes the clamping slide the construction and operation of which will be clearly understood from Figs. 3, 4, 5, 8 and 8ᵇ. This slide reciprocates in a dovetail groove 150 in block 98 in a line at right angles to the feed slide, see dotted lines Fig. 8. Gibs 149ª are provided on both sides of the slide to take up wear from long continued use, one of said gibs being adjusted by screws 149ᵇ, and the other by screws 149ᶜ, having at their inner ends collars 149ᵈ which engage angle slides 149ᵉ, see Fig. 8ᵇ, said screws being locked in

position after adjustment by set nuts 149f. 151 is a block adjustably secured to slide 149 by means of a bolt 152 which passes through a slot 153 in said block. 154 denotes a clamping finger which is secured to block 151 by a bolt 155. The forward end of this finger is made thin enough so as to permit it to pass readily between fingers 111 and 112 on the feed slide as is shown in Figs. 3 and 4. At the forward end of the clamping finger is a recess 156 which receives the shell and acts in connection with recess 119 in wearing plate 110 to clamp and hold the shell firmly while it is being acted upon by the trimming tool, see Fig. 8.

In describing the operation of the feed slide it has already been explained that fingers 111 and 112 carry each shell forward until recesses 109b in which the shell lies register with recess 119 in the wearing plate into which the shell is forced by the spring which controls the fingers. At the instant that the parts are in this position the clamping slide moves forward at right angles to the feed slide, clamping finger 154 passing between fingers 111 and 112 and acting to clamp the shell firmly in the position to which it is carried by the feed slide. The trimming tool, the operation of which I shall presently describe then descends and acts upon the shell. Simultaneously with the clamping of the shell and the commencement of the action of the trimming tool the backward movement of the feed slide commences. The shell being held firmly by the clamping finger it follows that fingers 111 and 112 on the feed slide must be forced upward against the power of spring 133 in order to disengage said fingers from the shell. The fingers yield outward at the commencement of the backward movement of the feed slide in the same manner that they are held outward during the forward movement of the feed slide as shown in Fig. 8a. This action of fingers 111 and 112 being so apparent it is not deemed to require special illustration.

It will be clearly understood from what has been said that when the backward movement of the feed slide commences inclines 109d which constitute the forward ends of the shell holding recesses in the fingers will ride over the surface of the shell throwing the fingers outward until the shell has been passed, spring 133 acting upon plate 127 to which the fingers are attached will then force said plate and the fingers back to their normal position as in Fig. 8. Block 151 on the clamping slide and the clamping finger are adjusted relatively to the slide and necessarily to the wearing plate also by means of a screw 157 which engages block 151 and is provided with a double head engaging a yoke 158 on the clamping slide, see Fig. 5. After adjustment the block is locked to the clamping slide by tightening up bolt 152.

Reciprocatory motion is imparted to the clamping slide in the manner which I will now describe. At the inner end of this slide is a loop 159 which incloses shaft 11 and is provided with a boss 160, on the under side of which is pivoted a roller 161, which bears upon cam 13 on shaft 11, the shape of said cam being clearly shown by dotted lines in Figs. 5 and 13. 162 denotes a lever pivoted on a stud 163, extending upward from the base of casting 3a. 164 denotes a spring one end of which is connected to one end of the lever, the other to an arm 165 extending upward from the bed. The inner end of lever 162 bears against a shoulder 166 on the clamping slide and by means of the spring acts to force the clamping slide forward and to hold roller 161 constantly in engagement with cam 13 except while a shell is being clamped, see Fig. 8 in connection with Figs. 4 and 5. It will be seen from Figs. 4 and 5 that the rotation of shaft 11 and cam 13 must necessarily impart reciprocatory movement to the clamping slide, the parts being so timed that the clamping slide will move forward and clamp a shell at the exact instant that the feed slide has placed it in position to be operated upon by the trimming tool.

The operative position of the trimming tool is clearly shown in Figs. 3, 4, and 9, which see in connection with Figs. 1 and 2. 167 denotes the trimming tool which is carried by a taper spindle 168 journaled in a carrier 169 adjustably secured to a slide 170. The upper end of the spindle is cone shaped and engages an adjusting screw 171 in the carrier, said screw being locked in position after adjustment by set nuts 172. Power is applied to drive the spindle and trimming tool by means of a belt 173 running over a belt pulley 174 secured to the spindle by a set screw 174a and over a pulley 175 on a shaft 176 journaled in a bracket 177 extending outward from the bed, see Figs. 1 and 2. 178 denotes a platform secured to the bracket and adapted to carry a basket or box to receive the shells as they drop from trough 148. The outer end of the bracket is bifurcated, as shown in Fig. 1, each arm thereof being provided with an opening 179 to receive one of the bearings 180 for shaft 176. These bearings are adjustable in the openings by means of set screws 181 which pass through the arms and engage the bearings. 182 denotes oil cups under the bearings. Power is applied to drive the shaft and spindle by means of a belt, not shown, running over a belt pulley 183 on shaft 176. The belt running over pulley 183 extends to any suitable main or counter shaft, not shown, this being the only movement of the machine that is not driven from shaft 4. 184 is a headed taper bushing in carrier 169 through which the spindle passes and which supports the spindle and parts carried thereby, the adjustment to compensate for wear in use being effected by loosening set screw 174a, setting up the spindle in the bushing and then tightening up set screw 174a and adjusting screw 171. The outer face of slide 170 consists of a dove tail 191 which engages ways in

the carrier, gibs 185 and set screws 186, see Fig. 2ª, being provided on both sides to take up wear from long continued use. The carrier is adjustably connected to the slide by means of a lug 187 which extends inward from the carrier and lies in a groove 188 in the slide. This lug is threaded to receive a screw 189 having at its upper end a collar 189ª, and a rod 189ᵇ which extends upward through a lug 190 on the outer face of the slide and is provided with a head 197, see Fig. 4. It will be seen that rotation of this screw will necessarily move the carrier, spindle and trimming tool upward or downward as may be required relatively to the slide, head 197 being provided with holes to receive a turning rod so as to give the finest possible adjustment to the carrier and trimming tool. 190ª denotes a socket in lug 190 in which is a a spring 190ᵇ surrounding the rod and bearing against the collar and the base of the socket. The object of this construction is to provide a yielding upward movement for the carrier, trimming tool, &c., should a shell slightly longer than the others be presented to the trimming tool, so that no injury can possibly happen to the tool or to the machine. The inner face of slide 170 consists of a dove tail 192 which engages ways in a plate 193 which is secured to casting 3ª by means of screws 194. Gibs 195 and set screws 196 are provided on both sides of the slide by which the wear may be taken up after long continued use so as to insure that the slide shall always run true to the minutest fraction of an inch. Reciprocatory motion is imparted to the slide by means of a roller 198 on a stud 199 which extends inward from the slide, the roller engaging cam groove 9 in disk 8. The shape of said groove is clearly shown in Fig. 2. The disk is secured to shaft 4 by means of a key 200. It will be seen therefore that the vertical movement of the slide, carrier and trimming tool as well as all the other movements of the machine except the rotary movement of the trimming tool are received from shaft 4. The movement of the slide, carrier and trimming tool is so timed relatively to the other parts of the machine that at the exact instant a shell is grasped and held by the clamping slide, the trimming tool will begin to act upon the shell. In the present instance as already stated I have illustrated the machine as adapted to trim the head of a shell, and have shown a tool for that purpose attached to the spindle.

The operations of the several mechanisms have been so fully explained in the general description of the machine that further description of the operation is hardly deemed necessary. It is deemed sufficient for the purpose of this specification to say that the shells to be operated upon are placed loosely in a hopper in which they are picked up by a feed wheel and delivered into a tube, the feed wheel being provided with arms which enter the open ends of the shells so that it is impossible for a shell to be delivered to the tube except with the open end upward. In case the machine is required to trim the open end of a shell no reversing mechanism is required as the open ends of the shells will be upward when they pass from the tube. In case it is required to trim the heads of shells they are caused to pass into sockets in a reversing disk which at the end of a half revolution delivers the shell to another tube with the head end up. The shells pass from this tube into a recess formed partially in a wearing plate and partially in fingers carried by a feed slide. When the slide moves forward the shell is carried into a position directly under the trimming tool. At this instant a clamping slide moves forward at right angles with the feed slide and clamps and holds the shell in position to be operated upon. The instant the shell is clamped the trimming tool descends and trims the head, the feed slide and fingers having in the meantime moved backward, received another shell and commenced to move it forward. The instant the trimming operation is completed the clamping slide moves backward out of the way releasing the shell that has just been operated upon. The fingers upon the feed slide now move forward and expel the trimmed shell from the machine and place another shell in position to be grasped by the clamping slide and operated upon, these operations being constantly repeated and the special mechanisms by which they are performed having been fully explained in the general description of the machine.

Every part of the machine is made adjustable so as to provide for long continued use and for the most exact adjustment, it being understood that in this class of work accuracy is required even to less than a thousandth part of an inch.

It should be understood that my invention is not limited to the exact details of construction shown and described but may be varied within reasonable limits without departing from the principles thereof.

I claim—

1. The combination with casting 16, casting 17 comprising diaphragm 18 having opening 19, a sleeve 20, a rim 27 secured to casting 17, said rim and casting having an opening 59 leading into the chamber in front of the diaphragm 18, of shaft 25 turning in said sleeve and having a collar 52, the feed wheel journaled on said shaft, and a spring which forces the feed wheel against the collar, causing the feed wheel to normally rotate with the shaft.

2. The combination with the hopper and the feed wheel having arms 26 provided on their backs with inclines 31, extending from the outer ends of the arms inwardly across the tube, of curved tube 29 having slot 30 through which the arms pass, and a tube 32 connecting with tube 29 and having a corresponding slot to permit the arms to pass out, said inclines acting to prevent the shells from

clogging in either of said tubes when they drop off from the arms.

3. The combination with the reversing disk and shaft 62 by which it is carried, of feed ratchet 71 keyed to the shaft, arm 67 adapted to oscillate on said shaft, a feed pawl pivoted to one end of said arm and engaging the ratchet, a vertically movable rod pivoted to the other end of the arm, and a spring 79 one end of which is connected to said arm the other to a fixed portion of the machine, so that each upward movement of said rod will oscillate the arm and move the feed pawl backward over the face of the ratchet and against the power of the spring, after which the spring will act to draw the arm downward and the feed pawl will impart a forward movement to the ratchet and shaft.

4. The combination with shaft 62, the feed ratchet keyed thereto, and oscillating arm 67 carrying a pawl engaging the ratchet, of cam 14, lever 80 carrying a roller engaging said cam, rod 76 pivoted to said lever and to the oscillating arm, and a spring 79 connected to the arm and to a fixed portion of the machine whereby during each revolution of the cam, lever 80 is oscillated raising the rod which oscillates the arm against the power of the spring and moves the feed pawl backward over the face of the ratchet, after which the spring acts to return the arm, rod and lever to their normal position and causes the pawl to move the shaft and ratchet forward.

5. The combination with shaft 62, the feed ratchet keyed thereto, arm 67 adapted to oscillate on said shaft and carrying a feed pawl, and a spring acting to hold said pawl in engagement with the ratchet, of vertically moving rod 76 pivoted to the other end of said arm, and a spring 79 also connected to the arm and to a fixed portion of the machine, said spring acting to return the parts to their normal position and cause a forward movement of the ratchet and shaft after the lever has been oscillated by a movement of the rod.

6. The combination with shaft 62, and the feed ratchet carried thereby, of arm 67 adapted to oscillate on said shaft and carrying a pawl engaging the ratchet, a pin 78 extending from the other end of said arm, vertically movable rod 76 having a head 77 journaled on said pin, and a spring 79 connected to said pin and to a fixed portion of the machine.

7. The combination with shaft 62, the feed ratchet, oscillating arm 67 carrying a pawl engaging the ratchet, and stop ratchet 73, of locking pawl 91 adapted to engage said ratchet, and a pin 87 extending from the oscillating arm which engages the locking pawl to disengage the stop ratchet at each upward movement of said arm.

8. The combination with shaft 62, the feed ratchet, oscillating arm 67 carrying a pawl engaging said ratchet, and stop ratchet 73, of locking pawl 91 adapted to engage said ratchet, and pin 87 which engages the oscillating arm and carries a roller 90 which engages the locking pawl at each upward movement of the arm, disengaging said locking pawl from the stop ratchet and leaving the shaft and parts carried thereby free to be moved forward by the feed pawl when the reverse movement of the arm takes place.

9. The combination with shaft 62, the feed ratchet, oscillating arm 67 carrying a pawl engaging said ratchet, and the stop ratchet, of locking pawl 91 adapted to engage the stop ratchet, pin 87 extending from arm 67 and adapted to engage the locking pawl, vertically movable rod 76 pivoted to arm 67, and a spring 79 also connected to the arm and to a fixed portion of the machine, so that each upward movement of rod 76 will oscillate the arm thereby disengaging the locking pawl from the stop ratchet and will move the feed pawl backward over the face of the feed ratchet after which the spring will reverse the movement of the arm causing the feed ratchet to move the shaft and parts carried thereby forward and the locking pawl will engage the stop ratchet to lock said parts in position after the forward movement.

10. The combination with shaft 62, the feed ratchet, oscillating arm 67 carrying a pawl engaging said ratchet, and the stop ratchet, of locking pawl 91 adapted to engage the stop ratchet, pin 87 extending from arm 67 and adapted to engage the locking pawl at each upward movement of the arm, and a guard 96 which retains the locking pawl from being thrown backward out of the way.

11. The combination with shaft 62, the feed ratchet, oscillating arm 67 carrying a pawl engaging the feed ratchet, a pin 87 extending from said arm, and the stop ratchet, of locking pawl 91 engaging the stop ratchet, springs for holding said pawls in engagement with their respective ratchets, and guard 96 which retains the locking pawl from being thrown out of engaging position when the upward movement of the oscillating arm and pin 87 takes place.

12. The combination with shaft 62, the feed ratchet carried thereby, oscillating arm 67, and the feed pawl carried thereby and provided with a pin 85, of lever 70 adapted to be turned on said shaft and provided with an incline 84 which is adapted to engage pin 85 to lift the feed pawl out of engagement with the ratchet.

13. The combination with shaft 62, the feed ratchet, oscillating arm 67 and the feed pawl carried thereby and provided with a pin 85, of lever 70 pivoted on said shaft and provided with an incline 84 adapted to engage said pin and a slot 86, pin 87 extending through said slot and having an enlargement 89 and a spring the ends of which bear against said enlargement and the lever, whereby the latter is held in contact with the oscillating arm and caused to move therewith so that at one extreme of the movement of said lever the incline will be retained out of engagement with the pin and the feed movements will take place, and

at the other extreme of its movement the incline will be placed in position to engage said pin and lift the feed pawl out of engagement with the ratchet thereby causing shaft 62 and parts carried thereby to remain stationary.

14. The combination with shaft 62, the reversing disk-tubes 32 and 66, the feed ratchet, oscillating arm 67, and the feed pawl carried thereby and having pin 85, of lever 70 adapted to turn on the shaft and having an incline 84 adapted to engage the pin and a slot 86, a pin 87 extending through said slot and having an enlargement 89, and a spring bearing against said enlargement and against the lever to hold it in contact with the oscillating arm as and for the purpose set forth.

15. The combination with shaft 62, the feed ratchet, oscillating arm 67 carrying a feed pawl and a pin 87 having an enlargement 89 and a roller 90, a pin 85 extending from the feed pawl, and a stop ratchet keyed to the shaft, of the locking pawl adapted to engage the stop ratchet, lever 70 adapted to turn on the shaft and having an incline 84 adapted to engage pin 85 and a slot 86 through which pin 87 passes, and a spring 88 bearing against enlargement 89 and lever 70 to hold the latter in contact with the oscillating arm as and for the purpose set forth.

16. The combination with shaft 62 having a loose collar 57^a and shoulder 62^a, and the reversing disk keyed to said shaft to be revolved positively thereby but free to slide longitudinally thereon, said disk having a hub 54^a with a socket 55^a, of spring 58^a bearing against the base of the socket and against the collar by which the reversing disk is pressed against the shoulder.

17. The combination with shaft 62 having shoulder 62^a, and loose collar 57^a, of reversing disk 60 keyed to said shaft to be revolved positively thereby but free to slide longitudinally thereon, said disk having on its outer face a hub 54^a having a socket 55^a and handles 56^a, a spring 58^a bearing against the base of the socket and the collar and acting to hold the disk in contact with the shoulder, and nuts 57^b by which the collar is held in position on the shaft.

18. The combination with shaft 62, the feed ratchet, the feed pawl having pin 85, and lever 70 having an incline adapted to engage said pin, of the reversing disk keyed to said shaft but free to be moved longitudinally thereon, and a spring for holding said disk in operative position so that when pin 85 is engaged by the incline no movement will be imparted to the shaft and disk and the latter may be moved longitudinally to disengage shells in case of clogging.

19. The combination with shaft 62, the feed-ratchet, the feed pawl having pin 85 and a lever 70 having an incline adapted to engage said pin, of the reversing disk keyed to the shaft but free to be moved longitudinally thereon, said disk having a socket 55^a and handles 56^a and a spring in said socket bearing against the base thereof and against a collar on the shaft so that when the feed pawl is disengaged no movement will be imparted to the shaft and disk and the latter may be moved by the handles against the power of the spring as and for the purpose set forth.

20. The combination with the reversing disk and shaft 62 by which it is carried, of feeding mechanism substantially as described and shown whereby intermittent rotary motion is imparted to the shaft, locking mechanism substantially as described and shown whereby the disk is locked in position after each movement, spring 79, vertically movable rod 76 and intermediate connections between said rod and the feeding and locking mechanism.

21. The combination with the reversing disk and shaft 62 by which it is carried, of the feeding mechanism, the locking mechanism, suitable means for operating the feeding and locking mechanism, and a lever 70 pivoted on said shaft by which the feeding mechanism may be thrown out of operation.

22. The combination with the reversing disk and shaft 62 by which it is carried, of the feeding mechanism, the locking mechanism, suitable means for operating the feeding and locking mechanism, a lever 70 pivoted on said shaft by which the feeding mechanism may be thrown out of operation, and a spring 88 bearing against said lever whereby it is retained either in or out of operative position.

23. The combination with the reversing disk and shaft 62 by which it is carried, of the feeding mechanism, the locking mechanism, spring 79, vertically movable rod 76, and cam 14 and lever 80 by which said rod is operated.

24. The combination with tube 66 and plate 110 having recess 109^a, of the feed slide, and spring actuated fingers 111 and 112 pivoted thereto and provided with recesses 109^b by which the shells are carried forward into a position to be operated upon.

25. The combination with tube 66 and plate 110, of the feed slide and spring actuated fingers carried thereby, said plate and fingers being provided with recesses which together form a recess 109 into which the shells pass from the tube and from which they are carried forward by the movement of the slide.

26. The combination with the feed slide having a recess 126, of plate 127 pivoted in said recess, fingers 111 and 112 secured to said plate, and spring 133 for holding said fingers in operative position.

27. The combination with the feed slide having a recess 126, of a plate 127 pivoted in said recess, fingers 111 and 112 secured to said plate, stud 128 forming a pivot for the plate and engaging the slide, and a spring 133 carried by said stud and acting to hold the fingers in operative position.

28. The combination with the feed slide having a recess 126, of a plate 127 pivoted in said recess, fingers 111 and 112, screws 129 and 130 by which the fingers are secured to

the plate, stud 128 engaging the slide and forming the pivot for the plate, and a spring carried by said stud the free end of which bears against screw 130 acting to hold the fingers in operative position.

29. The combination with the feed slide having recess 126, of plate 127 pivoted in said recess, finger 112 secured to said plate and having a block 131 lying in front of the plate, finger 111 lying above finger 112 and the block leaving a space 132 between said fingers and in front of the block, and a spring for holding said plate and fingers in operative position.

30. The combination with plate 110 having recess 109^a and incline 109^c, of the feed slide, plate 127 pivoted thereto, fingers 111 and 112 secured to said plate and a spring for holding the fingers in operative position, said fingers having recesses 109^b and inclines 109^d, which recesses together form a recess 109 to receive the shell when the slide is at one extreme of its movement, the shell remaining in recesses 109^b and being forced out of recess 109^a along incline 109^c by the forward movement of the slide, the fingers yielding against the power of the spring which retains the shell in contact with plate 110.

31. The combination with plate 110, the feed slide having slot 137, plate 127 pivoted to said slide, fingers 111 and 112 carried by said plate, and a spring for holding the fingers in operative position, of shaft 11 having cam 12, bell crank lever 135 one end of which engages slot 137 the other arm being provided with a roller 139 engaging said cam, and a spring 141 acting to hold the roller in engagement with the cam.

32. The combination with the feed slide having slot 137 and shaft 11 having cam 12, of bell crank lever 135 one arm of which engages said slot the other being provided with a roller 139 engaging said cam, and a spring for holding the roller in contact with the cam.

33. The combination with the feed slide and shaft 11 having cam 12, of bell crank lever 135 one arm of which engages said slide the other having a roller engaging the cam, a spring for holding the roller in contact with the cam and set screw 143 engaging said lever as and for the purpose set forth.

34. The combination with the feed slide, of adjustable plate 115, adjustable plate 114 having flange 116, and wearing plate 110 secured to said flange.

35. The combination with the feed slide and plate 115, of plate 114, block 98, screw 120 having a collar 121 engaging said plate whereby the latter is adjusted, and a bolt 122 passing through a slot in said plate whereby it is locked in position after adjustment.

36. The combination with plate 110 having recess 109^a, the feed slide and fingers 111 and 112 having recesses 109^b, said recesses together forming recess 109, of tube 66, holder 99 which receives the end of said tube and suitable means for adjusting said holder so that the shells will pass into recess 109.

37. The combination with the feed slide and fingers 111 and 112 having recesses 109^b, of plate 114 having flange 116, plate 110 secured to said flange and having recess 109^a said recesses together forming recess 109, tube 66 and holder 99 which receives the end of said tube and rests upon the flange and is provided with a lip 146 which insures that the shells shall pass into said recess.

38. The combination with the feed slide, fingers 111 and 112 having recesses 109^b, plate 110 having recess 109^a, said recesses together forming recess 109, tube 66, holder 99 which receives the end of said tube and is provided with a plate 100, and suitable means for adjusting plate 100 laterally and transversely to cause the holder to register with recess 109.

39. The combination with holder 99, plate 100 by which it is carried and plate 101 upon which plate 100 is superimposed transversely, of screw 106 engaging plate 101 and having a collar 107 engaging plate 100, yoke 104, and screw 102 engaging plate 101 and having a double head engaging the yoke.

40. The combination with holder 99. plate 100 by which it is carried and plate 101 upon which plate 100 is superimposed transversely, of screw 106 engaging plate 101 and having a collar 107 engaging plate 100 by which said plate is adjusted, yoke 104, screw 102 engaging plate 101 and having a double head engaging the yoke by which plate 101 is adjusted, and bolts 105 and 108 passing through slots in said plates by which they are locked in position after adjustment.

41. The combination with the feed slide and fingers 111 and 112 by which the shell is moved forward, said fingers having a space 132 between them, of the clamping slide having a finger 154 adapted to pass between fingers 111 and 112 and clamp the shell after it has been moved into operative position.

42. The combination with plate 110 having recess 119 and the feed slide and fingers 111 and 112 by which the shells are carried to said recess, of clamping finger 154 which passes between fingers 111 and 112 and clamps the shell in recess 119.

43. The combination with plate 110 having recess 119 and the feed slide and fingers 111 and 112, of the clamping slide, block 151 adjustably secured thereto, and clamping finger 154 secured to the block and adapted to pass between fingers 111 and 112 to clamp the shells in recess 119.

44. The combination with the feed slide having a yoke 158, of block 151, clamping finger 154 secured thereto, screw 157 engaging said block and having a double head engaging said yoke whereby the block and finger are adjusted on the slide, and a bolt 152 passing through a slot in the block whereby the latter is secured in position after adjustment.

45. The combination with the clamping slide having loop 159, shoulder 166, and boss 160

carrying roller 161, and the clamping finger, of shaft 11 having cam 13, lever 162 one arm of which engages the shoulder, and spring 164 engaging the other arm of said lever and acting to hold the clamping finger in engaging position, and the roller in contact with the cam except at the instant a shell is being clamped.

46. The combination with plate 110 and the feed slide having fingers 111 and 112 by which the shells are carried forward, of the clamping slide having a finger 154 adapted to pass between fingers 111 and 112 and clamp the shells when the feed slide is at the extreme of its forward movement.

47. The combination with plate 110 having recess 119 and the feed slide having fingers 111 and 112 by which the shells are carried forward, of the clamping slide and clamping finger provided with a recess 156, said clamping finger being adapted to pass between fingers 111 and 112 and clamp the shells in the recesses after the forward movement of the feed slide.

48. The combination with plate 110, the feed slide and fingers 111 and 112 pivoted thereto and provided with concave curves 147, of the clamping slide and clamping finger by which the last shell carried forward by the feed slide is clamped and held, the last previous shell being engaged by the curves and carried forward out of the way.

49. The combination with plate 110, the feed slide, spring actuated fingers 111 and 112 having recesses 109^{b} in which the shell lies while being carried forward, and inclines 109^{d}, of the clamping finger which passes between fingers 111 and 112 and clamps the shell lying in recesses 109^{b}, said fingers 111 and 112 yielding outward and the incline riding over the shell when the backward movement of the feed slide takes place.

50. The combination with plate 110 having recess 119, the feed slide, spring actuated fingers carried thereby having recesses 109^{b}, inclines 109^{d}, and curves 147, of the clamping finger which is provided with a recess 156 which acts in connection with recess 119 to engage the shell after the forward movement of the feed slide, the last previous shell being expelled by curves 147 during the forward movement and the inclines riding over the clamped shell when the backward movement of the feed slide takes place.

51. The combination with plate 110 having recesses 109^{a} and 119, and incline 109^{c}, and the feed slide having spring actuated fingers 111 and 112 provided with recesses 109^{b}, inclines 109^{d} and curves 147, of the clamping finger having recess 156 whereby the shells are fed forward, clamped in position to be operated upon and then expelled from the machine.

52. The combination with the clamping slide and gibs on opposite sides thereof, of screws 149^{f} engaging one of said gibs, angle slides 149^{c} engaging the other gib, and screws 149^{c} having collars engaging the angle slides by which the other gib is adjusted.

53. In combination the tool spindle, the carriage therefor, the driving means for reciprocating said carriage, the intermediate slide upon which the tool carriage is directly supported to receive through it the movement of said driving means, said slide being movable in ways in the supporting frame, and having longitudinal guide ways upon which the carriage may move, the adjusting screw carried by the intermediate slide extending longitudinally through the guide ways, and engaging the carriage to adjust the same along the slide, and the projection at the upper end of the slide adapted to engage the said driving means which consists of the cam, substantially as described.

54. The combination with the trimming tool, spindle and the carrier provided with a lug 187, of the slide having socket 190^{a}, screw 189 which engages the lug and is provided with a collar 189^{a} and a rod 189^{b} extending upward through the socket and the slide, and a spring 190^{b} bearing against the collar and the base of the socket so that the screw, carrier and tool will yield upward without injury to the tool or mechanisms should a shell of greater length than those being operated upon be presented to the tool.

55. The combination with the trimming tool, spindle and carrier, having lug 187, of the slide having groove 188 which receives lug 187, and a lug 190 having a socket 190^{a}, screw 189 having a collar 189^{a}, and a rod 189^{b} extending upward through the socket and lug and provided with a head 197, and a spring in said socket bearing against the collar and the base of the socket which permits the screw and parts carried thereby to yield as and for the purpose set forth.

56. The combination with the trimming tool, spindle, carrier and slide to which it is adjustably connected, of a roller 198 upon said slide, and shaft 4 having a disk 8 provided with a cam groove 9 which is engaged by said roller so that each rotation of said disk will produce an upward and downward movement of the slide and parts carried thereby.

57. The combination with the spindle having a belt pulley 174, a carrier in which the spindle is journaled, and suitable mechanism for reciprocating the carrier, of belt pulley 175, and a belt connecting said pulleys by which rotary movement is imparted to the spindle without regard to the position of the carrier.

58. The combination with the trimming tool, the spindle by which it is carried and which is provided with a belt pulley 174, and a vertically movable carrier in which the spindle is journaled, of shaft 176 carrying a belt pulley 175, a belt connecting said pulleys, bearings 180 in which said spindle is journaled, and set screws for adjusting said bearings.

59. The combination with the feed slide having fingers 111 and 112, and the clamping finger, of the trimming tool, a vertically movable spindle by which it is carried, and air tube 123 through which a blast is passed to blow away the chips made by the trimming tool.

60. The combination with the feed slide, fingers 111 and 112 carried thereby, and the clamping finger, of the trimming tool, and suitable mechanism for moving said tool into operative position when a shell is held by the clamping finger.

61. The combination with the trimming tool, a spindle by which it is carried, and a carrier in which the spindle is journaled, of slide 170 having a dovetail engaged by the carrier, gibs 185 between said carrier and the slide, and set screws for adjusting the gibs.

62. The combination with the trimming tool, a spindle by which it is carried, and a carrier in which the spindle is journaled, of slide 170 to which the carrier is adjustably connected, plate 193 having a dovetail groove to receive a corresponding portion of the slide, gibs between said slide and plate, and set screws for adjusting the gibs.

63. The combination with the feed slide, fingers 111 and 112, the clamping slide, and the clamping finger, of the trimming tool, a spindle by which it is carried and which is provided with a belt pulley, a carrier in which the spindle is journaled, mechanism for imparting vertical reciprocatory movement to the carrier and parts carried thereby, and a belt connecting said pulleys whereby rotation is imparted to the spindle and pulley independent of the movements of the carrier.

64. The combination with the feed slide, fingers 111 and 112 carried thereby, and the clamping finger, of adjustable plate 114 having a flange 116, plate 110 secured to said flange, the trimming tool, a spindle by which it is carried, a carrier in which said spindle is journaled, means for imparting vertical reciprocatory movement to the carrier, and means independent of the carrier for imparting rotation to the spindle and tool.

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

CHARLES R. RICHARDS.

Witnesses:

A. M. WOOSTER,

PEARL M. REYNOLDS.