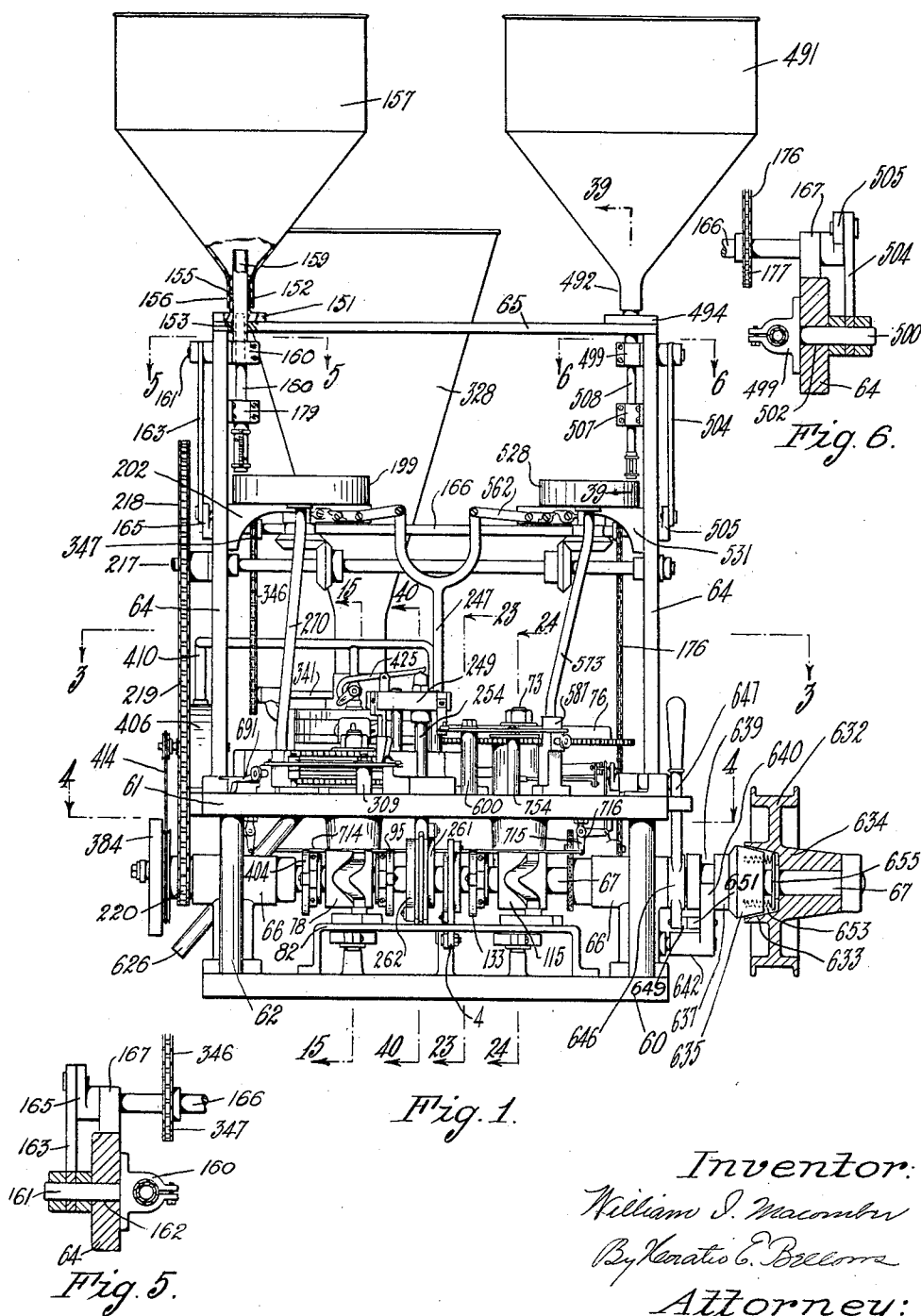


W. I. MACOMBER.
MACHINE FOR LOADING CARTRIDGES.
APPLICATION FILED FEB. 3, 1917.

1,282,609.

Patented Oct. 22, 1918.

12 SHEETS—SHEET 1.



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 12 SHEETS—SHEET 2.

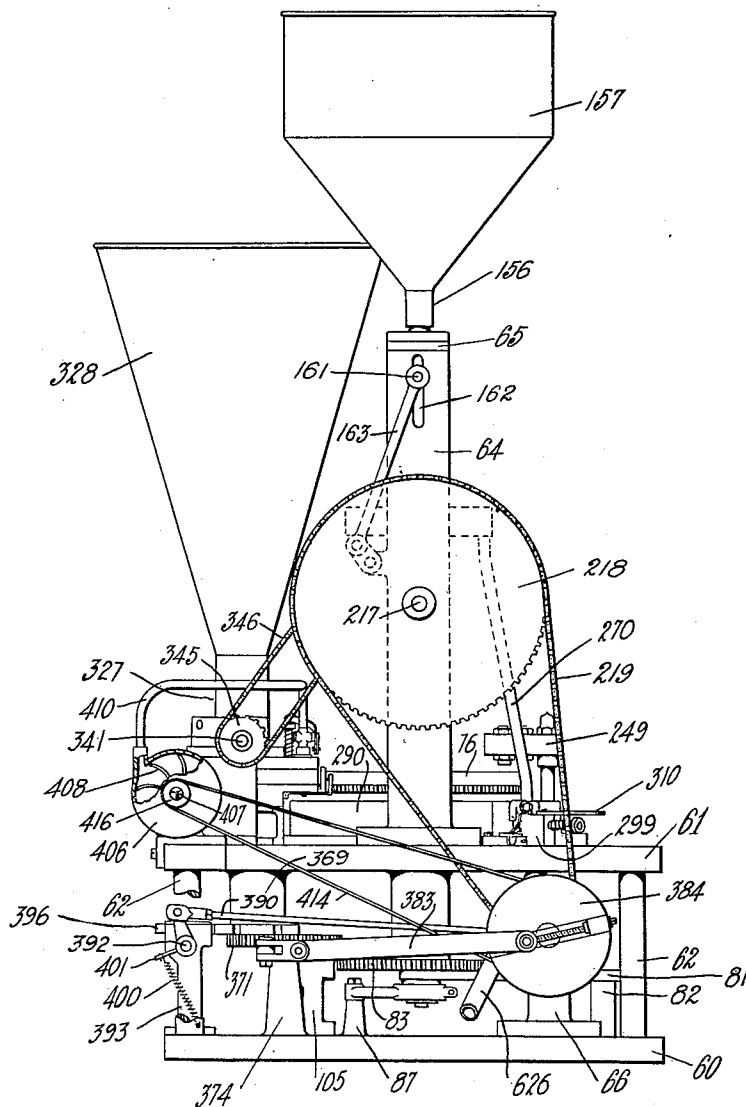


Fig. 2.

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12 SHEETS—SHEET 3.

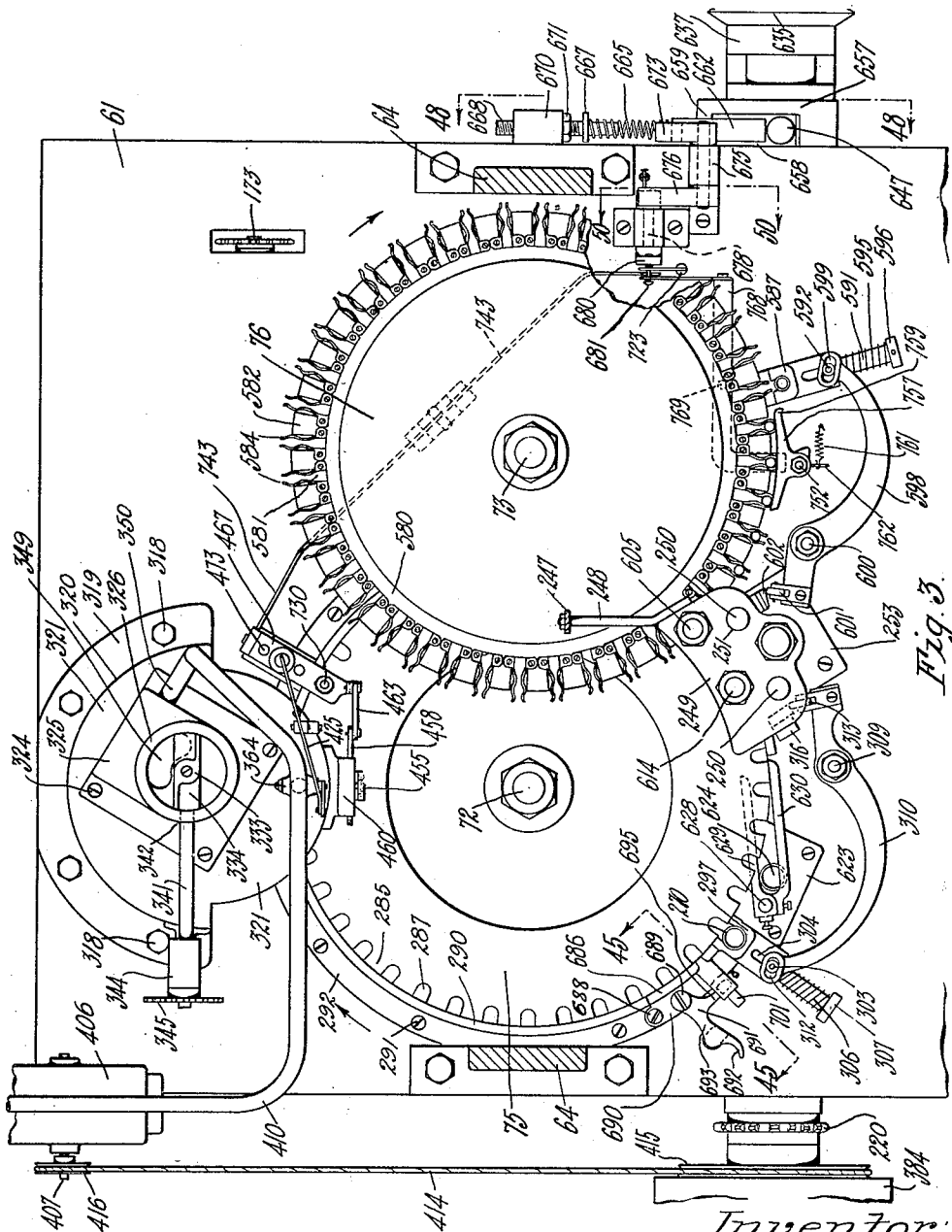


Fig. 3.

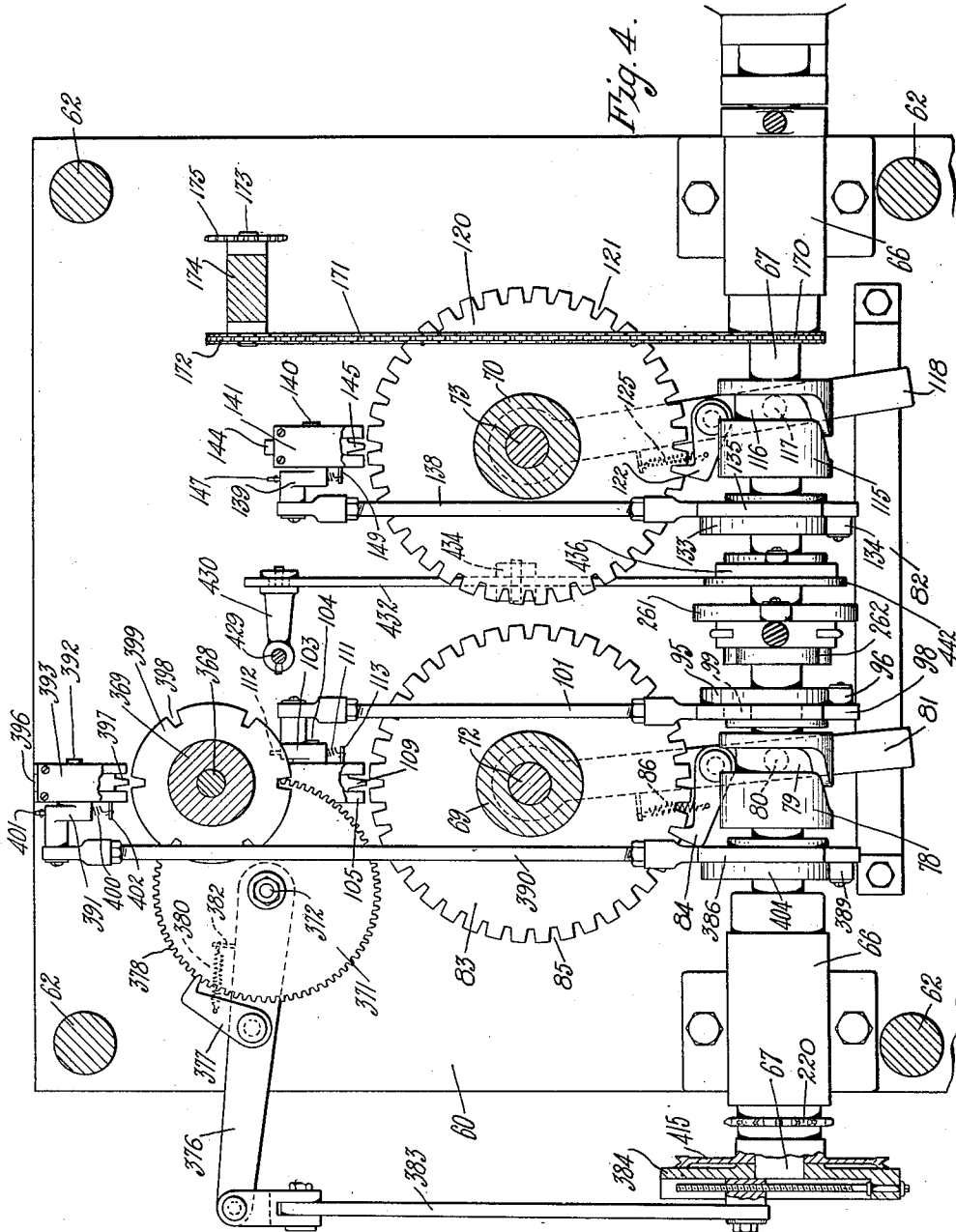
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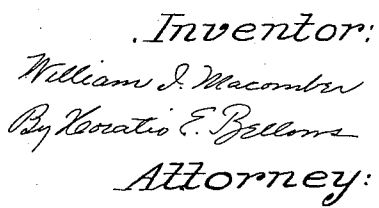
Patented Oct. 22, 1918.
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12 SHEETS—SHEET 5.



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12 SHEETS—SHEET 6.

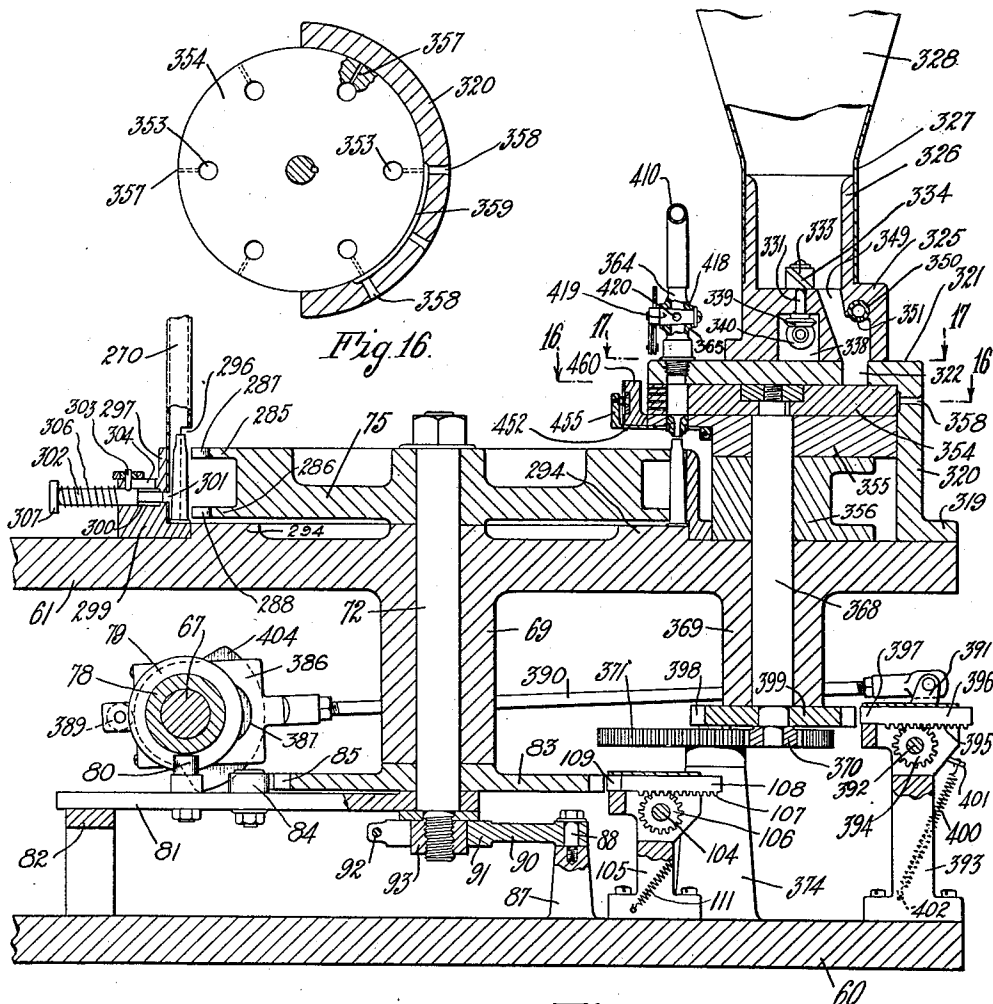


Fig. 15.

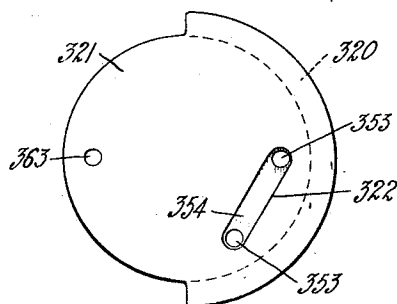


Fig. 17.

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12 SHEETS—SHEET 7.

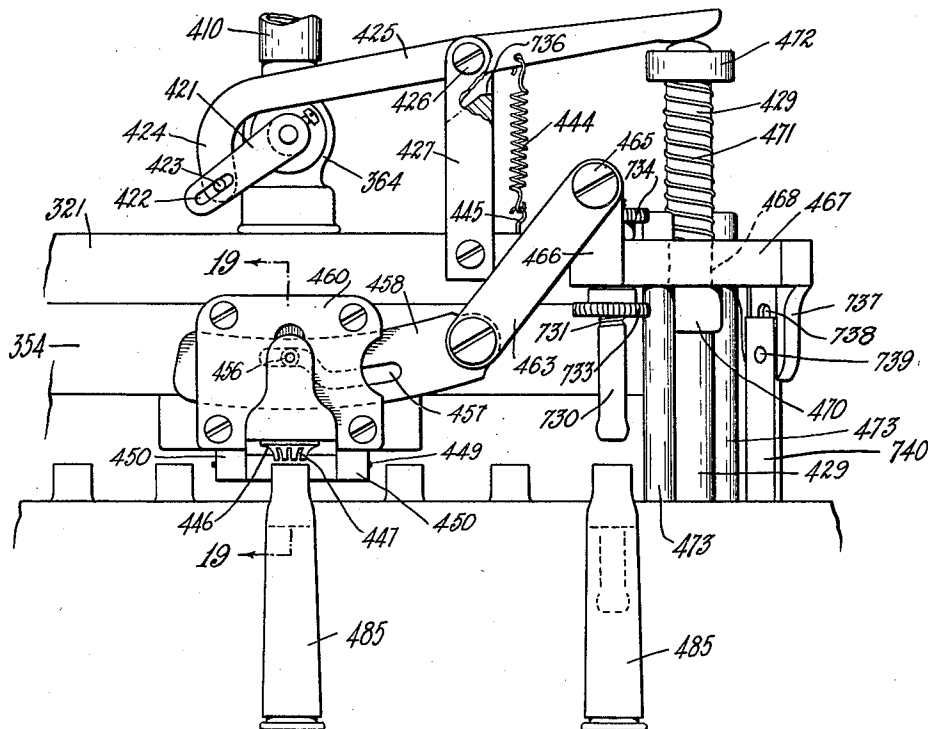


Fig. 18.

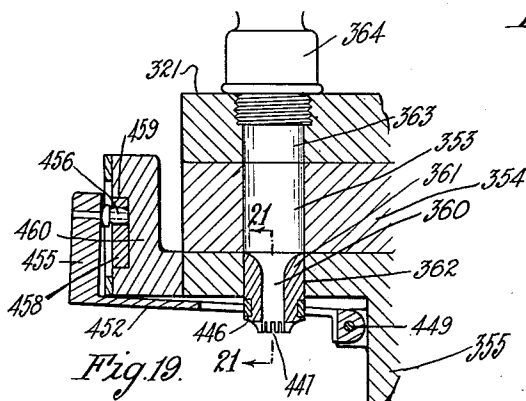


Fig. 19.

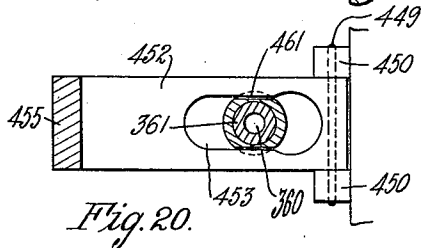


Fig. 20.

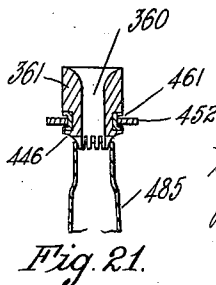


Fig. 21.

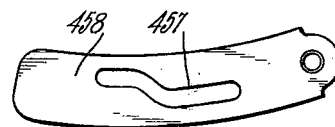


Fig. 22.

Inventor:

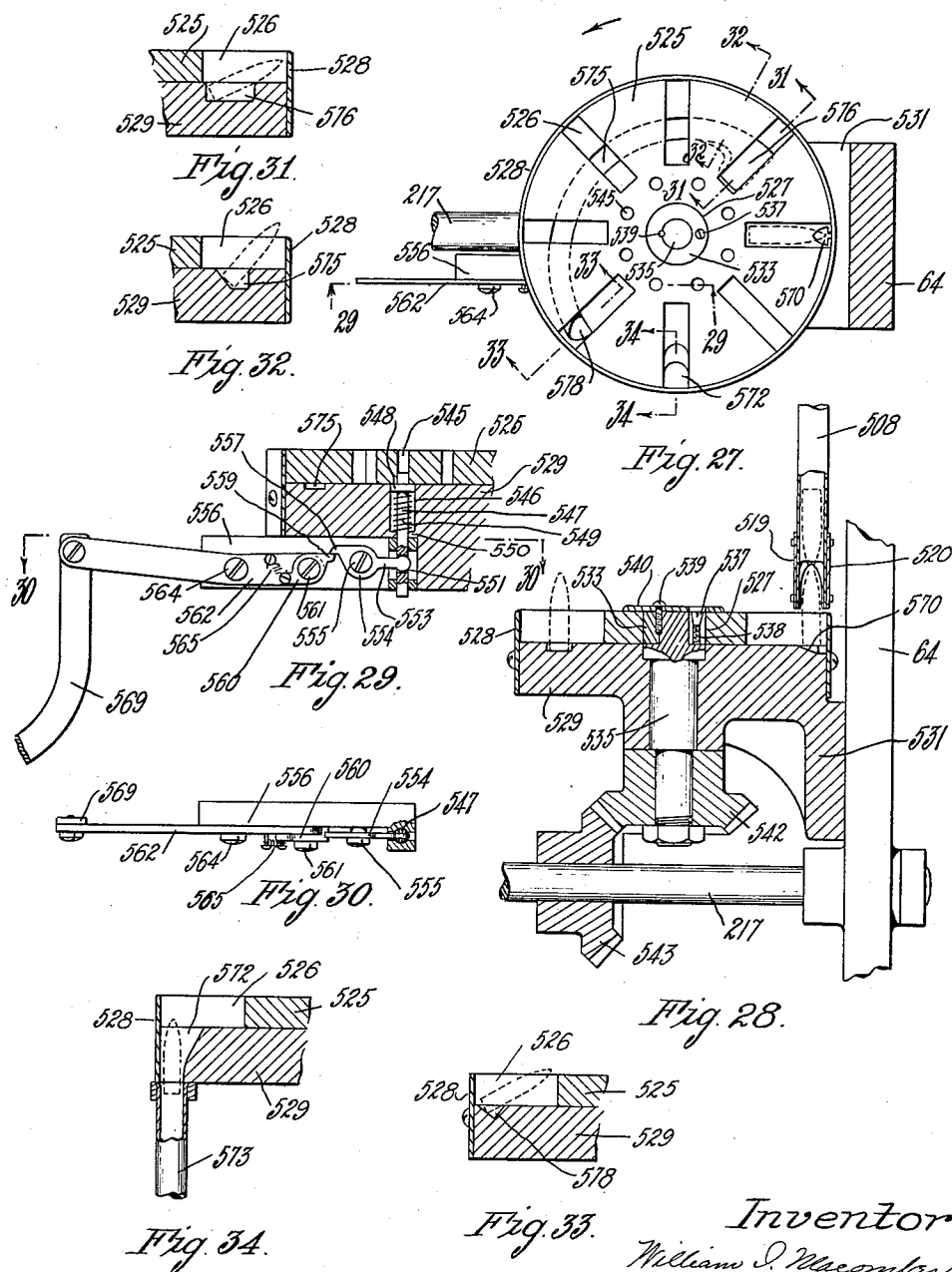
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Patented Oct. 22, 1918.
12 SHEETS—SHEET 9.



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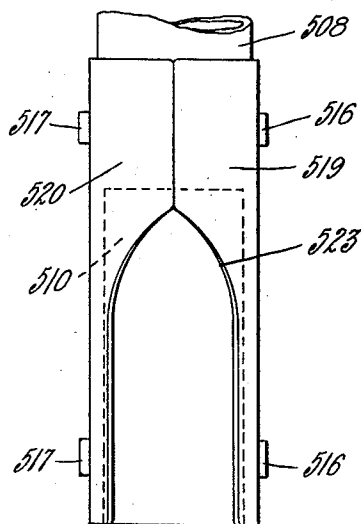
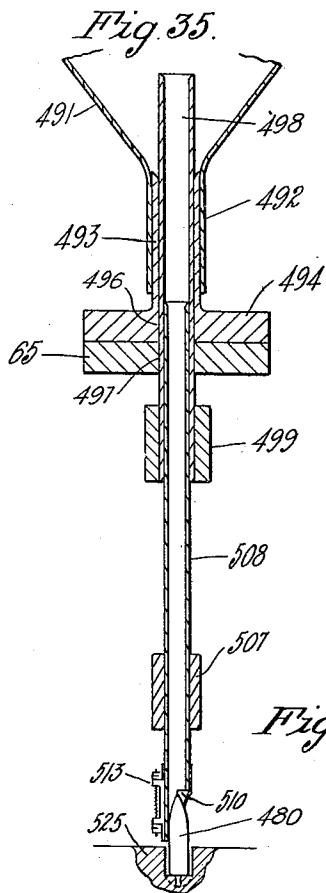
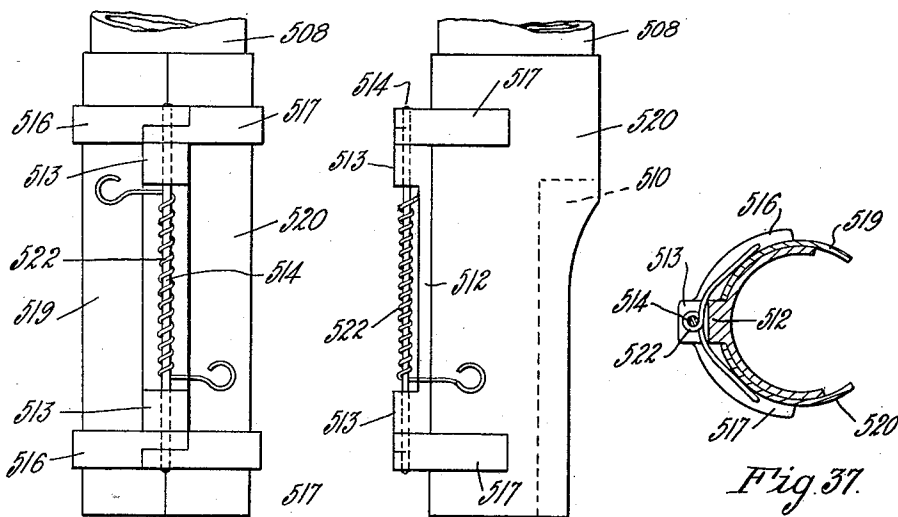
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12 SHEETS—SHEET 10.



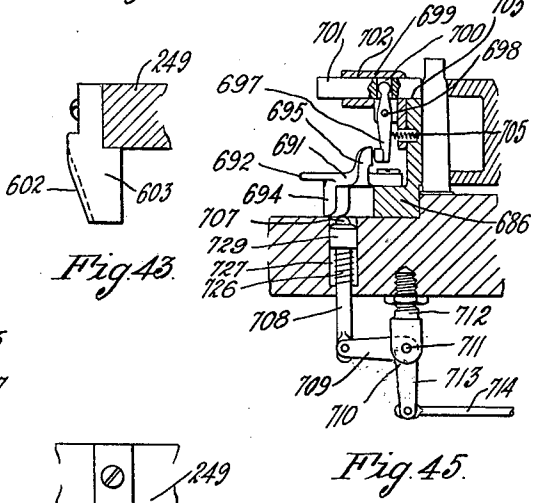
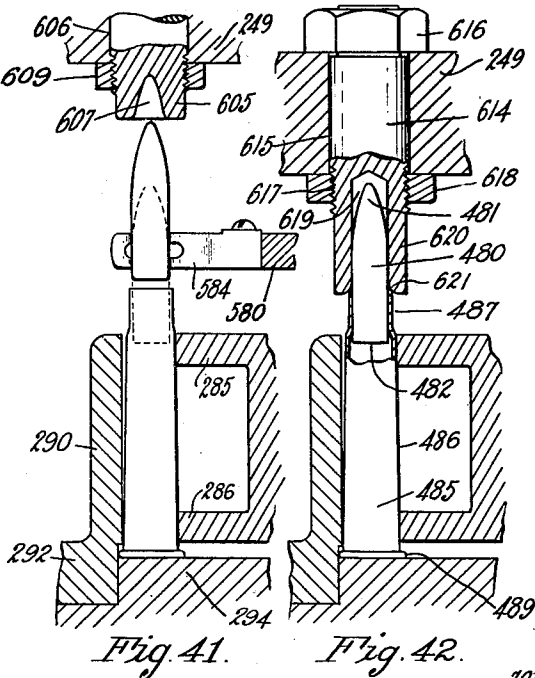
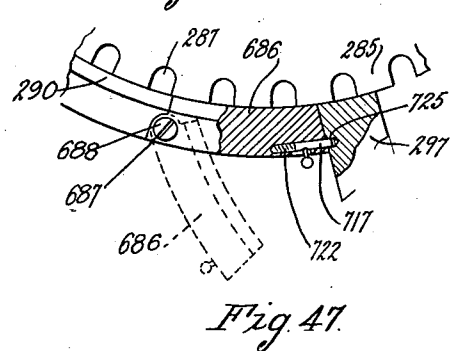
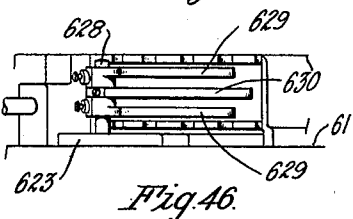
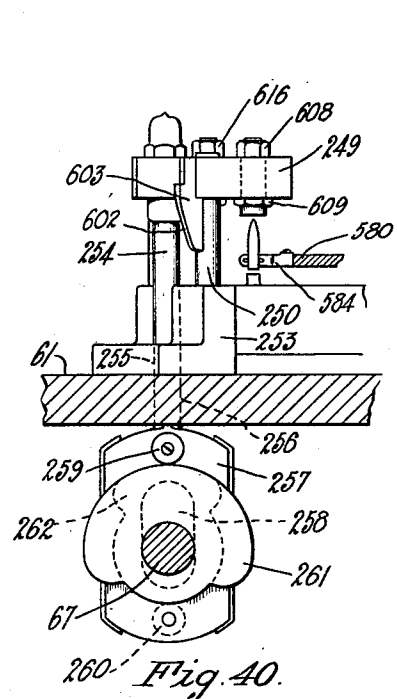
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1,282,609.

Patented Oct. 22, 1918.
12 SHEETS—SHEET 11.



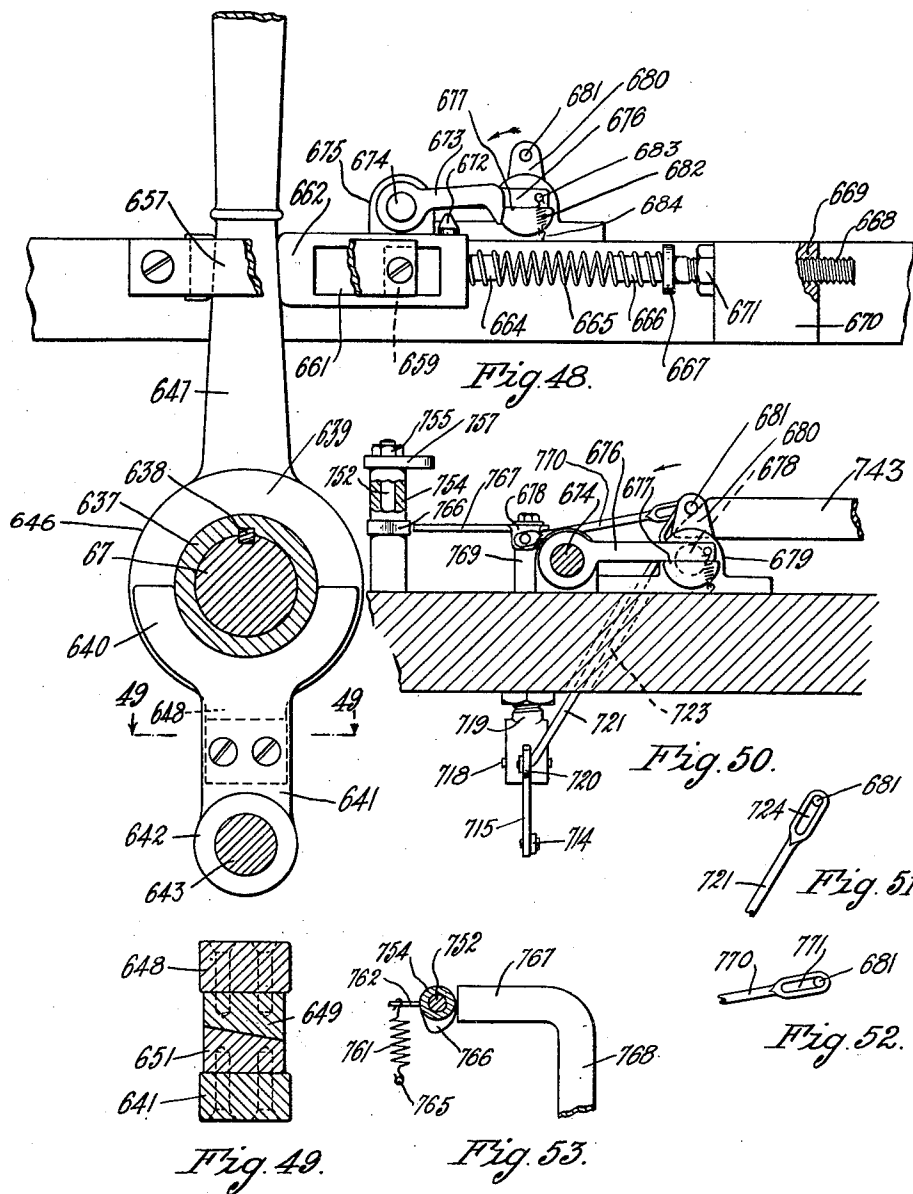
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1,282,609.

Patented Oct. 22, 1918.
12 SHEETS—SHEET 12.



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UNITED STATES PATENT OFFICE.

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FRANK G. ROWLEY, OF PAWTUCKET, RHODE ISLAND.

MACHINE FOR LOADING CARTRIDGES.

1,282,609.

Specification of Letters Patent.

Patented Oct. 22, 1918.

Application filed February 3, 1917. Serial No. 146,391.

To all whom it may concern:

Be it known that I, WILLIAM I. MACOMBER, a citizen of the United States, residing at Cranston, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Machines for Loading Cartridges, of which the following is a specification.

My invention relates to a machine for loading shells, and its essential objects are to automatically, and in a single machine, insert into a shell the powder charge and bullet, bullets, or pellets, and clamp the bullet in the shell; to load the shell at a maximum speed; to save time, labor, and consequent expense; to automatically correct any false position of the empty shell or the bullet before they are submitted to the loading operations whereby clogging or breaking of the mechanism is avoided; to automatically insert the empty shell into the shell carrier disk; to insure the shell against tilting after introduction into the carrier disk; to insure an accurate delivery of the bullet to the shell concentrically of the latter; to avoid destruction of the shell and injury to the machine; to positively feed the powder charge into the empty shell rather than fill the same by gravity, to the end that a complete charge shall be insured in each shell; to deliver the loaded shells uniformly in a position that will prevent marring or denting thereof; to insure that the machine automatically stop instantly if an unloaded shell be absent from its seat in the carrier disk, or if no bullet for a shell is present, or if the powder charge of a shell is absent or inadequate.

Further objects of my invention will appear from the drawings and the following description.

To the above ends my invention consists in such parts and combinations of parts and mode of operation of parts as fall within the scope of the appended claims.

In the accompanying drawings which form a part of this specification, and which illustrate the principles of this invention and the best mode now known to me of applying those principles,

Figures 1 and 2 are front and end elevations respectively of my machine,

Figs. 3, 4, 5 and 6, sections on lines 3—3, 4—4, 5—5, and 6—6, respectively of Fig. 1,

Figs. 7 and 8, a plan view and vertical central section respectively of the shell conveyor,

Fig. 9, a section on line 9—9 of Fig. 7,

Fig. 10, a detail elevation of the shell clasp taken at a different angle from that shown in Fig. 8,

Fig. 11, a transverse section of the same,

Figs. 12, 13, and 14, sections on lines 12—12, 13—13, and 14—14 respectively of Fig. 7,

Fig. 15, a section of certain parts on line 15—15 of Fig. 1,

Fig. 16, a section of the powder feeding device on line 16—16 of Fig. 15,

Fig. 17, a section of the same on line 17—17 of Fig. 15,

Fig. 18, a front elevation of the powder feeding mechanism,

Fig. 19, a section on line 19—19 of Fig. 18,

Fig. 20, a plan view of the powder funnel vibrator,

Fig. 21, a section of the powder funnel engaging a shell taken on line 21—21 of Fig. 19,

Fig. 22, a detail view of the powder funnel actuating cam,

Fig. 23, a partial section on line 23—23 of Fig. 1 showing the powder detector in side elevation,

Fig. 24, a section of the bullet disk and feed on line 24—24 of Fig. 1,

Fig. 25, a detail view of the bullet carrier locking cam,

Fig. 26, a plan of the brake band,

Figs. 27 and 28, a plan and vertical section respectively of the bullet conveyer or rectifier mechanism,

Fig. 29, a section on line 29—29 of Fig. 27,

Fig. 30, a plan on line 30—30 of Fig. 29,

Figs. 31, 32, 33 and 34, sections respectively on lines 31—31, 32—32, 33—33 and 34—34, respectively of Fig. 27,

Figs. 35, 36, 37 and 38, a front elevation, side elevation, transverse section, and rear elevation respectively of the bullet clasp,

Fig. 39, a section on line 39—39 of Fig. 1,

Fig. 40, a section on line 40—40 of Fig. 1,

Figs. 41 and 42, partial sections of the bullet plunger and swaging tools respectively,

Figs. 43 and 44, detail views of the bullet and shell feeding cams respectively,

Fig. 45, a section on line 45—45 of Fig. 3,

Fig. 46, a front view of the shell extractor,

Fig. 47, a plan partially in section of the hinged portion of the shell carrier abutment,

Fig. 48, a section on line 48—48 of Fig. 3,

Fig. 49, a section on line 49—49 of Fig. 48,

Fig. 50, a section on line 50—50 of Fig. 3,

Figs. 51 and 52, side elevations of the terminal loops of the shell and bullet stop motion connections respectively, and

Fig. 53, a transverse section of the post and sleeve for carrying the bullet feeler plate.

Like reference characters indicate like parts throughout the views.

The frame work of my machine may be of any form best adapted for carrying the operative parts. The form thereof herein shown comprises a base 60 adapted to rest upon a bench or to be supported by legs. A table 61 is supported by corner posts 62 upon the base, and carries upon its ends up-rights 64 connected by a cross piece 65. There are suitable bearings 66 on the base for the main shaft 67. The main driving parts of the machine are located between the base and table. In bearings 69 and 70 in the table are rotatably mounted vertical shafts 72 and 73 fast upon which are rotary disks 75 and 76 constituting a shell carrier and a bullet carrier respectively. Both these disks have a step by step rotary motion. The shell carrier is actuated by the main shaft through the following mechanism. Fast on the main shaft is a cam 78 in whose cam channel 79 slides a cam roller 80 upon the end of a lever 81 pivoted at one end to the spindle 72. The free end of this lever is slidably supported by a bridge 82 fixed to the base 60. Fast to the disk spindle 72 is a toothed wheel 83. On the lever is a pawl 84 coöperating with the cavities 85 of the toothed wheel. The pawl is held in operative connection with the disk 83 by the spring 86 having one end attached to the pawl and the other to the lever 81. The vibration of this lever imparts step by step motion to the shell disk. To reduce momentum of the toothed wheel a brake device is provided consisting of a post 87 upon the base 60 to whose top is fixed by a screw 88, an arm 90, integral with whose end is a split ring 91, in whose ends is an adjusting screw 92. The ring 91 embraces a nut 93 fast on the spindle 72. In order to insure a uniform, positive, and absolute registration of the parts coöperating with the shell carrier, the following intermittent locking device is employed. An edge cam 95 on the main shaft engages a cam roller 96 upon the end of a plate 98 provided with an oblong slot 99 adapted to loosely receive the main shaft. On the plate is a rod 101 pivotally

connected with a crank 103 upon a shaft 104 journaled in a housing 105 fixed to the base 60. Upon the shaft 104 is a pinion 106 which engages the teeth 107 of a rack pin 108 slidably mounted in the housing, and having its projecting inner end 109 movable by its actuating cam into marginal slots 85 of the toothed wheel. The pin is withdrawn from the slots, and the cam roller is maintained in engagement with the cam by means of a spring 111 having one end fixed to a pin 112 on the crank, and its other end to a pin 113 on the housing.

The bullet carrier disk 76 has imparted thereto a step by step rotary motion consisting of the following mechanism. A cam 115 upon the main shaft, as shown in Fig. 24, has a channel 116 in which moves a stud or roller 117 upon a lever 118 whose end is pivotally mounted upon the spindle 73 of the carrier. This arm rests upon the bridge 82. Fast upon the spindle is a toothed wheel 120 whose cavities 121 receive a pawl 122 pivoted upon an intermediate portion of the lever 118. The pawl is induced into the cavities by a spring 125 attached at one end to the pawl, and at the other end to the arm 118. The retarding or tensioning device for the disk 76 comprises, as shown in Fig. 26, a split ring 127 embracing the spindle 73, and having its split ends connected by a clamping screw 128. An arm 129 integral with the other end of the ring is fixed by a screw 130 to the top of a post 131 upon the base. The intermittent locking device for the bullet carrier, which is purposed to insure a positive and certain step by step registration of the bullet carrier disk with its coöperating parts, consists, as shown in Fig. 25, of a cam 133 on the main shaft whose edge engages a cam roller or stud 134 upon the end of a plate 135 provided with a longitudinal slot 136 adapted to span the shaft. On this plate is a rod 138 attached to a crank 139 upon a rock shaft 140 mounted in the housing 141 having a pinion 142 engaging the teeth 143 of a rack pin 144 slidably mounted in the housing, and whose end 145 is movable into the marginal cavities of the wheel 120 by the operation of the cam upon the main shaft. The pin is intermittently withdrawn from the cavities between the teeth by a spring 146 having its ends fixed to a pin 147 in the crank, and a pin 149 at the base of the housing.

Shells are arranged and successively fed to the shell carrying disk as follows: Fast upon the cross piece 65, as shown in Fig. 1, is a circular plate 151 provided with a central opening 152 registering with an opening 153 in the cross piece. Integral with the plate is a hollow post 155 embraced by the neck 156 of a conical hopper 157 containing a supply of empty shells. Slidable in the post is a reciprocating tube 159 extending

27

below the cross piece and fast to a cross head 160 which carries a horizontal pin 161 movable in a vertical slot 162 in one of the up-rights 64. Pivotaly connected with the end 5 of the pin 161 is a connecting rod 163 attached to a crank 165 fixed to the end of a shaft 166 rotatably mounted in the bearings 167 upon the uprights 64. The shaft 166, as shown in Fig. 4, is driven by a sprocket 10 wheel 170 fast to the main shaft through a chain 171 engaging a sprocket wheel 172 upon a shaft 173 mounted in a bearing 174, attached to the lower face of the table 61. Upon the shaft 173 is a second sprocket 15 wheel 175 driving the chain 176, engaging a sprocket wheel 177 upon the shaft 166, as shown in Fig. 1. The described driving mechanism serves to vertically reciprocate the tube 159 from a point below the top of 20 the post 155 to a point in the hopper, thus coöperating with the inclined wall of the hopper to agitate the shells and induce them successively downward. Fixed to the up-right 64 below the cross head is a support 25 179 rigidly holding a tubular guide 180, which telescopes the tube 159 and extends into the post forming a conductor section. The lower portion of the guide has a vertical slot 181 of sufficient breadth to permit 30 the passage therethrough of an upright shell. Embracing the guide is a clasp which, as shown in Figs. 8, 10, and 11, consists of a vertically disposed fixed hinge member 183 fast to the guide having shoulders 184 in 35 which is fixed a pintle 185, upon whose ends are pivoted curved arms 187 and 188; arms 187 being fixed to a substantially semi-cylindrical shell 189, and the arms 188 being fixed to a similar shell 190. These hinged sections 40 are pressed around the guide by means of a spring 192 upon the pintle with its ends pressing against the outer faces of the sections. The adjacent vertical margins of the sections are cut away for some distance 45 forming a vertical opening 193, at the upper end of which are laterally extending cavities 194. The sections yield to permit an empty shell to be drawn out of the lower end of the guide, and the cavities 194 are 50 provided to facilitate the delivery of a reversed shell.

It is essential that the shell to be operated upon should be delivered to its carrying disk 75 with its head or closed end downward. In order to insure this result, there 55 is interjected into the path of the shell the following described mechanism for conveying the shells in succession, and for reversing any shell end for end which may 60 initially have begun its travel from the hopper with its closed end upward rather than downward. This mechanism, as shown in Figs. 7 and 8, comprises in a general way a circular conveyer member 196, with radially 65 disposed openings 197, and a central open-

ing or bearing 198. This member is rotatable with its periphery in slidable contact with a rim 199 fixed to a circular base 200 by screws 201 or otherwise. The lower face of the member 196 rests upon the base 200 70 which is supported upon a bracket 202 upon the uprights 64 referred to. The conveyer member 196 is intermittently rotated, and the parts contributing to this actuation thereof are as follows: Frictionally engaged 75 in the central opening 198 of the conveyer is a split ring 204, which surrounds the upper end 205 of a shaft 206. This shaft is purposed to rotate the member 196 under normal conditions, but as will be later described, 80 the member 196 is intermittently locked, during which period of inaction it is essential that the shaft 206 continue its rotation independently of the member 196. This result is effected by means of the split ring 204 being 85 provided at its adjacent ends with registering tapering threaded holes 208, adapted to receive a screw threaded tapering wedge 210. By screwing the wedge member in and out of the holes any degree of frictional 90 engagement between the member 196 and 204 may be secured. The rotary split ring is in this instance attached to the shaft 206 by means of either a removable spline or a 95 screw 212. A washer 213 fixed to the upper end of the shaft 206 assists in retaining the member 196 in position. A gear 215 upon the lower end of the shaft 206 meshes with the gear 216 fast on the shaft 217, journaled 100 in the uprights 64. Upon the shaft 217 is a sprocket wheel 218 driven by a chain 219 engaging a sprocket wheel 220 on the main shaft. Thus continuous motion is communicated from the main shaft to the shaft 206. The means for intermittently locking the 105 member 196 during this rotation to produce a step by step motion timed with the shell disk 75 is as follows. The member 196 is provided with an annular series of openings 221, adapted to register with the hole 223 in the base 200, as shown in Fig. 9, in which 110 hole is slidably mounted a vertical pin 225 adapted to intermittently project into one of the openings 221. This pin is normally held with its upper end in one of the openings by virtue of a collar 227 near its upper 115 end against which abuts the end of a helical spring 228, whose lower end rests upon a resultant shoulder 229 in the opening 223. In the bottom of the pin 225 is an opening 120 230 which loosely receives the end of an arm 231 upon a plate 232 pivoted on a screw 233, fixed in a plate 234 upon the base 200. Upon one end of the plate 232 is a projection 236 engaging a similar projection 237 upon a 125 lever plate 238, pivoted upon a screw 239, fixed in the outer end of a lever 240, pivoted intermediate its length upon the screw 241 upon the plate 234. To one end of the plate 238 is fixed the end of the spring 243 at- 130

tached at its opposite end to a pin 244 in the lever arm 240. The means for pulling the pin 225 out of its seat in one of the holes 221 is as follows: The outer end of the lever arm 240 is pivotally connected with the yoke portion 246 of the vertical rod 247 to whose lower end, as shown in Fig. 3, is fixed a rod 248 fast to a head 249. This head is vertically reciprocable on guide rods 250 through openings 251 in the head. The guide rods are rigid on a block 253 fixed to the top of the table adjacent the shell carrying disk. The head, as shown in Fig. 40, is fast to the top of a rod 254 which passes through openings 255 and 256 in the base and table respectively. Upon the lower end of the rod 254 is a plate 257 provided with a central opening 258 to loosely embrace the driving shaft 67. Upon the opposite faces of the plate 257 at opposite ends are cam rolls 259 and 260 engaging respectively cams 261 and 262 fixed to the driving shaft. These cams serve to positively reciprocate the head, and through the described lever connections intermittently depress the pin 225 and unlock the shell conveyer member 196 so that said member has a step by step motion. The empty shells are received in the disk 196 through the tube 180 as follows when the shell has its head or closed end directed downwardly. The head enters one of the slots 197 of the member 196 at one end thereof and rests upon the face of the base 200. The rotary movement of the member 196 draws the empty shell out of the lower end of the tube 180 through the slot 181 thus distending the plates 189 and 190 and permitting passage through slot 193. The empty shell is at this instance in vertical position, and it is essential that it be laid down in a horizontal plane with its closed end adjacent the periphery of the member 196. This is accomplished by gravity in conjunction with an arcuate groove or angular recess 264 in the base 200, as shown in Figs. 7 and 8. That is to say, the head of the shell rests upon the marginal portion 266 of the cavity 264, and the weight of the shell tilts and throws it upon its side into the radial slot 197 in which position the shell is then carried in the direction of the arrow shown in Fig. 7 to a curved discharge opening 268 in the base 200 at its periphery, where the weight of the head impels the shell head-first downwardly through a guide 270 whose upper end is fixed to the bottom of the base 200, and whose lower end leads to a point adjacent the shell carrier 75. When, however, the shell leaves the hopper with its open end downwardly directed, and it is therefore necessary to reverse its position before it reaches the shell carrying disk, the course of the shell is as follows. It enters the radial slot 197 with its open end in contact with the marginal portion 266 of the base 200,

and by gravity and the recess 264 is tilted and thrown upon its side with its open end toward the periphery of the member 196. It is essential, however, that the shell be reversed before it is delivered to the guide 270. This result is effected as follows. During the rotation of the member 196, the head of the shell falls by gravity into the broad end 272 of an inclined tapering arcuate slot 273. The slot or groove extends from a point near the center of the base to a point 274 near the periphery thereof. The latter portion is the most narrow and shallow; and adjacent this portion is a somewhat deeper portion or cavity 275. The described initial position of the shell is shown in broken lines in Fig. 12, with its open end elevated somewhat above the plane of the upper face of the member 196. The shell, in this position, is carried into contact with a shoulder 277 upon a cam shaped plate 278 fixed to the wall 199 and extending in a horizontal plane over the top of the member 196. From the shoulder 277 the cam plate has a portion 280 corresponding with the curve of the channel 273. The shell, after its initial contact with the shoulder 277 is gradually elevated, as shown in Fig. 13, until it assumes a vertical position head down which it maintains until the head reaches a narrow marginal surface 282 adjacent the auxiliary angular cavity 275 whereupon the head drops into the latter cavity by gravity and the shell falls upon its side with the head toward the periphery of the conveyer. Thence the latter moves the shell along the upper surface of the base 200 until it reaches the opening 268 in the latter, and follows the course of the shell already described.

The shell carrier disk 75, as shown in Fig. 15, is provided with upper and lower peripheral flanges 285 and 286 having respectively semi-circular marginal cavities 287 and 288. In the present instance, the cavities 287 are of less diameter than the cavities 288 to accommodate shells of greater diameter at their closed ends than at their open ends. Otherwise, shells of this character might be so unstable in the carrier as to interfere with successful automatic operation upon the shell. The shells are retained in the marginal cavities of the carrier 75 by a circular abutment or wall 290 contacting with the periphery of the flanges, and is fixed to the table by screws 291 in its base flange 292. This abutment extends around the major portion of the carrier, but a portion thereof is omitted to permit access to the carrier of certain feeding and discharge devices. The table is provided below the carrier member with a supporting surface 294 for the head of the shell as it is being impelled by the carrier.

The shells as they descend through the tube 270 are positioned vertically adjacent

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the flanges of the carrier 75. The lower end of the tube, as shown in Fig. 15, is cut away to form a vertical opening 296 adjacent the carrier, and of slightly greater length than the length of the shell. The shell is automatically delivered from this tube through the opening into the carrier cavities as follows. Partially surrounding the lower end of the tube 270 is a wall or housing 297 fixed to the table 61 and provided in its lower and extended portion 299 with a bore 300 which registers with the opening 301 in the wall of the tube 270. In the bore 300 is slidably mounted a plunger 302 carrying a pin 303 movable in a slot 304 in the housing. The plunger is normally held out of contact with the shell by a helical spring 306 having one end bearing against the housing and its other end against a shoulder 307 upon the plunger. The plunger is intermittently advanced against the successive shells as follows:

Upon a stud or post 309 in front of the member 75, as shown in Fig. 3, is pivotally mounted a lever 310 in one end of which is an elongated slot 312 through which loosely passes the pin 303. Upon the other end of the lever is a cam roll 313 engaging the face 314 of a cam 315 on a depending arm 316 fixed to the head 249 and shown in Fig. 44. Since the head 249 vertically reciprocates, as heretofore described, the plunger is forced successively against a shell at each step in advance of the shell carrier and inserts the shell into its seat.

The carrier disk advances the shells as they are successively introduced thereto into a position to facilitate the reception of a powder charge therein. The mechanism for inserting the charge of powder is as follows: Upon the rear portion of the table is fixed by screws 318 the flange 319 of a support comprising a vertical arcuate housing wall 320 provided with a circular top 321 having an oblong slot 322, shown in Fig. 15. Fixed to the top 321 by screws 324, or otherwise, is a block, housing, or casing 325 integral with the top of which is a hollow post or tube 326 embraced by the neck 327 of a hopper or funnel 328 adapted to hold a supply of powder. Rotatable in the upper portion of the casing 325 is a shaft 331 to whose upper portion is fixed an agitator 333 comprising inclined radial blades 334 in slidable contact with the upper surface of the member 325 which constitutes the bottom of the magazine formed by the tube 326. The block 325 is cut away in its central portion to form a chamber 338 in which is a pinion 339 upon the shaft 331. Journaled in an opening 342 in the block and supported, as shown in Fig. 3, in a bearing 344, fastened to the housing wall 320, is a shaft 341 carrying a pinion 340 meshing with pinion 339. On this shaft also is a sprocket wheel 345

driven by a chain 346 engaging a sprocket wheel 347 upon the shaft 166, as shown in Fig. 1. Thus the member 333 is continuously rotated. The powder agitated by this member passes through a downwardly inclined chute 349 in the block 325 which chute registers with the opening 322 in the wall 321. The agitator insures a uniform density of the descending powder and thus contributes to insure a uniform amount of powder in the shells. An air pipe 350 is fixed in the top 325 of the support and is provided upon its lower side with perforations 351 opening into the upper portion of the powder chute 349. Air through this pipe, as shown in Figs. 15, 16 and 17, forces the powder downwardly through the chute into two adjacent holes 353 of an annular series of charge holes in a rotary disk 354 resting upon a plate 355 fast to a block 356 attached to the table 61 and constituting a part of the support. The air current is a positive means and insures a complete charging of the holes 353. Since the air is forcing the powder into certain of the holes 353, it is obvious that an escape of the air must be afforded after its work of impelling the powder has been performed. This escape is provided by attenuated passages 357 in the disk 354 leading from the holes 353 to the periphery of the disk, and connecting with the annular series of larger openings 358 in the wall 320 through an oblong groove 359 in said wall connecting the larger openings. The radial passages 357 being of less diameter than the powder grain, the air is permitted escape without interfering with the descent of the powder. The disk 354 has a step by step movement timed with the movement of the shell carrier which brings the holes 353 successively and intermittently into registration with the opening 360 in a tube or funnel 361 slidably mounted in a discharge opening 362 in the plate 355, as shown in Fig. 19. In alinement with the funnel is an opening 363 in the top 321 of the housing in which opening is a pipe 364 provided with a valve 365 adapted to control the admission of air through the openings 363, 353, and 360. The air through the pipe 350 is continuous, and the air through the pipe 364 is, because of the valve 365, intermittent. The construction of the valve and the means for controlling its action will be hereinafter described. The use of pneumatic means for forcing the powder through the funnel into a shell insures a complete charge therein and by a positive means.

The rotation of the power charge disk 354 already referred to is effected through a shaft 368 fast to the disk, rotatably mounted in a bearing 369 on the table 61, as shown in Fig. 15. Upon the lower end of the shaft is fixed a pinion 370 engaging and driven by a gear 371 rotatably mounted on a stud 372

fixed in a support 374 upon the base 60. Pivoted at one end to the stud 372 is a lever arm 376 to an intermediate portion of which is pivoted a pawl 377 engaging the teeth 5 378 of the gear 371, as shown in Fig. 4. The pawl is maintained in engagement with the teeth by a spring 380 fixed at one end to the pawl, and at the other end to a pin 382 upon the lever. Upon the free end of the lever is 10 pivotally attached the connecting rod 383 of an adjustable crank disk 384 fast to the main shaft 67.

The powder charge disk 354 is locked at the end of each of its step by step movements by the following mechanism similar 15 to the locking mechanisms already described. This comprises, as shown in Fig. 15, a slotted plate 386 embracing through its slot 387 the main shaft, and carrying upon its outer 20 end a stud or cam roll 389, and upon its opposite end a rod 390 pivotally connected with a crank 391 whose shaft 392 is journaled in an upright housing 393 fixed to the top of the base plate 60. A pinion 394 fast 25 to the shaft engages the teeth 395 of a rack pin 396 whose end 397 enters the cavities 398 of a locking disk 399 fast to the spindle 368. A spring 400 has one end attached to a pin 401 upon the crank arm 391, and its other 30 end attached to a pin 402 fixed to the housing 393 by which means the cam stud is kept in constant contact with its cam 404 fixed to the main shaft.

The means for furnishing air to the powder 35 charging device may be of any pneumatic character preferred either operated by the machine, or from any other convenient source. In the present instance, the air is supplied by a compressor or blower whose 40 casing 406 is mounted on the table 61, as shown in Figs. 2 and 3. The shaft 407 of the compressor carries the blades 408, and the casing has leading therefrom a pipe 410 leading to the pipes 364 and 365. The compressor is driven by a belt 414 from a pulley 45 415 fixed to the main shaft, and engaging a pulley 416 upon the shaft 407.

The means for controlling the intermittent ingress of air through the pipe 364 is as follows: The valve 365 in this pipe is in detail, as shown in Fig. 15, a valve casing 418 50 in which is a valve cock 419 provided with a port 420. The cock is extended beyond the casing, and has fixed thereto, as shown in Fig. 18, a lever arm 421 provided with a longitudinal slot 422 in which slidably 55 moves a pin 423 upon the bent end 424 of a lever 425 pivoted intermediate its length by a pin 426 to an upright 427 fixed to the casing 321. The free end of the lever 425 rests 60 upon the top of a vertically reciprocating rod 429 whose lower end is fixed to a stud 430 loosely connected with the rear end of a lever 432, pivoted intermediate its length 65 to a standard 434 upon the base 60, as shown

in Fig. 23. The opposite end of the lever has pivoted thereto a vertically disposed plate 436 provided with a central longitudinal slot 437 through which passes the main shaft. On opposite sides of the plate at 70 the top and bottom ends thereof respectively are studs or cam rollers 439 and 440, which engage the edges of cams 441 and 442 respectively fixed to the main shaft. These cams vibrate through the lever arms 425 and 75 421 the valve cock 419. The arm 425 is maintained in contact with the reciprocating rod 429 by means of a helical spring 444 having one end attached to said arm, and the other end attached to a hook 445 upon 80 the casing 321.

After the shells have been received into the disk 75 they are first conveyed to the mechanism for positively introducing the powder charge therein. Each shell is successively presented with its open upper end 85 below the powder funnel 361, as shown in Fig. 18. This funnel has upon its lower end a reduced or frusto conical portion 446 provided with a series of vertical slots 447 extending upwardly in its wall from its lower 90 edge. These slots are of less width than the dimensions of a powder grain, but are of sufficient width to permit the escape of air. This funnel descends into the top of each 95 successive shell, assuming the position shown in Fig. 21, wherein, it will be noted that the open end of the shell extends partially over the slotted portion 446 of the funnel, thus admitting the discharge of powder downwardly, while the air escapes to the atmosphere through the uncovered upper portions 100 of the vertical slots 447.

Provision is made for the vertical reciprocation of the funnel to permit its removal 105 from and introduction into successive shells and to insure such a registration with the shell as to prevent leakage of the powder exterior of the shell. Pivoted upon a pintle 449 in lugs 450 upon the plate 355 is a flat 110 arm 452 provided with an oblong intermediate slot 453. Upon the free end of the arm 452 is a vertical finger 455 carrying upon its inner face a cam roll 456 movable in an irregular longitudinally disposed cam 115 slot 457 in an arcuate cam plate 458 slidably mounted in a guideway 459 in a housing 460 fixed to the plate 355. The funnel 361 extends through the opening 453, and is provided with lateral slots 461 which receives the plate 452 at each margin of the 120 opening 453 whereby the funnel is prevented from axial movement without impediment to its vertical reciprocation. Upon one end of the cam plate 458 is pivoted a link 463 125 whose opposite end is pivotally connected by a pin 465 to a post 466 fast to a cross head 467, provided with an opening 468 to slidably receive the rod 429. The head rests upon the shoulder 470 upon the rod, 130

and the head is maintained in contact with the shoulder by a helical spring 471 surrounding the rod, and having one end abutting against the head, and the opposite end abutting against a collar 472 fixed to the upper end of the rod. The cross head is guided in its reciprocation by means of vertical guide rods 473 passing therethrough fast in a block 475 fixed to the table 61, as shown in Fig. 23. Thus it will be seen that the reciprocation of the rod vibrates the cross head and the funnel through the link and cam connections described.

The operation of the mechanisms for impelling the powder into the shell, and for guiding the same are relatively timed so that a blast of air is admitted through the valve 365 at the instant that the powder charge in the opening 353 of the powder conveyer disk is presented the valve, above the powder funnel. Thereupon and after an empty shell has been brought into vertical alinement with the funnel, the latter is moved downwardly into the shell and the powder is next thereby blown there-through into the shell.

After a shell has received its charge of powder, it is conveyed by the disk 75 to a position preparatory to receiving the bullet. The bullet 480 in the present instance is of oblong shape, having a round or pointed end 481 and a blunt base 482, as shown in Fig. 42, in which figure is also shown the usual form of shell 485 comprising a tapering body portion 486, a reduced neck or open end portion 487, and a flange 489 upon its head or base end.

The bullets are fed to the bullet carrying disk 76 in a manner similar to that of feeding the shells to the shell carrier 75. A conical hopper 491 has its reduced neck 492 embracing a hollow post 493 integral with a plate 494, fixed to the cross piece 65, and having an opening 496 registering with an opening 497 in the cross piece. Slidably mounted in the base is a reciprocating tube 498 fixed in a cross head 499 rigid with which is a pin 500 slidable in a vertical slot 502 in the second upright 64. A connecting rod 504 is pivoted to the end of the pin, and to a crank 505 upon the end of the shaft 166 by which means the tube 498 is reciprocated in the hopper and the individual bullets induced therefrom. Fixed to the upright 64 below the cross head is a support 507 rigidly carrying a tubular guide 508 which extends within the tube 498 and coöperates with the same to form a bullet conductor. The lower portion of the guide 508 has a vertical slot 510 of dimensions ample to deliver a vertically disposed bullet in a lateral direction. A bullet delivery clasp, as shown in Figs. 35 to 38 inclusive, consists of a vertical hinge shoulder 512

upon the guide having lugs 513 carrying a pintle 514 upon whose ends are pivoted curved arms 516 and 517. The arms 516 are rigid with a curved shell 519, and the arms 517 are fixed to a like shell 520. The shell sections are clasped to the guide by a spring 522 mounted upon the pintle with its ends abutting against the exterior of the sections. The adjacent margins of the sections are cut away to form a vertical opening 523.

It is necessary that the blunt end of the bullet be first presented to the bullet carrying disk. The mechanism for insuring such a position and rectifying the position of any bullet initially introduced into the guide with its pointed end first comprises, as shown in Figs. 27 and 28, a rotatable conveyer member 525 of circular outline having radial openings 526 and a central opening 527. The periphery of this member is embraced by a rim 528 fast to a circular base 529. The bottom face of the member 525 contacts with the base 529 mounted on a bracket 531 fast upon one of the uprights 64. The member 525 is intermittently rotated as follows. A split ring 533 is located in the central opening 527 of the conveyer, and surrounds a shaft 535, which under normal conditions rotates the member 525. The latter member, however, is intermittently locked, and during the locked interval, the shaft 535 continues to rotate independently thereof. This is permitted by means of a tapering wedge 537 engaging in tapering threaded holes 538 in the adjacent ends of the split ring. The split ring is attached to the shaft 535 by means of a screw 539 or otherwise.

Fixed to the top of the shaft 535 is a washer 540 which overlaps the member 525. A gear 542 on the shaft engages a gear 543 upon the shaft 217. The intermittent locking means for the member 525 includes an annular series of openings 545 adapted to register with the hole 546 in the base 529. In the latter is a slidable pin 547 movable into the openings 545. The pin has a collar 548 near its upper end against which presses a vertical spring 549 whose other end presses against an internal shoulder 550. In an opening 551 in the pin is the end of an arm 553 upon a plate 554 pivoted by a member 555 in a plate 556 upon the base. A projection 557 on this plate engages a projection 559 upon a second plate 560 pivoted on a screw 561 upon a lever 562. The latter is pivoted on a screw 564 in the plate 556. The plate 560 is tensioned by the spring 565 having its opposite ends attached to the lever arm and to the plate itself. The lever 562 has its end pivotally connected with a yoke portion 569 of the vertical rod 247, the vibration of which already described pulls the pin 547 successively out of the holes

545. The step by step motion of the conveyer 525 will thus be seen to be similar to and timed with the intermittent travel of the shell conveyer 196. A bullet descending through the tubes 498 and 508 enters one of the longitudinal slots of the conveyer disk 525 with its base directed downwardly. The axial movement of the latter member throws the bullet out of the slotted end of the tube through the slot 523 formed in the yielding shells embracing the lower part of the conductor. The upright bullet is thrown into a horizontal position in the slot 526 with its point directed toward the axis of the member by the assistance of an angular recess 570 in the base 529 as shown in Fig. 28. In this position, the bullet is carried in the direction of the arrow shown in Fig. 27 to an inclined discharge opening 572 in the base; whence, by gravity, the bullet is impelled with its blunt end directed downwardly through a conductor 573 whose upper end is fast to the base 529, and whose lower end extends adjacent the bullet carrier 76. If the bullet, however, leaves the hopper point downward, the blunt portion of the bullet by gravity cooperating with the cavity 570 throws the bullet into a horizontal position with its point toward the periphery of the conveyer, as shown in Fig. 27. The bullet is reversed during the rotation of the member 525 by being moved over the end of an arcuate slot 575 which end 576 is of greater depth than elsewhere, but which gradually grows more shallow and decreases in width as it approaches its opposite end adjacent the periphery of the member 525. At the shallow end of the channel is a deeper cavity 578. When the base of the bullet falls into the cavity 576, the bullet is inclined, as shown in Fig. 31, and as the bullet progresses along the inclined narrowing channel 575, as shown in Fig. 32, the bullet gradually assumes a vertical position until it reaches the cavity 578 where, by gravity, and the shape of the cavity, the bullet is tilted to a horizontal position with the point of the bullet directed toward the axis of the member 525, whereupon the bullet is in position to be discharged through the opening 572 down the conductor 573. The bullet carrier 76 comprises a peripheral flange 580 provided with a series of radial openings 581 forming peripheral rectangular teeth 582. Fixed to the adjacent faces of these teeth, as shown in Fig. 3, are resilient clips or fingers 584 which project slightly beyond the periphery of the flange, and are adapted to receive and frictionally embrace the bullets as they are discharged from the conductor. The lower end of the conductor 573, as shown in Fig. 24, is cut away to form an opening 585 adjacent the flange of slightly greater length than the length of the bullet. This

opening is enlarged at its bottom by a cavity 586 to allow passage therethrough of the end of the spring clips. The bullet is automatically inserted into the clips as follows: The lower end of the tube is partially surrounded and rigid in the housing 587 fixed to the table 61 and having an extension 588 provided with a horizontal bore 589 which registers with an opening 590 in the tube. A plunger 591 is slidably mounted in the bore, and has a pin 592 thereon movable in an oblong slot 594 in the housing. A helical spring 595 surrounds the plunger and bears against the extension 588 and against a shoulder 596 on the plunger. This plunger is intermittently advanced against successive bullets, as shown in Fig. 3, by means of a lever 598 provided with a slot 599 through which the pin 592 projects. This lever is pivoted intermediate its length to a post 600 upon the table and has on its opposite end a cam roll 601 which engages the cam face 602 of a cam plate 603 fixed to the head 249, as shown in Fig. 43. The reciprocation of this head already described advances the plunger, and thus forces the bullet out of the conductor 573 into a pair of the clips 584, whereupon the bullet carrying disk advances a step. The flange of the latter disk overlaps the margin of the shell carrying disk, and is preferably spaced some distance above the latter. The shell carrier 75 and bullet carrier 76 each rotate step by step in the direction of the hands of a clock intermittently bringing their respective seats successively into vertical alinement with each other at the end of each advance. As the shell loaded with its charge of powder reaches a position in vertical alinement with a certain one of the series of bullets carried by the bullet carrier, the bullet is forced down into the open retracted end of the shell by a driving tool or plunger 605 in an opening 606 in the reciprocating cross head 249. This tool is provided in its lower end with a conical centrally disposed cavity 607 to conform to the contour of the pointed or rounded end of the bullet, as shown in Fig. 41. The tool is vertically adjustable by means of nuts 608 and 609 upon the threaded upper and lower portions of the tool, above and below the head 249. The tool reciprocates at the end of each intermittent advance of the bullet carrier.

After the bullet has been inserted into the shell as described, the step by step movement of the disks 75 and 76 bring the next holes into alinement and the bullet so inserted is carried to a position below and in vertical alinement with a swaging tool or plunger 614 mounted in an opening 615 in the member 249. This tool has a nut 616 upon its upper end, and is provided upon its exterior lower portion with a thread

DRAFTSMAN

27

617 engaging a nut 618 abutting against the lower face of the head, and is thus vertically adjustable. The lower end of the tool is tubular, having a central vertical cavity 619 forming an annular wall 620 provided with a rounded end portion 621 adapted to frictionally engage the exterior of the neck portion of the shell and press the same tightly into engagement with the exterior of the bullet. The bullet driving and swaging tools are vertically reciprocated by the mechanism hereinbefore described.

After leaving the swaging tool, the shell and bullet is advanced to the shell removing or unseating device which in detail, as shown in Figs. 3 and 46, consists of a plate 623 fixed to the table adjacent the shell carrier and provided with an opening 624 communicating with the upper end of an inclined delivery tube 626 fixed in the table 61. Near one end of the plate 623 is a post 628 to which is fixed in vertical alinement with each other two spaced horizontal arms or rods 629 inclined toward and into contact with the carrier 75 and with the inner faces of the upper and lower flanges of the same, so as to be in the path of the advancing shell and engage its inner side. These arms have inward bends. The third arm or finger 630, horizontally disposed and having an outward bend, is fixed to the post at a point intermediate the first two arms and spaced laterally from said arms forming a longitudinal opening in the resultant guide frame, which opening terminates at a point immediately over the opening 624. As the shell carrier advances the completely loaded shells they are forced by the disk and guided by the fingers 629 and 630 to the opening 624, where, by gravity, they successively pass downward through the delivery tube 626 in a uniform position previous to packing, thus avoiding the danger of denting or other injury, and facilitating other automatic handling.

In the present instance, the driving pulley 632 is loose on the main shaft 67, and has a conical recess 633 in its hub 634 in which is seated the conical head 635 of the movable member of a clutch whose shank 637 is slidable on the main shaft by virtue of a spline 638. The shank 637 has an annular groove 639 to receive a yoke 640 upon a vertical arm 641 upon whose lower end is a horizontal tube or sleeve 642 slidable upon a pin 643 fixed to one of the bearings 66. As shown in Fig. 48, there is a ring 646 loose on the main shaft adjacent the movable member of the clutch having a vertical operating handle 647 upon its upper portion, and a lug 648 upon its bottom portion. A wedge block 649 is fixed to a side face of this lug whose operating face contacts with the operating face of the wedge

block 651 fixed to the post 641 of the yoke, so that when the ring is rocked by the operating handle the movable cone 635 is moved into frictional engagement with its seat in the pulley hub. Springs 653 have one end abutting against a flange 655 upon the shaft and their opposite end engaging the end of the movable cone.

The friction clutch already described is primarily purposed to facilitate the operation of a series of stop devices arranged upon different parts of the machine and which act upon the operating arm or lever 647. As shown in Figs. 3 and 48, the guide plate 657 fixed to the side of the table 61 has a longitudinal slot 658 and serves to guide and retain in said slot the operating lever 647. The unslotted end of the guide plate consists of a rectangular cross piece 659 which is a slidable fit in an oblong slot 661 in a slidable block 662 which has one end in contact with the operating lever, and has upon its opposite end a projection 664 embraced by one end of the helical spring 665 whose opposite end embraces a pin 666 abutting against a collar 667 upon the latter pin. The pin threaded as at 668 is in a threaded opening 669 in a block 670 fixed to the side of the table. A nut 671 upon the threaded portion of the pin serves to adjust the pin longitudinally and vary the pressure of the spring 665. The block 662 has upon its upper face near one end a projection 672 in the path of a latch 673 fixed to the end of a rock shaft 674 mounted in a block 675 fixed to the top of the table. On the opposite end of the rock shaft, as shown in Fig. 50, is a finger 676 which rests upon a cam surface 677 upon the end of a rock shaft 678 mounted in a block 679 upon the table. Upon the end of the latter rock shaft is a crank arm 680 provided with a crank pin 681. The finger 676 and the latch 673 are held respectively against the cam surface 677 and behind the projection 672 when the machine is in normal or operating position, by means of a retractile spring 682 having one end attached to a pin 683 upon the finger and the other end to a hook 684 in the table. When the crank arm 680 moves in the direction of the arrow shown in Fig. 48, the cam surface elevates the finger 676 as well as the latch 673 whereby the projection 672 is released from the latch and the spring 665 forces the member 662 and the operating arm to the extreme or inoperative position as shown in said figure. When the operating arm is in the latter position, the friction clutch is thrown out of engagement.

It is conceivable that under abnormal circumstances a certain cavity in the shell carrier member 75 may have no shell as it leaves the shell conductor. In order to guard against such an emergency, and in order to

facilitate introduction of a shell in such a vacant cavity, and in order to notify the operator when such a condition exists, the following devices and connections are found advantageous. The front end of the abutment or wall 290 is transversely severed constituting a door 686 having a hinged lug 687 pivoted by a screw 688 to the adjacent fixed flange portion of the abutment forming a hinge connection. See Fig. 47. Pivoted by a screw 689 to the flange portion 690 of the door, as shown in Fig. 3, is a plate 691 provided with a finger piece 692 at one end of a projecting portion 693. Upon the lower portion of the arm 693 is a downwardly extending cam projection 694, as shown in Fig. 45. Extending at an angle from the arm or portion 693 is a lateral upwardly directed arm 695 engaging the lower end of a vertically disposed lever 697 pivoted upon a pin 698 in a block 699 fixed to the face of the door. The upper end of the lever loosely enters a slot 700 in a slidable pin or plunger 701 mounted in a horizontal bore 702 in the block, and extending through an opening 703 in the door. The lower end of the lever is outwardly pressed toward the arm 695 by a spring 705 seated in a cavity in the door and having its end pressing against the arm 697. The last mentioned spring normally maintains the end of the bolt 701 slightly within the area of the cavities of the carrier disk. The cam projection 694 normally rests upon the rounded head 707 of a pin 708, which head projects slightly above the top of the table. The lower end of the pin is pivotally connected with one arm 709 of a bell crank lever 710 pivoted upon a pin 711 in a stud 712 upon the lower face of the table. To the second arm 713 of the bell crank lever is a rod 714 pivotally connected with the arm 715 of a bell crank lever 716 pivoted, as shown in Fig. 50, upon a pin 718 in a stud 719 upon the lower face of the table. To the second arm 720 of the latter lever is a rod 821 whose upper end passes through an opening 723 in the table and projects above the table. The upwardly projecting portion of the rod is provided with an oblong slot 724, as shown in Fig. 51, through which passes the crank pin 681. The described parts operate as follows. When each cavity of the shell carrier is provided with a shell the parts are in normal position; that is, the plunger is extended outward as shown in Fig. 45, forcing the lever arm 697 against the spring 705. The cam projection 694 also, as shown in said figure, is in the position pressing the yielding pin 708 downwardly against the upper pressure of the spring 726 seated in a cavity 727 in the table, having one end abutting against the floor of the cavity, and the other end abutting against the shoulder 729 upon the

pin. If, or when, a cavity of the shell carrier, which has no shell therein, comes into alinement with the plunger 701 the latter immediately enters the cavity through the action of spring 705 which through the lever 697 forces outwardly the arm 695 also oscillating the plate 691 and releasing the pin 708 which immediately moves upwardly under the impulse of spring 726. The upward movement of this finger, and the action of this spring operation through the described lever connections moves the crank pin 681 in the direction of the arrow shown in Fig. 48, thereby throwing the operating lever of the machine to inoperative position. When a shell is absent from its seat in the carrier, the door 686 is swung into the position shown in broken lines in Fig. 47, giving access to the seat, and a shell is manually inserted in the seat. The door latch consists of a slidable bolt 717 in the door, pressed by a spring 722 and engageable in a cavity 725 in the housing 297.

It is found advantageous to insure against an insufficient amount of powder in the shell by providing means for detecting the quantity of powder in each shell after the charging thereof, and to stop the machine when the quantity of powder in the shell is inadequate. The means herein shown for effecting this end consists, as shown in Figs. 18 and 23, of a vertical pin 730 adjustably mounted in the head 467. The adjustment consists of a thread 731 upon the pin engaged by nuts 733 and 734 abutting against the bottom and top of the head. This vertical adjustment is such that when the head 467 descends the lower end of the pin 730 normally contacts with the powder which extends to a certain predetermined height in the shell. When the pin 730 contacts with the powder in the shell and is impeded thereby, the head 467 remains stationary, but the plunger 429 continues its movement downward under the impulse of its cam mechanism already described, and its motion is cushioned or taken up by the spring 471. As the rod 429 descends, as described, the free end of the lever 425 descends a certain distance impelled by the spring 444 but is stopped against excessive travel in that direction by a stop shoulder 736 upon the post 427. If and when the shell is presented to the feeler 730 without any powder or with a substantially less quantity of powder than that predetermined, the pin is impelled by the head 467 to a lower position such for instance as shown in dotted lines in Fig. 18. This condition operates the following stop motion. Upon one end of the head 467 is a lip 737 provided with a vertical slot 738 in which is an adjusting pin 739 fixed in a depending finger 740. Upon the base of the block 475, as shown in Fig. 23, is a guide

finger 741 intermediate which and the block 475 extends the end of the lever 743 pivoted intermediate its length by a pin 744 upon a block 746 fixed to the top of the table 61. 5 The opposite end of the lever has an inclined or cam surface 748 contacting with the under side of the crank pin 681. The lever is steadied by a helical spring 749 attached at one end to the lever, and at its other end to the top of the table 61, maintaining the lever in contact with the top of a stop pin 750 fixed upon the table. Since the end of the lever 743 is in the path of the finger 740, the latter in its excessive descent contacts with 10 said lever and tilts the latter thus oscillating the crank pin in the direction of the arrow shown in Fig. 48, and instantly stopping the machine. See Fig. 50.

It is found advantageous to detect the 20 absence of a bullet from the bullet carrier and to immediately stop the machine in case such an emergency should arise. This end is conveniently attained by means of a post 752, as shown in Figs. 3 and 53, fixed upon the table adjacent the bullet carrier having 25 loose thereon a sleeve 754 retained against escape by a nut 755 upon the head of the post. Fixed to the upper portion of this sleeve is an arcuate plate 757 projecting at 30 both sides of the tube with its edge extended in contact with a plurality, in the present instance three, of the bullets in the bullet carrier. This oblong plate or feeler has one end thereof somewhat rounded as at 759. 35 The rounded end of this member is held in contact with its adjacent bullet by means of a spring 761 having one end fixed to a pin 762 in the sleeve 754 and whose other end is attached to a pin 765 in the table. Fixed to 40 the lower portion of the sleeve 754 is a cam plate 766 in contact with the bent end 767 of a lever 768 pivoted intermediate its length on a post 769 upon the table. Upon the opposite end of this arm, as shown in Fig. 50, 45 is a link 770 provided with an oblong slot 771 which receives the crank pin 681. If a bullet be absent from its clips when the latter reaches a position opposite the curved portion 759 of the feeler plate, the latter is 50 swung inwardly toward and over the bullet carrier under the impulse of the spring 761, and the lever connections described move the crank pin 681 in the direction of the arrow shown in Fig. 50 thus immediately stop- 55 ping the machine.

I claim:—

1. In a shell loading machine, the combination with a shell carrier provided with a seat for a shell, of a support adjacent the 60 carrier, a powder funnel vertically mounted in the support above the seat, means for blowing air through the funnel, and means in the funnel for venting the air.

2. In a shell loading machine, the com-

bination with a shell carrier provided with 65 a seat for a shell, of a support adjacent the carrier provided with an opening above the seat, a reciprocating powder funnel mounted in the opening movable into and out of the shell, means for reciprocating the funnel, 70 and means for blowing air through the funnel.

3. In a shell loading machine, the combination of an intermittently movable shell carrier provided with a series of seats for 75 shells, and means for actuating the same, of a support adjacent the carrier and extending above the same and provided with a powder discharge opening in vertical alinement with the seats, means for continu- 80 ously forcing an air current through the opening, and means operated by the carrier actuating means for intermittently interrupting the current.

4. In a shell loading machine, the com- 85 bination with a support provided with a powder discharge opening, a powder carrier rotatably mounted in the support provided with a series of holes registerable with the discharge opening, a powder magazine 90 upon the carrier, a chute in the carrier registering with the openings and leading to the magazine, and pneumatic means in the chute for forcing the powder into the holes.

5. In a shell loading machine, the com- 95 bination with a support provided with a powder discharge opening, a powder carrier mounted in the support provided with a series of holes registerable with the discharge opening, a powder magazine upon 100 the support, an agitator in the magazine, a chute in the support registering with the holes and extending to the magazine, and pneumatic means in the chute for inducing 105 the powder into the holes.

6. In a shell loading machine, the combination of a support provided with a powder discharge opening, an air pipe in the support in alinement with the opening, and a powder carrier mounted in the support 110 between the pipe and opening provided with holes adapted to register with the opening.

7. In a shell loading machine, the combination of a support provided with a powder discharge opening, an air pipe in the 115 support in vertical alinement with the opening, a powder carrier rotatably mounted in the support between the pipe and opening provided with holes adapted to successively register with the openings, and means for 120 rotating the carrier.

8. In a shell loading machine, the combination with a stationary support provided with a discharge opening, an air pipe in the support in alinement with the opening, 125 a powder carrier rotatably mounted in the support provided with charge holes adapted to register with the pipe and opening, a

valve in the pipe, and means operating the carrier for actuating the valve.

9. In a shell loading machine, the combination with the support of an air pipe in the support, a powder carrier rotatably mounted in the support provided with charge holes adapted to register with the pipe, a blower attached to the pipe, a rotary valve in the pipe, and means actuating the powder carrier for rotating the valve.

10. In a shell loading machine, the combination with a rotary shell carrier and means for actuating the same, of a funnel above the carrier at right angles thereto, an air pipe connected with the funnel, a rotary blower upon the pipe, and means operated by the carrier actuating means for actuating the blower.

11. In a shell loading machine, the combination of a support, of a funnel slidably mounted in the support, a guide on the front of the support, a cam plate slidably mounted in the guide, a plate pivotally attached to the support engaging the funnel through an oblong slot, a finger on the arm engaging the cam, and means for sliding the cam.

12. In a shell loading machine, the combination with a support provided with a power discharge opening, a charge carrier in the support provided with a series of holes registerable with the opening, a powder magazine upon the support, a chute in the support extending from the magazine to the carrier and registering with the holes, an air pipe in the carrier extending transversely of the chute and provided with a series of lateral perforations within the chute, and a blower attached to the pipe.

13. In a shell loading machine, the combination of a support comprising a base, a top wall and a side wall provided with an internal horizontal groove, and with a series of openings extending from the groove to the exterior of the side wall, a circular charge carrier rotatably mounted on the base slidably engaging the top wall and provided with an annular series of vertical charge holes, and with horizontal radial passages extending from the holes and adapted to register with the groove, said top plate being provided with an oblong slot registering with the holes, means for forcing air through said slot, and means for rotating the carrier.

14. In a shell loading machine, the combination with shell carrying means, a support provided with a discharge opening, a device for carrying the powder charge to the opening, and means for actuating the charge carrying device, of means cooperating with the charge carrying actuating means for forcing the power charge through the opening.

15. In a shell loading machine, the com-

bination with the frame, of a driving shaft in the frame, a support on the frame, a powder charge carrier rotatably mounted in the support, a vertical shaft mounted in the frame fast to the carrier, a pinion on the second shaft, a stud on the frame, a gear on the stud meshing with the pinion, a lever arm pivotally connected at one end to the stud, a pawl on the arm engaging the gear, a crank disk on the driving shaft, and a connecting rod engaging the arm and disk.

16. In a shell loading machine, the combination with the frame, of a driving shaft in the frame, a support on the frame, a powder charge carrier rotatably mounted in the support, a vertical shaft mounted in the frame fast to the carrier, a pinion on the second shaft, a stud on the frame, a gear on the stud meshing with the pinion, crank connections between the gear and the main shaft, a locking disk fixed to the second shaft provided with peripheral cavities, a housing on the frame adjacent the disk, a rack pin slidably mounted in the housing adapted to enter the cavities of the disk, a rock shaft in the housing, a pinion on the rock shaft engaging the rack pin, a crank on the rock shaft, a cam on the driving shaft, a plate loose on the shaft, a cam stud on the plate engaging the cam, and a rod connecting the crank and plate.

17. In a shell loading machine, the combination with the frame, of a driving shaft in the frame, a vertical spindle rotatably mounted in the frame, a shell carrier fast to the spindle, a disk fast to the spindle provided with peripheral cavities, a lever pivotally attached at one end to the spindle, a pawl on the lever engaging in the cavities of the disk, a cam on the driving shaft, a cam stud on the lever engaging the cam, a housing on the frame adjacent the disk, a rack pin slidably mounted in the housing adapted to enter the cavities of the disk, a rock shaft in the housing, a pinion on the rock shaft engaging the pin, a crank on the rock shaft, a cam on the driving shaft, a plate loose on the shaft, a cam stud on the plate engaging the cam, and a rod connecting the crank and plate.

18. In a shell loading machine, the combination with a rotary shell carrier provided with a series of marginal seats, and means for actuating the same, of a rotary bullet carrier above the shell carrier provided with yielding peripheral seats adapted to successively register with the first mentioned seats, means for feeding bullets to the yielding seats, and means operated by the shell carrier actuating means for actuating the bullet carrier.

19. In a shell loading machine, the combination of a circular member bullet carrier, rectangular teeth upon the periphery of the

carrier, and resilient radial fingers fixed to the sides of the teeth adapted to embrace bullets.

20. In a shell loading machine, the combination with the frame and driving shaft, of a shell carrier mounted on the frame, a vertical rod mounted in the frame, a plate on the rod provided with a slot through which the driving shaft passes, cams on the shaft at each side of the plate, cam studs on opposite faces of the plate engaging the cams, a head on the rod above the carrier, and a forcing plunger depending from the head.

21. In a shell loading machine, the combination of a frame provided with a discharge opening, a shell carrier provided with peripheral seats mounted on the frame, a horizontally disposed shell guide mounted on the frame above the opening tangentially disposed with relation to the carrier and provided with a longitudinal opening extending to a point above the opening.

22. In a shell loading machine, the combination of a rotary carrier provided with peripheral seats for shells, of a table on which the carrier is mounted, a post on the table spaced from the carrier, arms upon the post extending to the carrier and provided with an inward bend, and an intermediate arm upon the post provided with an outward bend.

23. In a shell loading machine, the combination with the frame, of a horizontally disposed shell carrier rotatably mounted in the frame provided with peripheral seats for shells, a curved abutment upon the frame surrounding the carrier and embracing the shells comprising a stationary section and a movable section, and means for rotating the carrier.

24. In a shell loading machine, the combination with the frame, of a horizontal shell carrier rotatably mounted on the frame provided with peripheral seats for shells, a curved abutment on the frame surrounding the carrier and adapted to contact with the shells comprising two sections, a hinge connecting the sections, and means for rotating the carrier.

25. In a shell loading machine, the combination with the support, of a powder funnel mounted in the support provided in its lower end with a series of vertically disposed annularly arranged slots, and means for forcing an air current through the funnel.

26. In a shell loading machine, the combination with the frame, of a rotary shell carrier provided with seats mounted on the frame, an abutment on the frame adjacent the seats, a reciprocating plunger in the abutment movable into the seats, a plate pivotally mounted on the frame, a lever upon the abutment engaging the plate and the bolt, a

cam projection on the plate, a pin yieldingly mounted in the frame engaging the cam, a driving shaft, a clutch on the shaft, and operative connections between the pin and the clutch.

27. In a shell loading machine, the combination with the frame, of a rotary carrier provided with seats for the shells, a driving shaft in the frame, operative connections between the shaft and carrier, a clutch upon the shaft, a reciprocating rod in the frame, means upon the shaft for reciprocating the rod, a head yieldingly mounted on the rod above the carrier, a powder feeler on the head above the seats, a finger fast to the head, and a lever in the path of the finger for operating the clutch.

28. In a shell loading machine, the combination with the frame and driving shaft, of a vertically disposed reciprocating rod mounted in the frame, a head slidably mounted on the rod, a spring on the rod pressing against the head, a powder feeler upon the head, means for vertically adjusting the feeler, and means actuated by the driving shaft for operating the rod.

29. In a shell loading machine, the combination with the frame and driving shaft, of a vertically disposed reciprocating rod mounted in the frame, a shoulder on the rod, a head loose on the rod resting upon the shoulder, a head fast to the rod above the first head, a spring upon the rod intermediate the heads, a powder feeler depending from the first head, and means actuated by the driving shaft for reciprocating the rod.

30. In a shell loading machine, the combination of a support provided with a powder discharge opening, a powder carrier mounted in the support provided with a series of holes adapted to register with the discharge opening, a powder magazine upon the carrier communicating with the holes and pneumatic means for forcing the powder from the magazine into the holes and from the holes into the discharge opening.

31. In a shell loading machine, the combination with a shell carrier, of a rotary bullet carrier provided with peripheral seats overlapping the shell carrier, means for actuating the bullet carrier, and means for inserting bullets into the seats.

32. In a shell loading machine, the combination with a rotary shell carrier and means for actuating the same, of a rotary bullet carrier above the first carrier and cooperating therewith and provided with peripheral seats, a bullet guide adjacent the bullet carrier, and means for forcing bullets from the guide into the seats.

33. In a shell loading machine, the combination with the support, of a powder funnel mounted in the support provided with a tapering lower end portion, said end portion

being provided with slots, and means for forcing an air current through the funnel.

34. In a shell loading machine, the combination with a rotary bullet carrier and a shaft for driving the same, of a clutch device on the shaft, and a vibratory detector plate adjacent the bullet carrier and adapted to contact with bullets in the carrier for operating the clutch device.

35. In a shell loading machine, the combination of a rotary bullet carrier provided with peripheral seats for bullets, a vibratory detector plate beside the carrier adapted to simultaneously engage a plurality of the bullets, a driving shaft, a clutch on the shaft, operative connections between the shaft and carrier, and lever connections between the plate and clutch.

36. In a shell loading machine, the combination of a rotary bullet carrier provided with peripheral seats for bullets, of a vibratory detector plate in the path of the bullets movable toward the carrier when a bullet is absent from its seat, a driving shaft, operative connections between the driving shaft and the carrier, a clutch on the driving shaft, and means actuated by the movement of the plate for operating the clutch.

37. In a shell loading machine, the combination with the frame of a driving shaft, a rotary shell carrier provided with seats mounted on the frame, driving connections between the shaft and carrier, a clutch on the shaft, a reciprocating plunger movable into the seats, a block slidably mounted on the frame, a vibratory arm loose on the shaft in the path of the block for operating the clutch to stop the machine, a spring upon the frame pressing the block toward the arm, a latch engaging the block to lock the same against the spring, a rock shaft on the frame rigid with the latch, a second rock shaft on the frame provided with a cam, a finger on the first rock shaft engaging the cam, and means actuated by the plunger for operating the second rock shaft.

38. In a shell loading machine, the combination with the frame, of a rotary bullet carrier mounted on the frame provided with seats adapted to contain bullets, a post on the frame adjacent the carrier, a sleeve loose on the post, a plate fast to the sleeve adapted to contact with the bullets, means for pressing the plate toward the bullets, a cam on the sleeve, a lever mounted on the frame engaging the cam, a driving shaft, a clutch on the shaft, and operative connections between the lever and the clutch.

39. In a shell loading machine, the combination with the frame, of a driving shaft, a rotary shell carrier provided with seats mounted on the frame, driving connections between the shaft and carrier, a reciprocating rod in the frame, means on the shaft for reciprocating the rod, a head on the rod above the carrier, a depending powder feeler on the head above the seats, a finger on the head, a lever on the frame in the path of the feeler, a block slidably mounted on the frame, a spring on the frame engaging the block, a latch engaging the block, a rock shaft mounted on the frame rigid with the latch, a second rock shaft on the frame provided with a cam, a finger on the first rock shaft engaging the cam, a crank on the second rock shaft engaging the lever, a ring loose on the shaft, an operating arm on the ring in the path of the block, a lug on the ring, a wedge block on the lug, a pin on the frame, a yoke slidably mounted on the pin, a wedge block on the yoke engaging the first wedge block, a slidable sleeve on the shaft engaged by the yoke, a conical head on the sleeve, a pulley loose on the shaft provided with a recess to receive the head, and springs in the head.

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

WILLIAM I. MACOMBER.

Witnesses:

CHARLES S. JENCKES,
HORATIO E. BELLOWES.