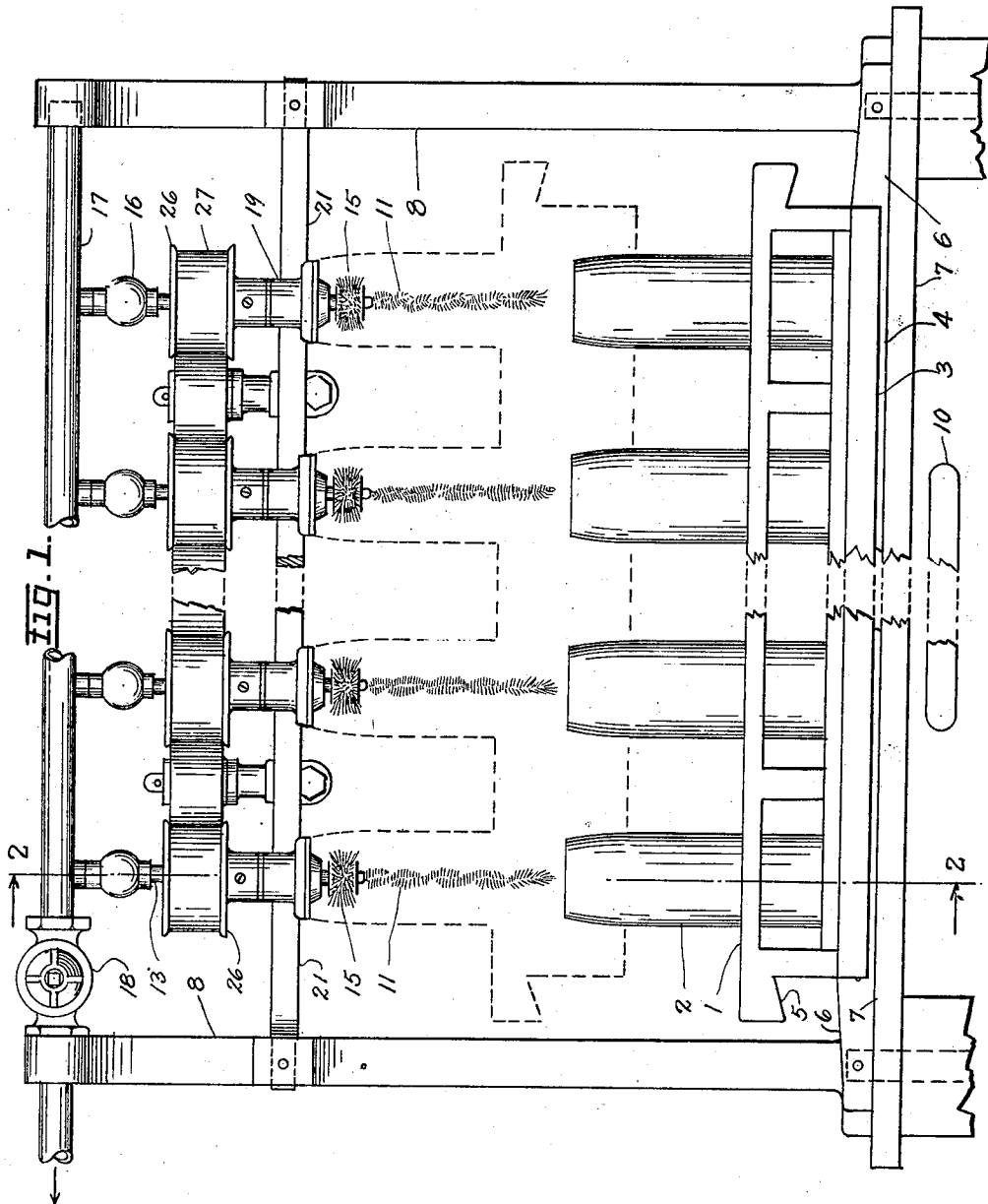


D. M. BLISS.
METHOD FOR LOADING SHELLS.
APPLICATION FILED NOV. 18, 1915.

1,317,422.

Patented Sept. 30, 1919.
10 SHEETS—SHEET 1.



WITNESSES

H. P. Palmer

BY

INVENTOR

Donald M. Bliss,

C. Messick
ATTY.

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Fig. 2.

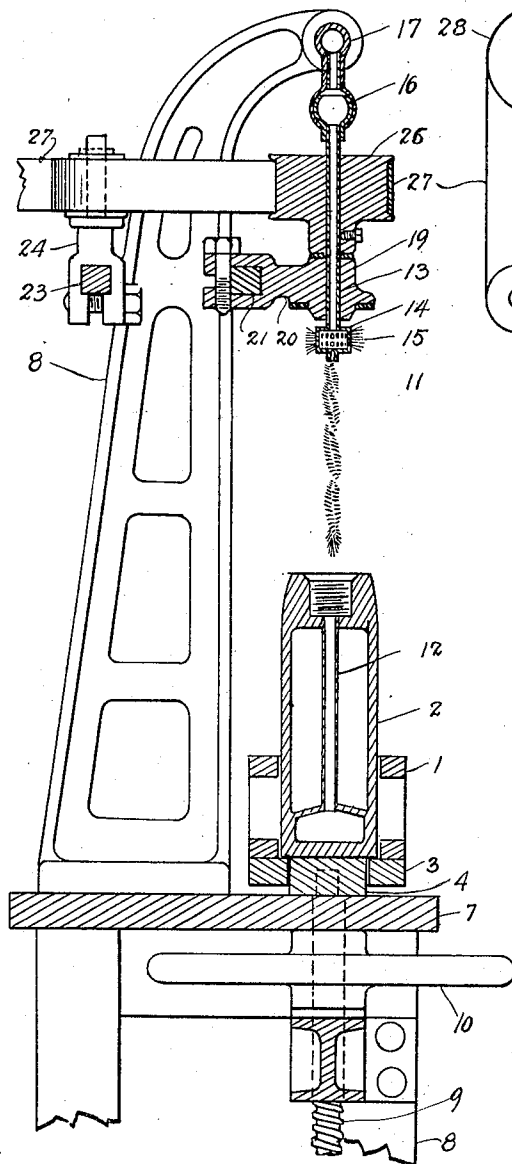


Fig. 3.

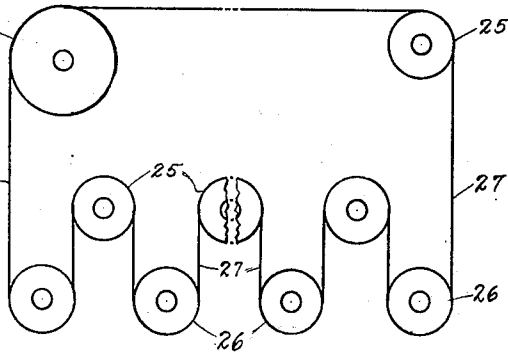
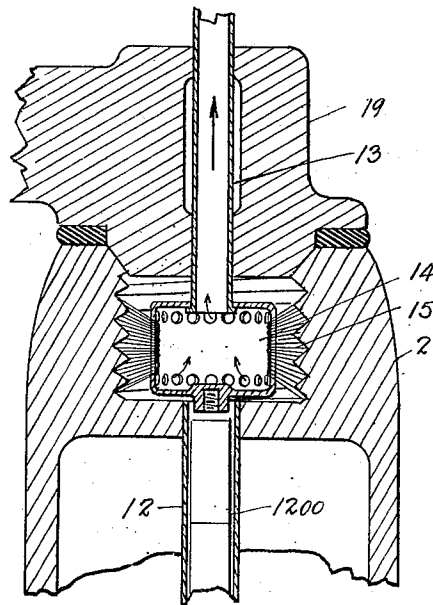


Fig. 4.



WITNESSES
H. J. Palmer

INVENTOR
Donald M. Bliss.

BY

Chas. H. Smith
ATTY

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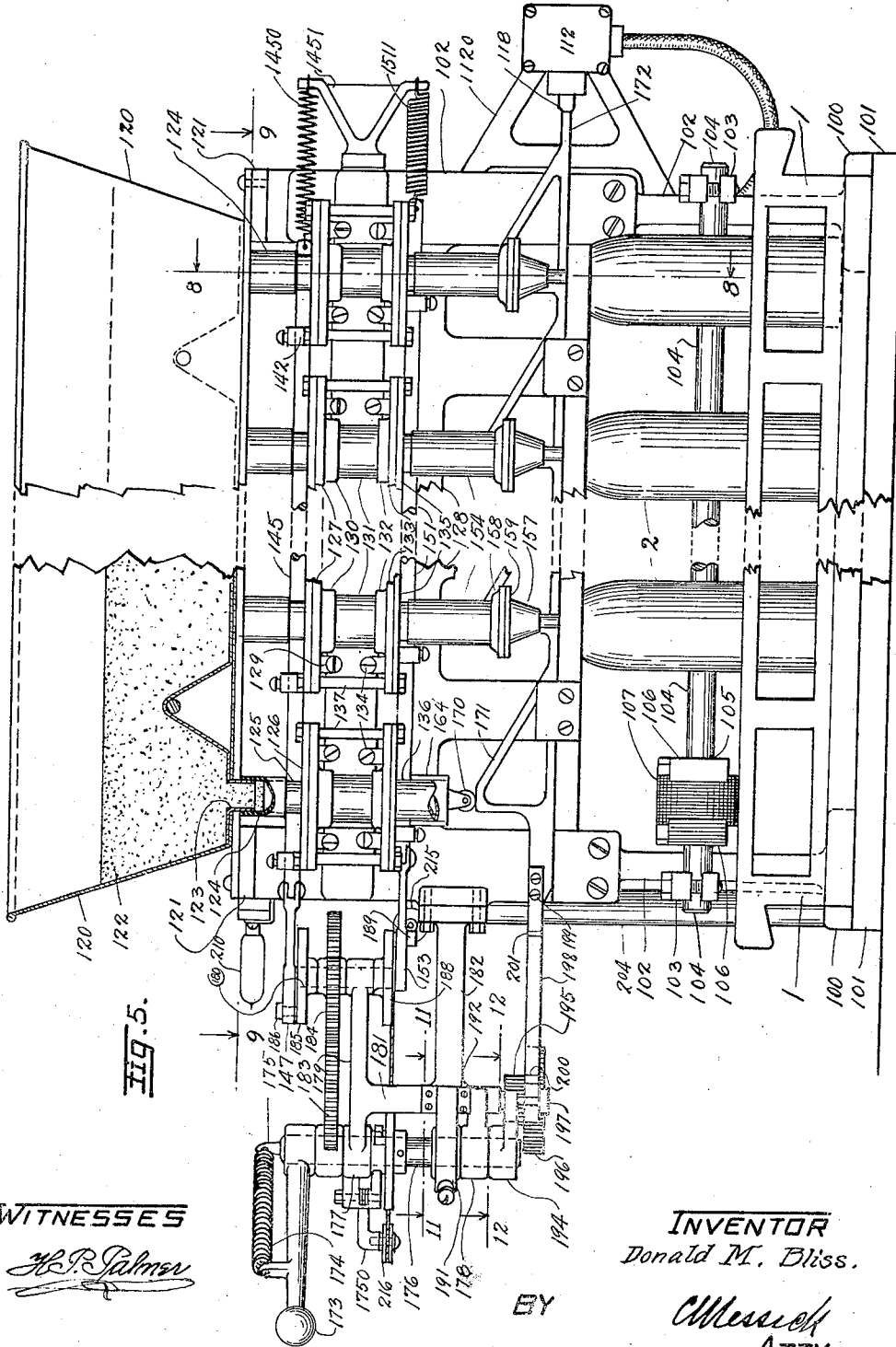


FIG. 5.

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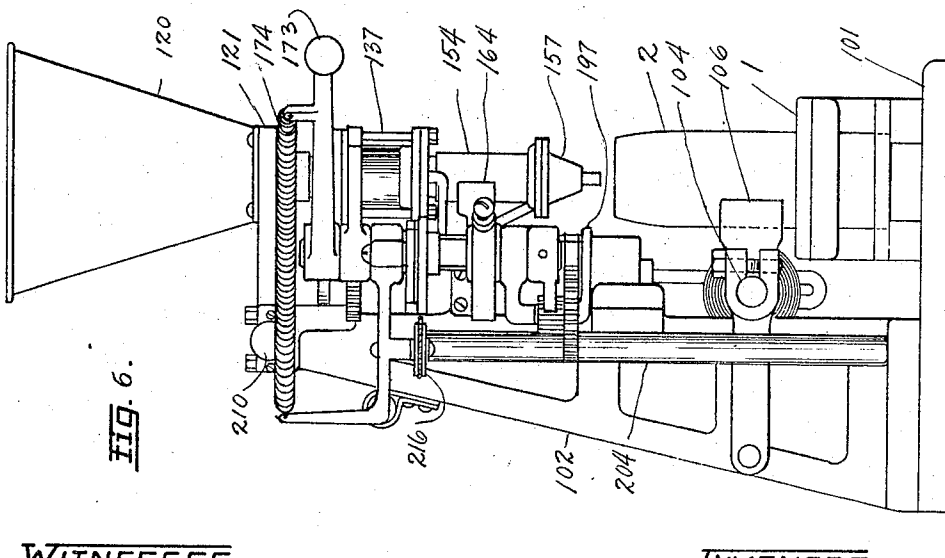
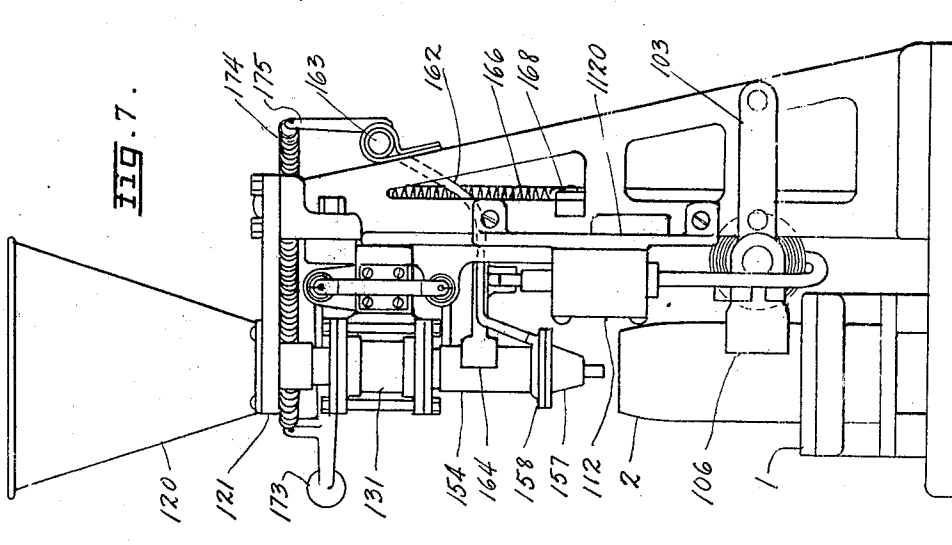
INVENTOR
Donald M. Bliss.

W. Messick
ATTY.

1,317,422.

D. M. BLISS.
METHOD FOR LOADING SHELLS.
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WITNESSES.

H. P. Palmer

INVENTOR.

Donald M. Bliss

BY

C. Messers
ATTY.

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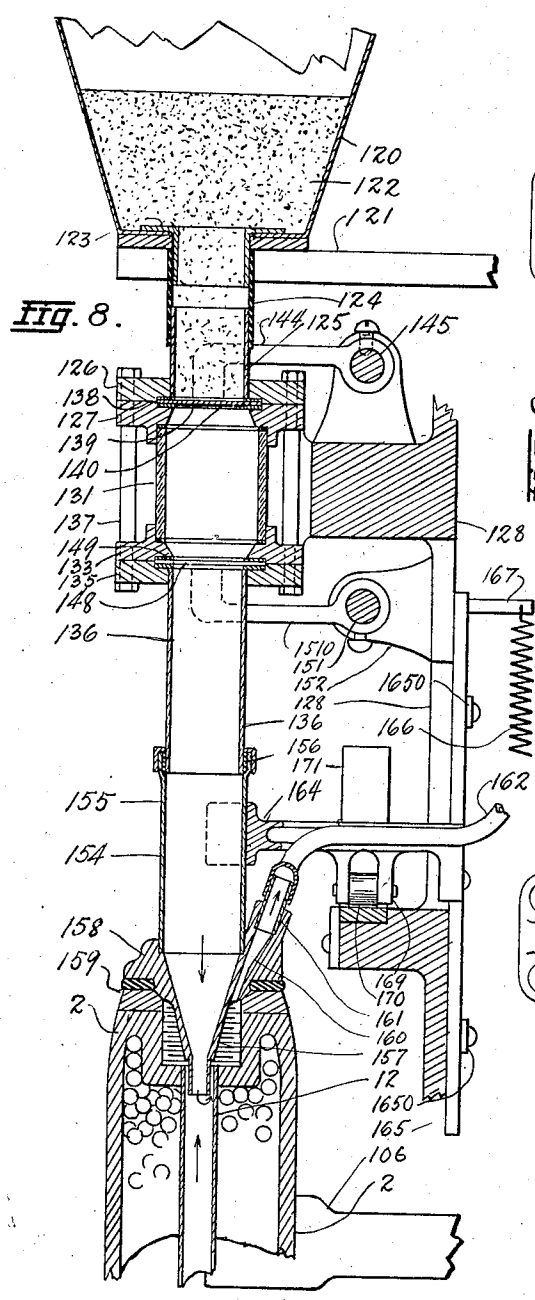


FIG. 8.

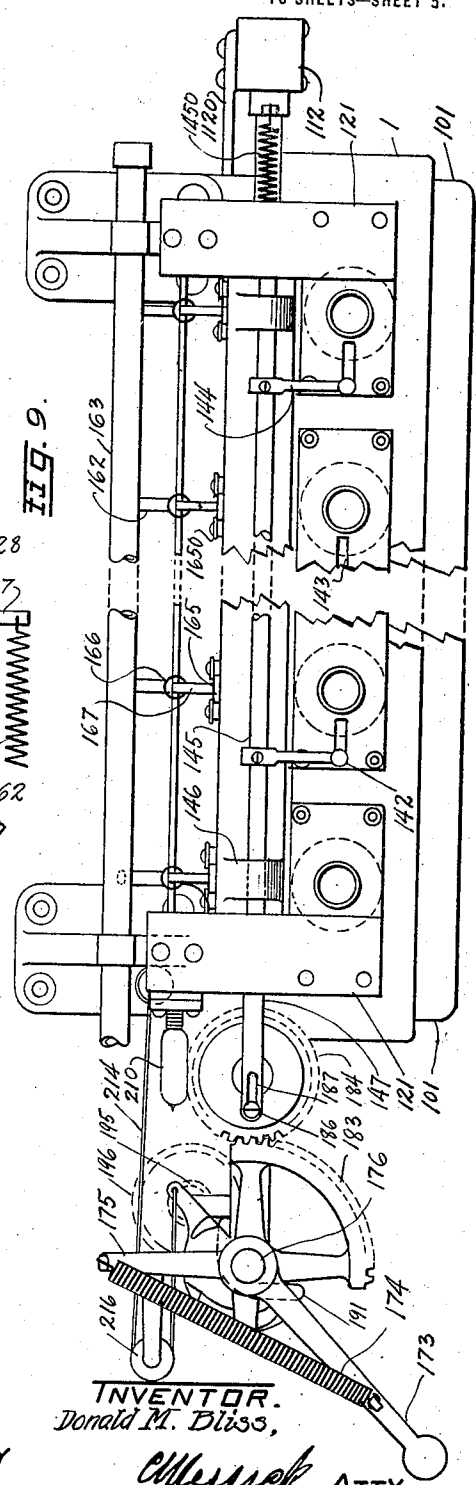


FIG. 9.

WITNESSES
W. P. Palmer

INVENTOR.
Donald M. Bliss,
BY *Attorney* ATTY.

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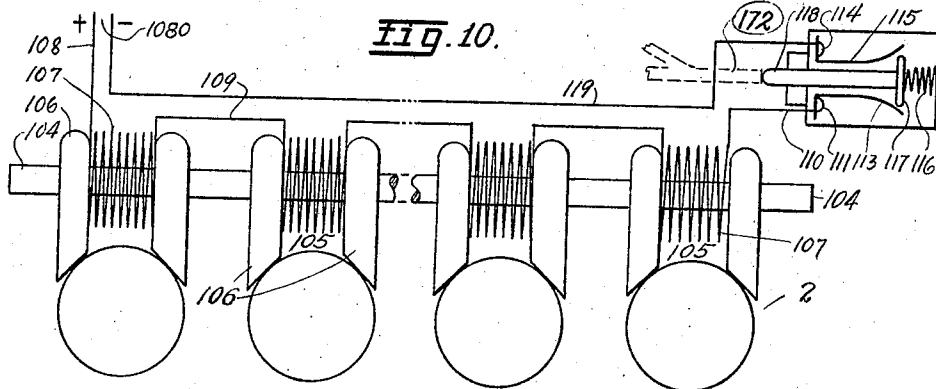


Fig. 11.

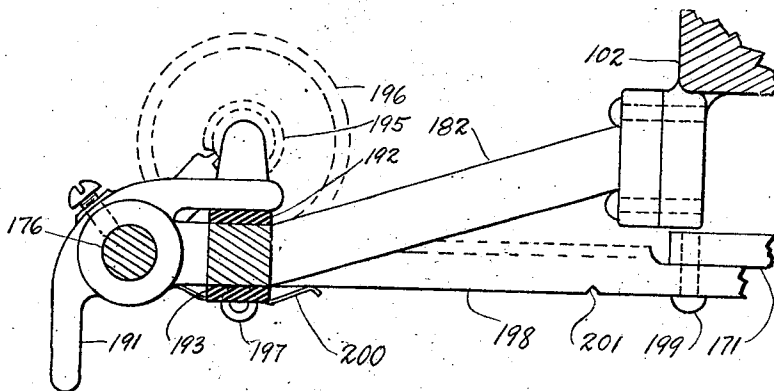
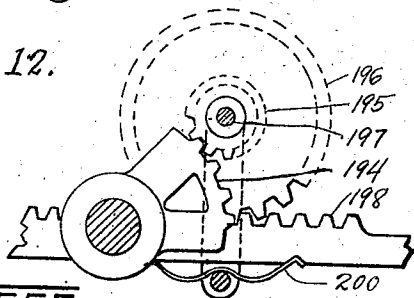


Fig. 12.



WITNESSES

H. P. Palmer

INVENTOR

Donald M. Bliss.

BY *Chas. H. Bliss*

ATTY.

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Fig. 13.

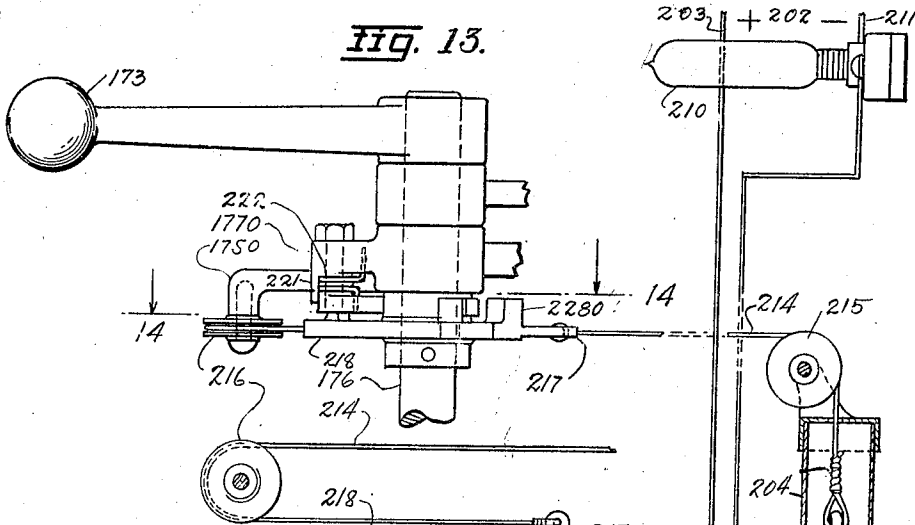


Fig. 14.

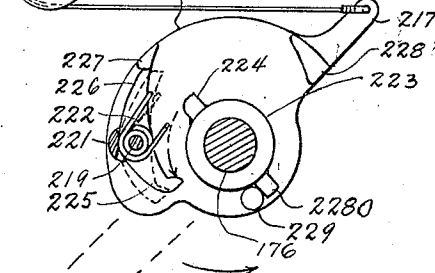
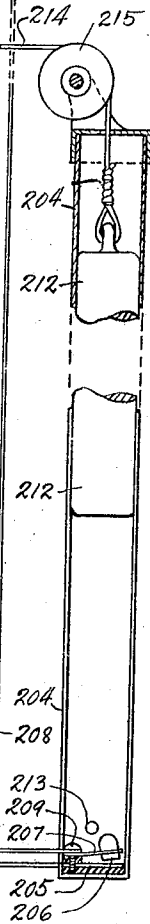
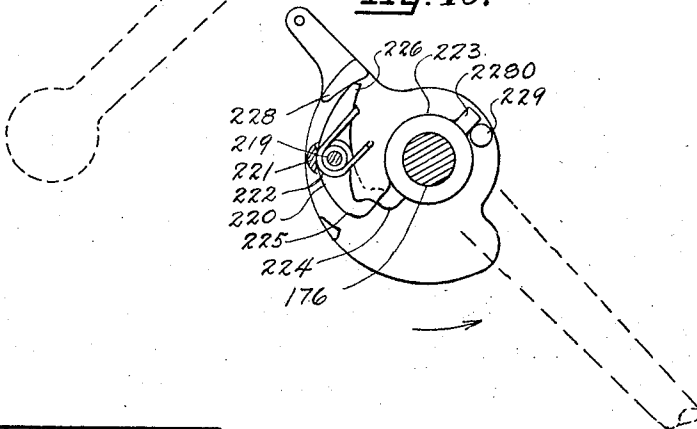


Fig. 15.



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H. R. Palmer

INVENTOR

Donald M. Bliss

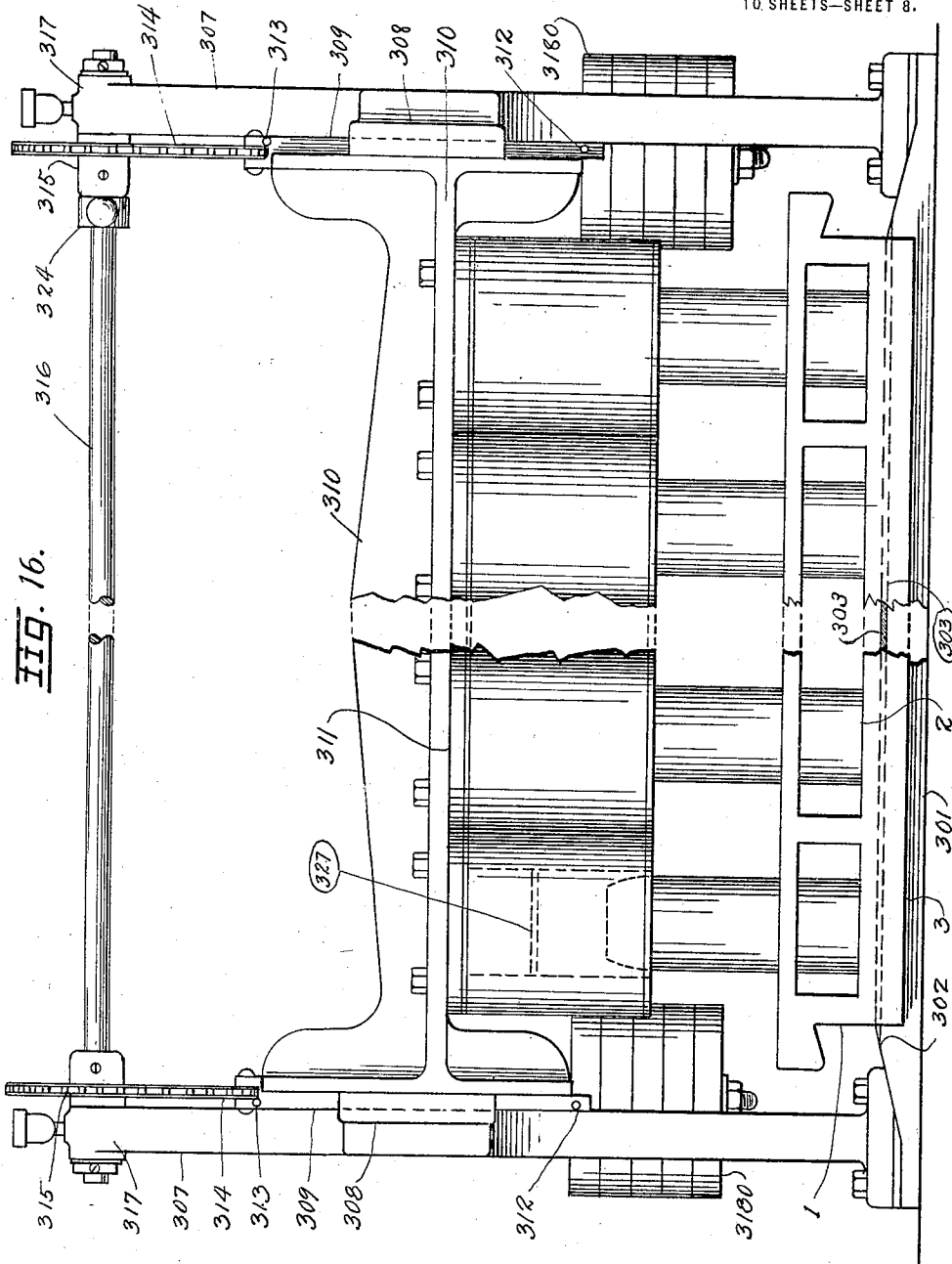
BY

Chas. H. Bliss
ATTY.

D. M. BLISS.
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Patented Sept. 30, 1919.
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WITNESSES

H. P. Palmer

INVENTOR

Donald M. Bliss,

BY

Chenick

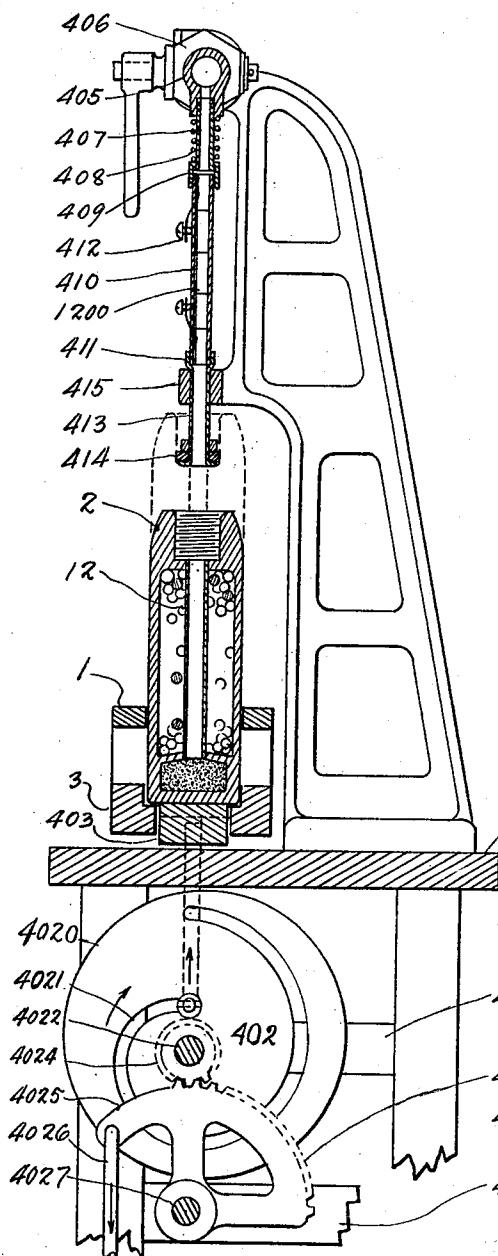
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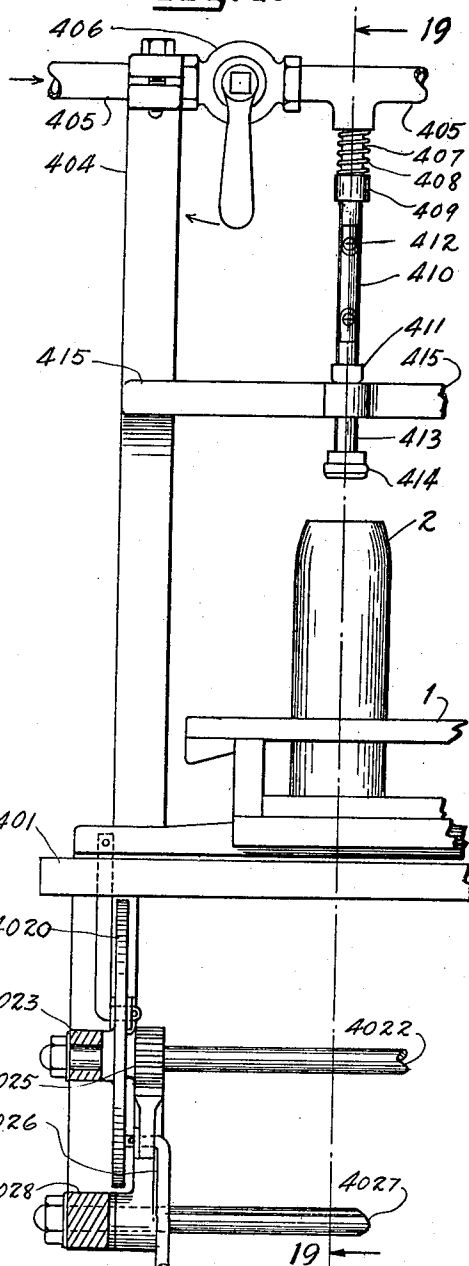
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Fig. 19.



WITNESSES
H. P. Palmer

Fig. 20



INVENTOR
Donald M. Bliss.

BY *Chas. M. Bliss*

ATTY.

UNITED STATES PATENT OFFICE.

DONALD M. BLISS, OF ORANGE, NEW JERSEY.

METHOD FOR LOADING SHELLS.

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Specification of Letters Patent. Patented Sept. 30, 1919.

Application filed November 18, 1915. Serial No. 62,168.

To all whom it may concern:

Be it known that I, DONALD M. BLISS, a citizen of the Dominion of Canada, residing in the United States, in the city of Orange, county of Essex, and State of New Jersey, have invented a new and useful Improvement in Methods for Loading Shells, of which the following is a specification.

Broadly, the object of my invention is to improve the art of loading shells and to provide a method and mechanical devices whereby the various operations may be performed efficiently with safety, rapidity and accuracy.

I will describe one embodiment of my method and one representative system of mechanism for using my method for loading the explosive charges of powder into shrapnel shells. The first operation consists of grouping the shells into gangs, for instance grouping five shells in a gang, and performing, by various mechanical devices to be described hereafter, the following operations successively upon the gangs. The second operation consists of cleaning the fuse tubes of the shells. The third operation consists of electromagnetically centering the shells and filling them with powder by the aid of a vacuum. The fourth operation consists of electromagnetically jolting the shells to pack the powder. The fifth operation consists of pneumatically inserting the fuses in the fuse tubes. The sixth operation consists of cleaning the threads, preparatory to inserting the plugs, after which the plugs are inserted by hand.

The principal mechanisms and devices used in carrying out my method are as follows:—First, a tray wherein the shells may be grouped into gangs for convenience in handling. Second, a gang cleaning machine. Third, a filling machine provided with a magnetic centering device, and with a vacuum device to accelerate the filling operation, and also containing a number of novel features, to be more fully described hereafter. Fourth, a jolting machine provided with an anvil arranged to slide in a slot in the bottom of the tray and having electro-magnets adapted to jolt the shells on the anvil. Fifth, a pneumatic machine to insert the fuses in the shells. Sixth, a slight adjustment in the gang cleaning machine to clean the threads in the noses of the shells. These six principal devices show many novel constructions which will appear more fully

from the following detail description and be pointed out in the claims.

Referring to the accompanying drawings:

Figure 1 is a fragmentary side elevation of a tray containing a gang of shells resting in position in a fuse-tube cleaning machine. Fig. 2 is a cross section on the line 2—2 of Fig. 1 looking in the direction of the arrows. Fig. 3 is a diagrammatic plan view of Fig. 1 to indicate the arrangement of the driving belt and pulleys. Fig. 4 is an enlarged cross section of some of the parts shown in Fig. 2, but arranged for a different operation, namely, the cleaning of the threads in the noses of the shells. Fig. 5 is a fragmentary view, partly in elevation and and partly in section showing my loading machine containing a gang of shells and having the funnels occupying their uppermost position. Fig. 6 is a left hand end view of Fig. 5. Fig. 7 is a right hand end view of Fig. 5. Fig. 8 is an enlarged cross section of Fig. 5, taken on the line 8—8 looking in the direction of the arrows, but showing the funnels as occupying their lowermost position. Fig. 9 is a section on the line 9—9 of Fig. 5 looking in the direction of the arrows; or in other words is equivalent to a plan view of the mechanism shown in this figure, with the hopper removed. Fig. 10 is a diagrammatic plan view of a magnetic centering device, such as is indicated in Figs. 5, 6, 7, 8, etc. Fig. 11 is an enlarged view of the handle limit stops and is taken on the line 11—11 of Fig. 5. Fig. 12 is an enlarged view of the gearing beneath the stop shown in Fig. 11, and is taken on the line 12—12 of Fig. 5, looking in the direction of the arrows. Fig. 13 is an enlarged side elevation of the handle, the time lock, and the pilot lamp shown at the left of Fig. 5. Fig. 14 is a plan view taken on the line 14—14 of Fig. 13, looking in the direction of the arrows. Fig. 15 shows some of the parts of Fig. 14 in the position which they assume after the handle has been moved by an operator to the limit of its travel. Fig. 16 is a fragmentary side elevation of my jolting machine. Fig. 17 is a right hand end view of the device shown in Fig. 16. Fig. 18 is a diagrammatic wiring diagram for the jolting machine electro-magnets. Fig. 19 is a cross sectional view of the fuse pellet inserting machine taken on the line 19—19 of Fig. 20, looking in the direction of the arrows. Fig. 20 is a frag-

mentary side elevation of the device shown in Fig. 19.

The numeral 1 indicates a wooden tray, best shown in Figs. 1 and 2. Into this tray are grouped five shrapnel shells 2, which are all alike. The tray 1 is provided with lower members 3, which extend part way under the lower end of the shrapnel shells 2. These lower members 3, are, however, separated so as to allow for the entrance of an anvil 4, upon which the lower ends of the shells 2 may rest without being removed from their position in the tray. The tray 1 is provided with handles 5 at each end, and by sliding the tray in a longitudinal direction on to an inclined end portion 6, of the anvil 4, the shells 2 will be slightly raised from the lower members 3, so that the weight of the shells will be entirely supported on the anvil, irrespective of the tray, thus avoiding effects of irregularities in the tray.

The anvil 4 forms a part of my fuse tube cleaning machine 7, which has a frame-work 8, and is provided with a screw adjustment device 9 and hand wheel 10, to raise the anvil 4, the tray 1, and the shells 2, to a sufficient height, as indicated in dotted lines in Fig. 1, so that the fuse tube cleaning brushes 11 will enter the fuse tubes 12, of the shells 2, and clean them, while the sweepings of the brushes 11 are sucked out through the hollow spindles 13 of the brushes 11. The hollow spindles 13 terminate at their lower ends in perforated hollow members 14, which are provided with brush bristles 15.

The brush bristles 15 are for the purpose of cleaning out the threads in the noses of the shells, as particularly indicated in Fig. 4, to perform the sixth operation in my method. In Fig. 4, the fuse tube is shown as containing powder pellets 1200; the brush 11 therefor has to be unscrewed and removed in order that the powder pellets 1200 may not be interfered with.

Referring to Figs. 1 and 2, the hollow spindles 13 are illustrated as entering at their upper ends into rotatable joints 16, which are attached to the pipe 17, in which is placed the valve 18 for opening and closing the connection to a source of vacuum into which the sweepings of the brushes are sucked.

The hollow spindles 13 are journaled in the bearings 19, which are supported on the brackets 20, these brackets being secured to the square bar 21, which is attached to the framework 8, thus forming a portion of my fuse tube cleaning machine 7. The framework 8 also supports a square bar 23, upon which are mounted idler pulley brackets 24, carrying idler pulleys 25. The hollow spindles 13 are driven by pulleys 26, through the medium of a belt 27, which passes around these several driving pulleys and also around the idler pulleys 25, as best indicated

in Fig. 3, where a power pulley 28 is also shown, through the medium of which all of the other pulleys may be driven.

After the fuse tubes 12 are cleaned by my fuse tube cleaning machine, as above described, the tray 1 and contents is removed by hand to my filling machine which I will now describe.

Referring to Fig. 5, the numeral 1 indicates the tray 1 supported upon the base portion 101, of my filling machine 100. Upon the base 101 are erected the frames 102. To these frames are attached brackets 103, which support a soft iron bar 104, which acts as a core member and also as a mechanical support for the magnetic centering devices 105, each of which consists of two pole pieces 106, beveled in the form of a V-block, as particularly shown in Fig. 10, so that when the coils 107 are energized, the shells 2 will be drawn up tight against these pole pieces and held in accurate alinement for the filling operation, to be described hereafter.

At the left of Fig. 10 is indicated a source of current 1080 which enters through the wire 108, into the left hand coil 107. The current passes through the several coils 107, which are connected together by connecting wires 109. After passing through the right hand coil 107, the current follows a wire 110, to the terminal 111, of the switch 112. The terminal 111 carries a contact spring 113. The switch 112 is also provided with a terminal 114, which carries a contact spring 115. The switch 112 is normally held closed by the spring 116, pressing the head 117, of the plunger 118, against the contacts 113 and 115. The switch 112 is shown open. In Fig. 5 its mounting bracket 1120 is shown. From the terminal 114 current passes through the wire 119, back to source 1080 indicated at the left of Fig. 10. Thus the coils 107 are normally energized. The switch 112, may, however, be opened by pressing the plunger 118, to the right against the spring 116.

Referring particularly to Fig. 5, a hopper 120 is shown supported upon brackets 121, which are attached to the upper ends of the frames 102. The hopper 120 is shown partly filled with powder 122, and this powder tends to drop by gravity down through the tubular extensions 123, of the hopper 120. The tubular extensions 123 are connected by short pieces of rubber hose 124, to the tubular portions 125 of the upper members 126, of the slide valve seats which also have lower members 127. These members 127 are attached to the main frame casting 128, by screws 129. At the base of the members 127 tubular recesses 130 are formed, into which are inserted tubular measuring chambers 131, which are made of glass in order that an operator may see that these chambers fill with powder. The lower ends of the

members 131 are entered into tubular recesses 132, which are formed in the upper members 133, of the lower slide valve seats. Members 133 are attached to the frame casting 128, by screws 134. The lower slide valve seats are also provided with lower members 135, which are connected with a tubular member 136. The members 126 and 127 are connected to the members 133 and 135 by studs 137, thus holding the several parts in permanent relation.

Between the members 126 and 127, recesses 138 for the upper slide valves 139 are formed (see Fig. 8) and these recesses are lined with soft material 140, preferably felt, in order that when the slide valves are operated any powder grains which may tend to clog the slide valves 139 may be cushioned and the danger of explosion from friction at this point reduced to a minimum. The slide valves 139 are attached to studs 142, which operate in slots 143, in the upper members 126. These studs 142 are connected to arms 144, which are adjustably connected to a sliding rod 145, which is supported in bearings 146 forming a part of the frame casting 128. The sliding rod 145 has free end movement and is connected to a connecting rod 147, the operations of which will be more fully described.

Lower slide valves 148 are contained between the members 133 and 135 of the lower slide valve seat, which is lined with felt 149. The lower slide valves 148 are connected to the sliding rod 151 by arms 1510. The sliding rod 151 is supported in bearings 152, which are formed on the frame member 128, and this sliding rod is connected to a connecting rod 153, to be described more fully.

The tubular members 136 enter into funnels 154. The funnels 154 consist of tubular portions 155, telescopically mounted to slide up and down on the members 136. At the upper end of the funnels 154, packing glands 156 are provided in order that the telescopic movement of the tubular portion 155 upon the member 136 may not cause air leakage. The funnels 154 are provided at the lower ends with tapering portions 157 adapted to enter into the fuse tubes 12. These tapering portions are also provided with shoulders 158 upon which are mounted rubber gaskets 159. These rubber gaskets are for the purpose of making seals at the noses of the shells so that a vacuum may be created within the fuse tubes 12 and the funnels 154 by suction through the suction passages 160, which enter into the recesses at the noses of the shells. The suction passages 160 are connected with connecting tubes 161, which are connected to rubber hoses 162. The rubber hoses 162 are connected to the vacuum pipe 163, as is shown best in Fig. 7.

Referring to Figs. 8 and 9, guide arms 164 connect the funnels 154 with guide rods 165 in order that the telescoping of the members 155 upon the members 136 may be maintained in proper alinement. These guide rods 165 are retained in rollers 1650 in order that they may move up and down smoothly, and springs 166 are attached to the guides 165 at the extended portions 167 in order to quicken the downward movement of the guides 165 and the other members to which they are connected. The lower ends of the springs 166 are attached to the rod 168, which in turn is attached to the frames 102 (see Fig. 7). The guide arms 164 are provided with forked portions 169, which contain rollers 170, and these rollers rest upon the raising and lowering cams 171. The raising and lowering cams are particularly shown at the left of Fig. 5, where one of the funnels 154 has been broken away. In the indicated positions of Fig. 5 all of the funnels are shown at the highest position, in which position the shell tray 1 and its contents, the shells 2, may be inserted or removed.

Referring again to Fig. 5, an extended portion 172 of the cam member 171 is shown in contact with the plunger 118, holding open the switch 112. Thus in the indicated position, the centering devices 105 are demagnetized, and the shells 2 may be placed by hand.

Referring to the left of Fig. 5, the operating handle 173 controls all the movements and operations of my loading machine, as will be more fully described. The handle 173 is provided with a spring 174 for the purpose of causing it to move to the extremes of its travel with relatively little manual effort, and this spring is attached to a bracket 175, which has several other parts and is attached to the frame 102 of my loading machine. The handle 173 is fastened to a vertical shaft 176, which carries several gears and other members to be more fully described. The shaft 176 is mounted in the bracket 175 at the journal bearings 177 and 178. The bracket 175 has an extended portion 179 upon which is journaled a shaft 180. The bracket 175 has a connecting member 181 and a main arm 182, which is connected to the frame 102, as indicated, and thus supports the bracket 175, and the members which it carries.

Upon the shaft 176 is mounted a quadrant 183 which meshes with a pinion 184. This pinion is mounted upon the shaft 180. At the upper end of the shaft 180 is mounted a disk 185, which is provided with a crank pin 186. The crank pin 186 extends through a slot 187 in the connecting rod 147. At the lower end of the shaft 180 is mounted a disk 188, which is provided with a crank pin 189,

which extends through a slot 190 in the connecting rod 153.

The shaft 176 has a normal angular movement of 90 degrees in a counter-clockwise direction according to Fig. 9, and is limited in its movement by a stop 191, which is mounted on the shaft 176. This stop is provided with rubber bumpers 192 and 193, as particularly shown in Fig. 11. The quadrant 183 has a movement of 90 degrees in a counter-clockwise direction best shown in Fig. 9 and rotates the pinion 184, which is half its diameter, 180 degrees in a clockwise direction. The crank pin 186 is shown particularly in Fig. 9, as having drawn the connecting rod 147 to its extreme left hand position, and it in turn has of course drawn the sliding rod 145 and arms 144 and the studs 142 and the upper slide valves 139 to the extreme left hand position, which is the open position for these upper slide valves. In this position the powder 122 fills freely into the measuring chambers 131. When the handle 173 is moved by an operator in a counter clockwise direction from the position shown in Fig. 9, the crank pin 186 moves in a circular orbit, but in a general direction toward the right of Fig. 9, which allows the connecting rod 147 and the sliding rod 145 to be pulled to the right by the tension of a spring 1450. This tension spring 1450 is attached to a bracket 1451, which is mounted on the right hand frame 102, as best shown in Fig. 5. This movement of the sliding rod 145 closes the slide valves 139 through the medium of the arms 144 and the studs 142. The total movement of the crank pin 186 is very much greater than the total movement of the slide valves 139 so that after the slide valves 139 have closed, the studs 142 abut against the right hand ends of the slots 143, which arrests the right hand movement of the arms 144 and the sliding rod 145 and the connecting rod 147, but as the crank pin 186 continues to move to the right, lost motion occurs in the slot 187. At the same time that the crank pin 186 is moving in its orbit toward the right, the crank pin 189 is moving in an orbit in a general direction toward the left, as particularly shown in Fig. 5. The first part of this movement toward the left is absorbed in lost motion within the slot 190 until the crank pin 189 abuts against the left hand end of this slot 190. During the interval in which lost motion is occurring in this slot the upper slide valves 139 have closed as above described, and at the completion of the lost motion the crank pin 189 draws the sliding rod 151 to the left against the tension of a spring 1511, which is attached at its right hand end, according to Fig. 5, to the bracket 1451. Thus the arms 1510 move to the left, and the lower slide valves 148 are opened. It will be noted from the foregoing that the upper slide

valves 139 are entirely closed before the lower slide valves 148 are opened. Thus the powder contained within the measuring chambers 131 is discharged through the tubes 136 into the funnels 154, as the handle 173 nears the limit of its travel in a counter clockwise direction according to Fig. 9.

After the powder has been discharged into the funnels as above described and the handle 173 is moved in a clockwise direction according to Fig. 9, the lost motion between the crank pin 186 and its slot 187 is first taken up, leaving the upper slide valve closed during the first half of the movement of the handle 173, but during this same part of the movement of the handle 173 the lower crank pin 189 is releasing the tension of the lower connecting rod 153, so that the tension spring 1511 pulls the sliding rod 151 to the right, according to some of the figures, including Figs. 5 and 9 and thus closes the lower slide valves 148 through the medium of the arms 1510. After the lower slide valves 148 are closed the continuation of the movement of the handle 173 in a clockwise direction according to Fig. 9 is absorbed by the lost motion between the crank pin 189 and the connecting rod 153. At about the same time as the lower slide valve 148 completely closes, the crank pin 186 begins to abut against the left hand end of the slot 187. This draws the connecting rod 147 and the sliding rod 145, the arms 144, the studs 142, and the upper slide valves 139 to the left, particularly indicated in Figs. 5 and 9 against the tension of the spring 1450. This opens the upper slide valves 139 and allows the powder 122 to refill the measuring chambers 131. The handle 173 is limited in its movement by the stop 191, which is attached to the shaft 176, as best shown in Fig. 11. This stop 191 is provided with a rubber bumper 192 against which it is resting in the indicated positions, such as are shown in some of the figures, particularly Figs. 5, 9 and 11. When the handle 173 is rotated in the counter clockwise direction, according to these figures, the stop 191 finally bumps against the rubber bumper 193 and thus limits the movement of the handle 173 in a counter clockwise direction, according to these figures.

The operation of the handle 173 also gives angular movement to the quadrant 194, particularly shown in Fig. 12. The quadrant 194 only contains a few teeth and meshes with a pinion 195, so that the quadrant 194 is only in mesh with the pinion 195, at or near the position occupied by the device when the handle 173 is at the extreme left hand position, according to Figs. 5, 9 and 12. The pinion 195 is attached to a gear 196 and both pinion and gear revolve freely upon a stationary shaft 197, which is mounted on the bracket 175 at the lower end of the con-

necting member 181. The gear 196 meshes with the rack 198, which is attached by the screws 199 to the left hand end of the raising and lowering cams 171, as shown best in Fig. 5.

Referring particularly to Fig. 5, where the relation of the several parts is best shown, it will be observed that the complete movement of the raising and lowering cams 171 occurs during a first part of the movement of the operating handle 173, that is, as the operating handle 173 is moved from left to right. The rack 198 is drawn to the left until a stop spring 200 enters into a V notch 201 on the rack and thus holds the rack 198 and its connected members in position as the quadrant 194 passes out of mesh with the pinion 195 as the operator continues to move the handle 173 to the right. As the lowering cams 171 move to the left the rollers 170 descend the inclined portions of the lowering cams 171, and under the guidance of the arms 164 the funnels 154 descend into the position indicated in Fig. 8 in which position the gaskets 159 form seals at the noses of the shells 2. The suction through the suction passages 160 then reduces the air pressure within the shells and accelerates descent of the powder from the funnels 154 through the fuse tubes 12 and also causes the powder to pack more complete within the shells than it would pack were it not for the vacuum acceleration in the filling. After the operator completes the movement of the handle 173 in a counter clockwise direction according to Fig. 9, and the shells are filled with powder, the operator returns the handle toward its indicated position in this figure by moving it in a clockwise direction. At the latter end of this return movement the quadrant 194 slips into mesh with the pinion 195 and through the medium of the gear 196 and the rack 198 draws the cams 171 back into their indicated position, according to some of the figures, including Figs. 5 and 12. It should be noted that the movements of the cams 171 as above described are so timed that the powder from the measuring chambers 131 is only discharged into the funnels 154 when the funnels 154 are at their lowest position, as indicated particularly in Fig. 8.

Referring particularly to Fig. 10, the plunger 118 of the switch 112 is shown in a position which opens the circuit through the magnetic centering devices 105 and this plunger 118 is held open by the extension 172 of the raising and lowering cams 171, as best shown in Fig. 5. This releases the shells 2 from being magnetically held by the magnetic centering devices 105. When the handle 173 is moved in a counter clockwise direction according to Fig. 9, the raising and lowering cams 171 and the extension

172 immediately begin to move to the left, as best shown in Fig. 5, and thus allow the spring 116 to close the switch 112, which energizes the centering devices 105 and the centering devices center the shells 2 beneath the funnels 154 before these funnels drop into the lower position, indicated in Fig. 8. After the filling of the shells as previously described, when the handle 173 is returned in a clockwise direction according to Fig. 9 to its indicated position, the switch 112 is again opened by the extension 172, moving to the right according to Fig. 5, and pressing against the plunger 118.

In addition to the devices and functions described in relation to my loading machine, I also provide safety devices to prevent a careless operator making mistakes. These safety devices consist principally of a pilot lamp and a dash-pot. The dash-pot is connected to the handle 173 through various members to be more fully described, and is to prevent an operator from returning the handle 173 to the indicated position, particularly shown in Figs. 5 and 9, until after a proper interval of time has elapsed with the handle in the extreme right hand position in which the powder is discharged from the funnels 154 into the fuse tubes 12, as previously described. The pilot lamp is to indicate the completion of the required time period so that an operator may know when it is proper to return the handle 173 from the extreme right hand position to the indicated position, particularly shown in Figs. 5 and 9.

A source of current 202 is indicated at the upper portion of Fig. 13 and current passes down through the wire 203 and through the bottom of a dash-pot 204. This wire 203 terminates in a stationary contact member 205, which is adapted to make contact with a contact button 206. The button 206 is mounted upon a spring contact member 207, which is connected to a wire 208 by means of a screw 209. This wire 208 passes upwardly and through the pilot lamp 210 which is illuminated upon the closing of the button 206 against the stationary contact member 205. A wire 211 from the lamp 210 returns to the source of current 202 and this completes the circuit. Within the dash-pot 204 is contained a rising and falling weight 212, and when the weight falls to its lowest position it presses the button 206 into contact with the stationary contact 205, the circuit is closed and the pilot lamp 210 lights. At the lower portion of the dash-pot 204 there is provided a vent hole 213 to regulate the rapidity of descent of the weight 212. A flexible cord 214 is attached at the upper end of the weight 212. This cord 214 passes over a pulley 215 which is located on the upper end of the dash-pot 204

and this flexible cord 214 leads around a second pulley 216 which is located upon an extension 1750 of the bracket 175. The end of the cord 214 is attached to a projection 217 of a cam 218 which is revolvably mounted upon the shaft 176, as best shown in Figs. 13, 14 and 15. A projection 1770 of the journal bearing 177 is provided with a stud 219 which carries a pawl 220, and this pawl is restrained from excessive rotary movement by a stop 221 formed upon the projection 1770. The pawl 220 is also provided with a spring 222 to make it tend to rotate in a counter clockwise direction, according to Figs. 14 and 15. This spring 222 bears against the pawl 220 at one end and is fastened into the projection 1770 at the other end. When the handle 173 in the indicated positions, best shown in Figs. 5, 9, 13 and 14, commences to travel to the right in accordance with the lower arrow of Fig. 14, a collar 223, which is attached to the shaft 176, is also rotated in the direction of the lower arrow of Fig. 14. The collar 223 carries a boss 224, which travels in a path indicated by the arrow in dotted lines in Fig. 14. When finally the boss 224 strikes the lower end 225 of the pawl 220, it causes the pawl 220 to be moved in a clockwise direction against the tension of the spring 222. This moves the upper end 226 of the pawl 220 out of contact with a lug 227, as indicated in dotted lines in Fig. 14. The lug 227 forms a part of the cam 218, and when this lug 227 is released the cam 218 is drawn in a counter clockwise direction according to Fig. 14 by the cord 214 and the falling weight 212. When the handle 173 reaches the position into which it is thus moved, as indicated in Fig. 15, the lower end 225 of the pawl 220 catches behind the boss 224, as indicated by dotted lines in Fig. 15, thus preventing the movement of the handle 173 in a direction opposite to the arrow of Fig. 15, until the pawl 220 is released. As soon as the falling weight 212 reaches its lowermost position, the cord 214 has drawn the cam 218 to the position shown in Fig. 15. The cam 218 carries a lug 228, which engages the upper end 226 of the pawl 220 and releases its lower end 225 from contact with the boss 224, so that the handle 173 may be returned to the position indicated in Fig. 14. The operator is advised that the weight 212 has reached its lowermost position and the handle 173 may be returned to the position of Fig. 14 by observing the pilot lamp 210, which lights when the weight 212 reaches its lowermost position as formerly described. When the operator returns the handle 173 from the position of Fig. 15 to the position of Fig. 14 the cam 218 is rotated back into the position of Fig. 14 by means of a lug 2280 on the collar 223 pushing a lug 229 on the cam 218 around in a

clockwise direction, according to Figs. 14 and 15. The rotation of the cam 218 from the position of Fig. 15 to the position of Fig. 14 causes the projection 217 to pull the end of the cord 214 to the right, according to Figs. 13 and 14, and this lifts the weight 212 into the position shown in Fig. 13.

After the powder is filled into the shells 2 through the fuse tubes 12, in my filling machine, as above described, the tray 1 and contents is removed by hand to my jolting machine which I will now describe.

Referring to Fig. 16, my jolting machine 300 is shown supporting the shell tray 1 and the shells 2 which have been slid into position by an operator, on to a iron anvil 301. The anvil 301 is provided with inclined portions 302 upon which the bottoms of the shells 2 are slid up and freed from resting upon the lower members 3 of the shell tray 85 1, so that when the jolting operation occurs the bottoms of the shells 2 will be jolted without coming into contact with the lower members 3 of the shell tray 1. The anvil 301 is provided at its upper face with a sheet of fiber, so that when the shells 2 are jolted upon the anvil 301 the bottoms of the shells 2 will not be marred by making metal to metal contact with the anvil 301.

Referring particularly to Fig. 17, a 95 wooden bench 304 is shown. This bench 304 is provided with a top 305 upon which is suitably mounted the anvil 301 and a bed-plate 306, at each end of which is supported a cast iron frame 307. The cast iron frames 307 are provided with vertical guides 308 to contain vertical slides 309. The slides 309 are formed one at each end of a raising and falling yoke 310. The yoke 310 supports several electromagnets 311, which have hollow centers as indicated in dotted lines at the left of Fig. 16, in which the left hand shell 2 is indicated in dotted lines as extending a short distance into the hollow central portion of the left hand electromagnet 311. 110

The yoke 310 is limited in its rising movement by limit pins 312, which are fastened at the lower ends of the slides 309. The yoke 310 is limited in its falling movement by limit pins 313, which are fastened at the upper ends of the slides 309. When the yoke 310 rises to the limit of its travel the limit pins 312 abut against the lower ends of the guides 308, and when the yoke 310 falls to the lower limit of its travel the limit pins 313 abut against the upper ends of the guides 308. At the upper ends of the slides 309 counter-weight chains 314 are attached and these counterweight chains pass over sprockets 315, which are attached to a shaft 316. The shaft 316 is mounted in bearings 317, which are formed at the upper ends of the frames 307. After the chains 314 pass over the sprockets 315 they descend to attachments with lever arms 318. The lever 130

arms 318 are pivoted upon studs 319 at their left hand ends, according to Fig. 17, and the studs 319 are fastened in the frames 307. The lever arms 318 are provided at the right hand ends according to Fig. 17 with counterweights 3180, so proportioned that the yoke 310 and the members which it carries may be moved up or down with a minimum of effort on the part of an operator. The lever arms 318 are provided with vertical connecting bars 320, which descend to pivotal attachment with the right hand ends of treadle levers 321, which are fulcrumed upon brackets 322. The treadle levers 321 extend to the left, according to Fig. 17 and are attached to a treadle 323 which may be conveniently operated by the foot of an operator to raise or lower the yoke 310 and the electromagnets 311, which are carried by the yoke 310. In addition to the treadle operation the raising and lowering of the electromagnets 311 may be effected by means of a hand lever 324, which is attached to the shaft 316. By raising or lowering the handle 324 the rotary movement will be communicated to the shaft 316 and this in turn will rotate the sprockets 315, which will cause the raising or lowering of the yoke 310 and the electromagnets 311.

Referring particularly to Fig. 17, dotted lines indicate the extreme upper and lower positions into which the lever arms 318 and their connected members travel, and on the frames 307 are mounted adjustable upper stops 325, which limit the upper movement of the lever arms 318, and this also limits the downward movement of the electromagnets 311. Upon the frames 307 are provided lower adjustable stops 326, which are for the purpose of limiting the downward travel of the lever arms 318 and thus limiting the upward travel of the electromagnets 311. These lower stops 326 also provide a safety device which prevents the counter weights 3180 from falling to the floor in the event of the counter-weight chains 314 breaking through any accidental cause. Within the upper ends of the hollow portions of the electromagnets 311 are provided fiber disks 327 which are to prevent the shells 2 from striking a metal to metal blow when the shells 2 are jolted.

Referring to Fig. 18, a diagrammatic wiring diagram of my loading machine 300 shows at the left a source of direct current indicated by the initials D. C. and at the right a source of alternating current indicated by the initials A. C. The A. C. current is led by wires 328 and 329 to the right hand contacts of a double pole, double throw switch 330, which is shown in the open position. The D. C. current is led by a wire 331 to a sign flasher 333, of the well known type which is used to intermittently illumi-

nate and extinguish electric display signs. The sign flasher 333 interrupts the D. C. current periodically, turning the current on and off, say for instance once each second, and the interrupted current is then led by a wire 334 to the lower left hand contact of the switch 330. A wire 332 leads from the source of D. C. current to the upper left hand contact of the switch 330. Central contacts of the switch 330 are connected through the wires 335 and 336, with coils 337 of the electromagnets 311.

In operation the operator first places the shells 2 and the shell tray 1 in position while the yoke 310 and the electromagnets 311 are in an upper position, higher than the position shown in Figs. 16 and 17. The operator then either presses down the treadle 323 or pulls down the hand lever 324 until the lever arms 318 are stopped by the adjustable stops 325. This causes the electromagnets to descend with the noses of the shells 2, entering the predetermined distance into the central portions of the electromagnets 311. As soon as the electromagnets 311 have been brought down to the predetermined position as just described, the operator throws the switch 330 to the left and this closes the circuit from the source of direct current D. C., according to Fig. 18, through the wire 331 and the sign flasher 333, which causes the direct current to be interrupted, as previously described. From the sign flasher 333 the circuit continues through the wire 334 to the lower left hand contact of the switch 330, and thence through the wire 336 to the electromagnet windings 337. The circuit through wire 336 enters the left hand electromagnet winding 337 and passes successively in series through the several electromagnet windings 337 emerging at the right of Fig. 18 through the wire 335, from which the circuit passes through the upper central member of the switch 330 and the wire 332 back to the source of direct current D. C. In this position the shells are electromagnetically jolted between the fiber disks 327 and the fiber sheet 303 by the intermittent magnetization of the electromagnets 311.

After the electromagnetic jolting operation is completed the operator throws the switch 330 to the right according to Fig. 18, and this causes an alternating current circuit from the source of alternating current A. C. to pass through the wire 328 and then through the upper members of the switch 330 to the wire 335 and into the righthand electromagnet winding 337, thence in series through the several windings 337 and out from the left hand winding 337 through the wire 336. The wire 336 leads to the lower central member of the switch 330 through which the circuit returns by way of the wire 329 to the source of alternating current A. C.

This establishes an alternating current circuit in the windings 337, which demagnetizes the shells 2 and prevent the possibility which might exist of the shells 2 remaining magnetized and affecting the barrels of the guns through which they are fired. After the alternating current has been allowed to demagnetize the shells 2 the switch 330 is opened and either the hand lever 324 or the treadle 321 raised so as to permit the shells 2 and the tray 1 to be removed from the jolting machine to my fuse pellet machine, which I will now describe.

Referring to Figs. 19 and 20, the shell tray 1 containing shells 2 is placed by an operator in position upon my fuse pellet inserting machine 400. The fuse pellet inserting machine 400 consists of a table 401 at the lower portion of which is a cam device 402 to raise and lower a member, such as for instance my anvil 403. The operation of the cam device is indicated by the several arrows in Fig. 19 and its purpose is merely that of raising and lowering the anvil 403. The cam device 402 consists principally of disks 4020 provided with helical grooves 4021. The disks 4020 are loosely mounted on a shaft 4022 which is suitably fastened at the side of the table 401 in cross pieces 4023 of the table 401. The disks 4020 carry pinions 4024, which mesh with quadrants 4025 and the quadrants 4025 may be operated by draw rods 4026, which may be attached to a foot treadle or other convenient device. The quadrants 4025 are loosely mounted on a shaft 4027, which is attached in a lower brace 4028 of the table 401.

Upon the table 401 are erected frames 404, which are provided at their upper ends with a pipe 405 leading from a source of air pressure as indicated by the arrow at the upper left hand portion of Fig. 20. A valve 406 is indicated in the pipe 405, and an arrow at the lower end of the valve handle shows the direction in which the handle may be turned to turn on the air pressure.

The pipe 405 contains several communicating pipes 407, which are provided with spiral compression springs 408 to hold down sliding couplings 409. The sliding couplings 409 are for the purpose of receiving tubes 410, which are used to contain a suitable number of fuse pellets 1200. Many of these fuse tubes 410 may be provided, and each one loaded with a suitable group of fuse pellets 1200, and then the tubes loaded with pellets are inserted by hand into my machine 400. The insertion of these tubes 410 is effected by the operator first inserting the lower ends of the tubes 410 into recesses 411 and pushing these couplings up against the springs 408 until the upper ends of the tubes 410 may be slipped into the couplings 409. The tubes 410 are each provided with retaining springs 412, which prevent the

powder pellets 1200 from dropping out and thus make it possible for an operator to handle the fuse tubes 410 as units. After the fuse tubes 410 discharge the fuse pellets 1200 the operator removes them, first pushing up the couplings 409. In operation the shells 2 are raised to the position indicated in dotted lines in Fig. 19 and tubes 413 which are provided at the lower ends with suitable flaring base portions 414, held in extended portions 415 of the frames 404, provide channels through which the fuse pellets 1200 may be pushed down into fuse tubes 12. The valve 406 is then opened and the compressed air forces down the fuse pellets 1200 into the fuse tubes 12 against the retaining or frictional holding of the retaining springs 412. The air pressure is released and the cam device 402 operated to lower the anvil 403 and the shells 2 into the position indicated in the figures, after which the shell tray 1 and the shells 2 may be removed for the insertion of the plugs, which is a hand operation.

I claim:

1. The method, herein described, of filling shells with powder; which consists in grouping the shells into gangs, discharging powder into the shells of each gang and subjecting the shells of each gang to the operation of shaking.

2. The method herein described of filling shells with powder which consists in grouping the shells into gangs, handling the gangs as units, submitting the gangs to pneumatic action in order to draw the powder into the shells, and subjecting the shells to agitation during the filling.

3. The method of filling shells with powder, which consists of grouping the shells into gangs, handling the gangs as units and submitting the gangs to the operations of filling and electromagnetic shaking.

4. The method of filling shells with powder, which consists of grouping the shells into gangs, handling the gangs as units, and submitting the gangs to the operations of filling under vacuum and electromagnetic shaking.

5. The method herein described of filling shells with powder, which consists in subjecting the shells to pneumatic action in order to force the powder thereinto, and agitating the shells during this step.

6. The method of filling shells with powder, which consists of submitting the shells to the operations of filling and electromagnetic shaking.

7. The method of filling shells with powder, which consists of submitting the shells to the operations of filling under vacuum and electromagnetic shaking.

8. The method of filling shells with powder, which consists of grouping the shells into gangs, handling the gangs as units, cen-

tering the gangs magnetically, and submitting the gangs to the operation of filling.

5 9. The method of filling shells with powder, which consists of grouping the shells into gangs, handling the gangs as units, centering the gangs magnetically, and submitting the gangs to the operation of filling under vacuum.

10 10. The method of filling shells with powder, which consists of grouping the shells into gangs, handling the gangs as units, centering the gangs magnetically, and submitting the gangs to the operations of filling and electromagnetic shaking.

15 11. The method of filling shells with powder, which consists of grouping the shells into gangs, handling the gangs as units, centering the gangs magnetically, and sub-

mitting the gangs to the operations of filling under vacuum and electromagnetic shaking. 20

12. The method of filling shells with powder, which consists of centering the shells magnetically and submitting the shells to the operation of filling under vacuum. 25

13. The method of filling shells with powder, which consists of centering the shells magnetically and submitting the shells to the operations of filling and electromagnetic shaking. 30

14. The method of filling shells with powder, which consists of centering the shells magnetically and submitting the shells to the operations of filling under vacuum and electromagnetic shaking.

DONALD M. BLISS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."