Aug. 2, 1955 E. M. HARVEY 2,714,334

BREECH BOLT LOCK FOR AUTOMATIC FIREARMS

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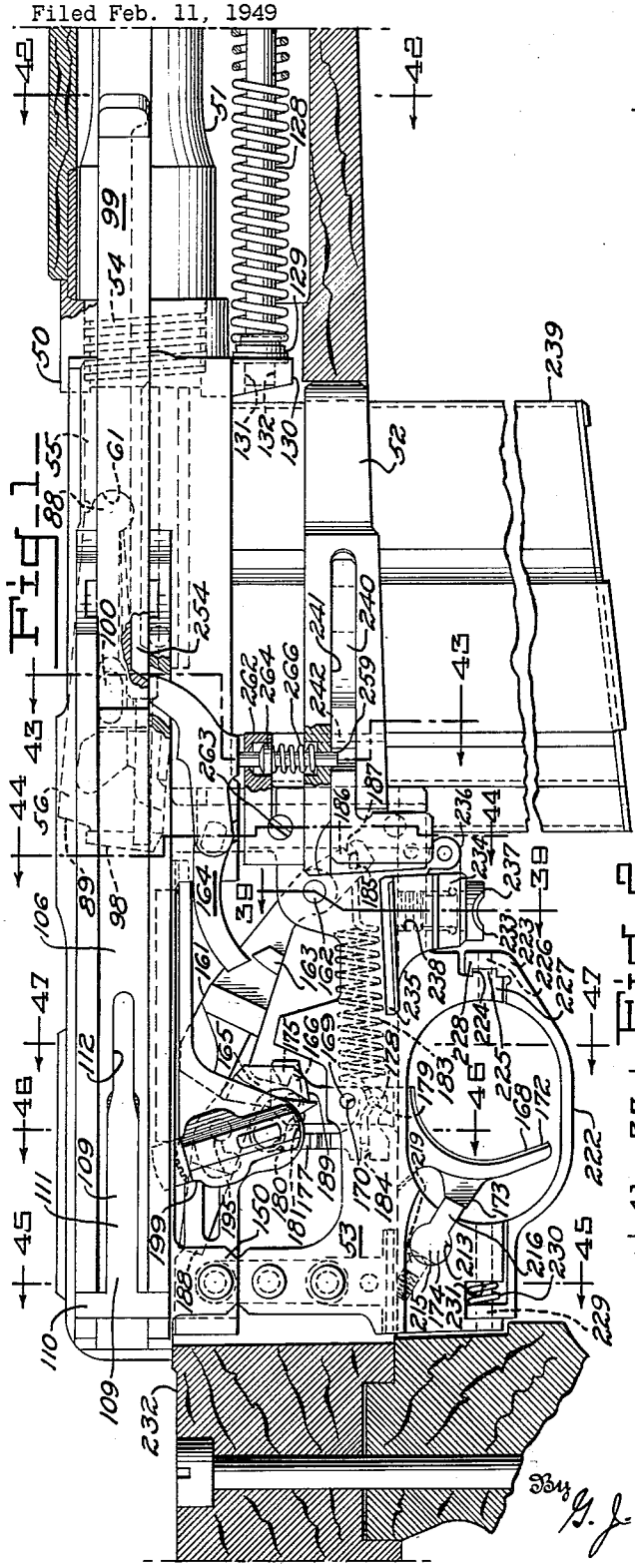


Fig. 1

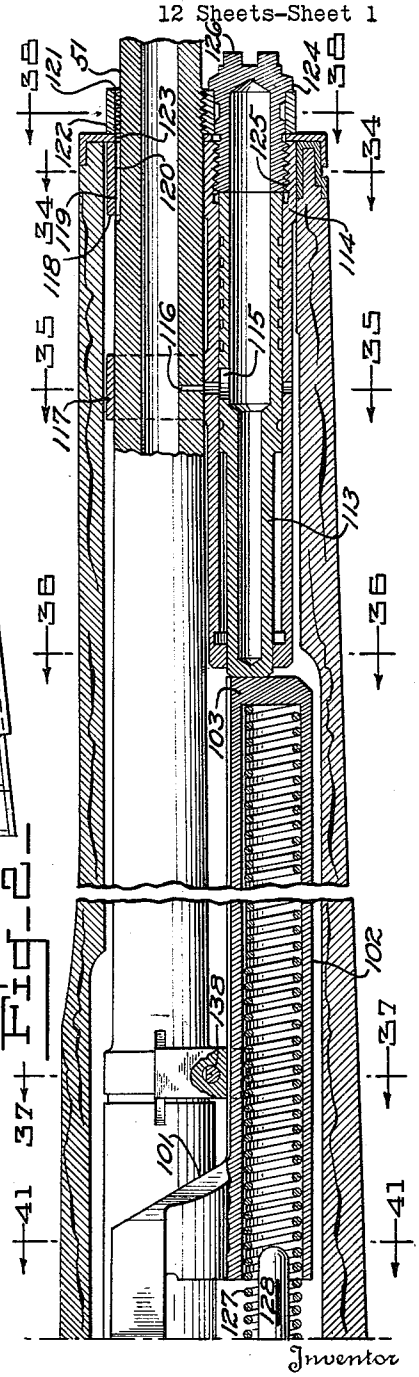


Fig. 2

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BREECH BOLT LOCK FOR AUTOMATIC FIREARMS

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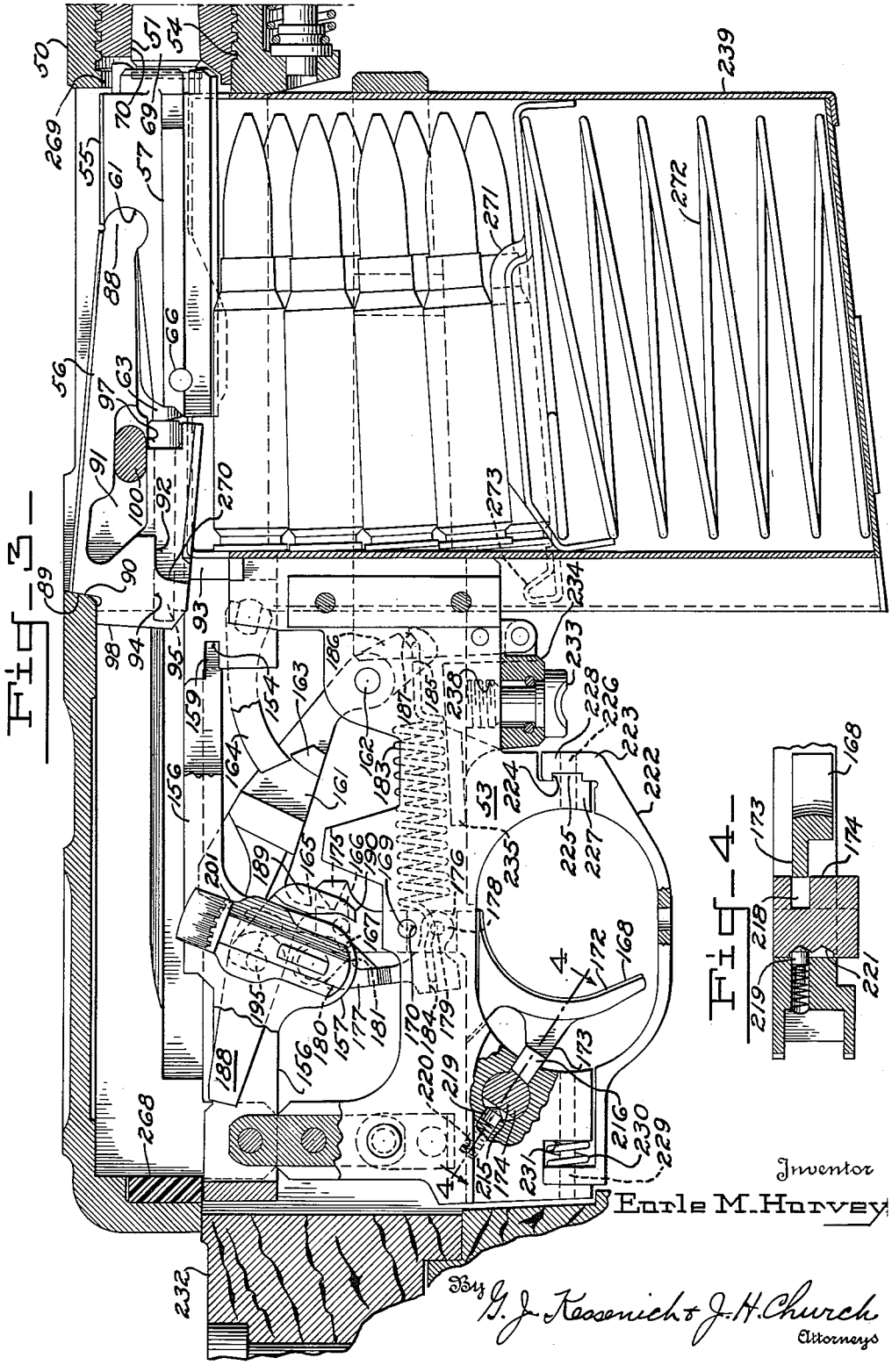


Fig. 3

Fig. 4

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BREECH BOLT LOCK FOR AUTOMATIC FIREARMS

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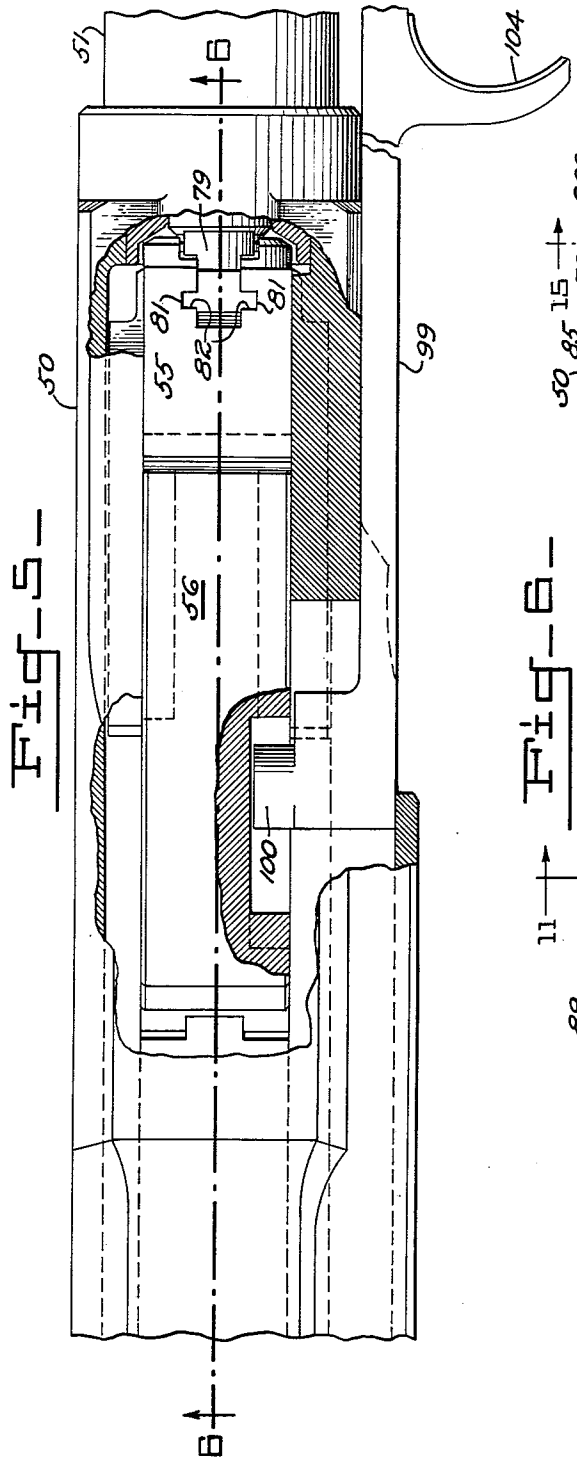


Fig. 5

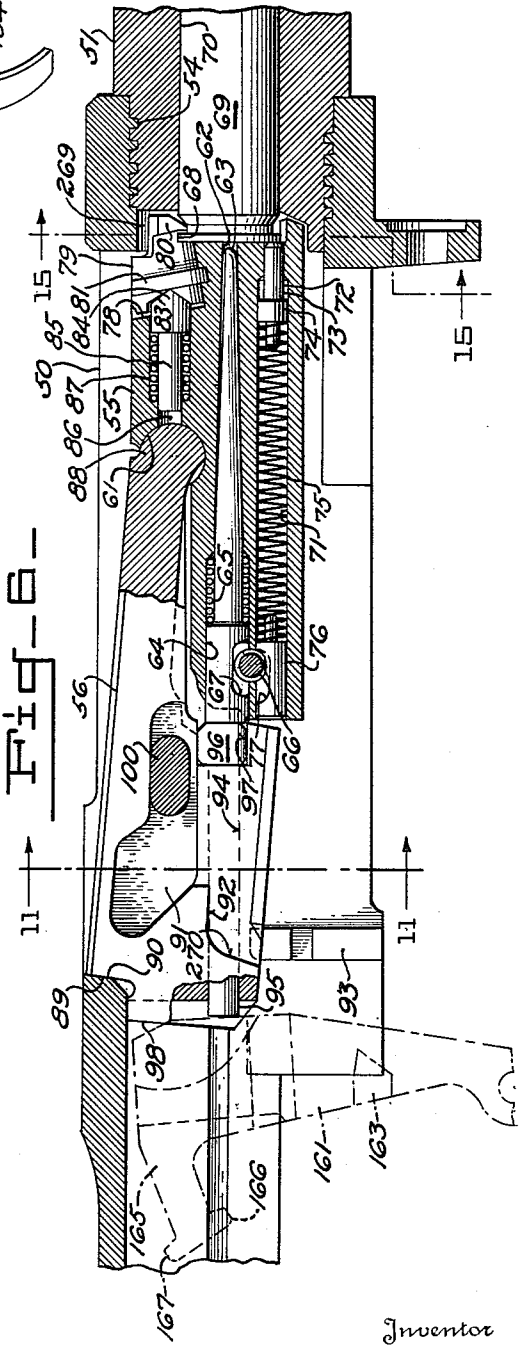


Fig. 6

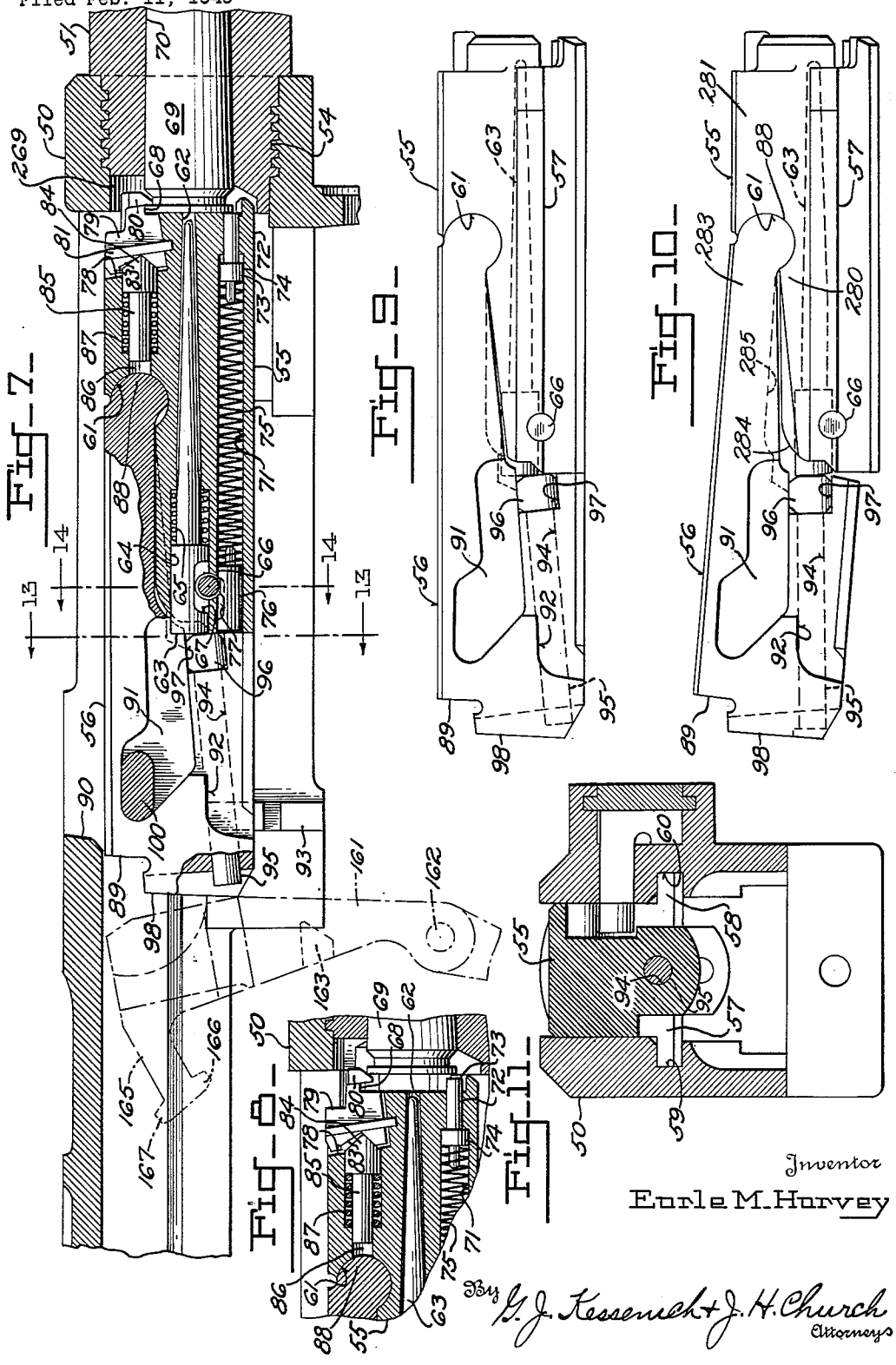
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BREECH BOLT LOCK FOR AUTOMATIC FIREARMS

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BREECH BOLT LOCK FOR AUTOMATIC FIREARMS

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Fig. 12.

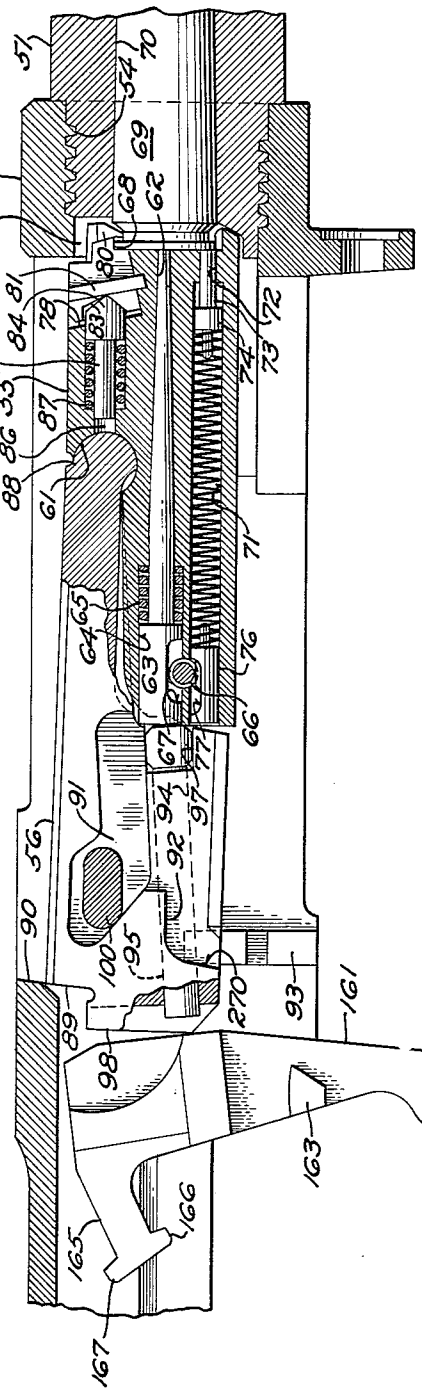


Fig. 15.

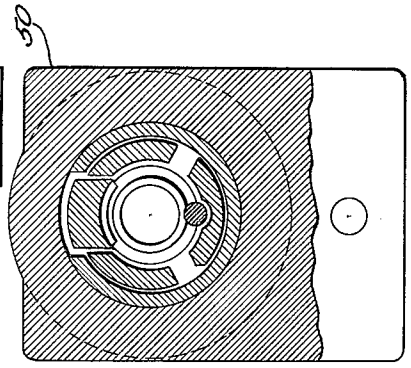


Fig. 14.

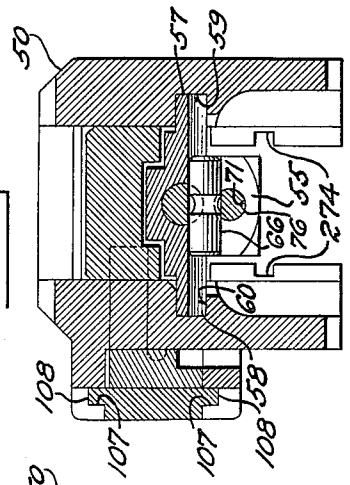
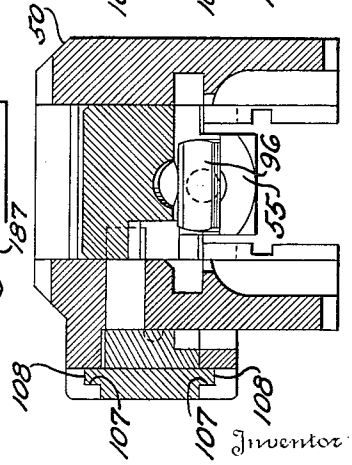


Fig. 13.



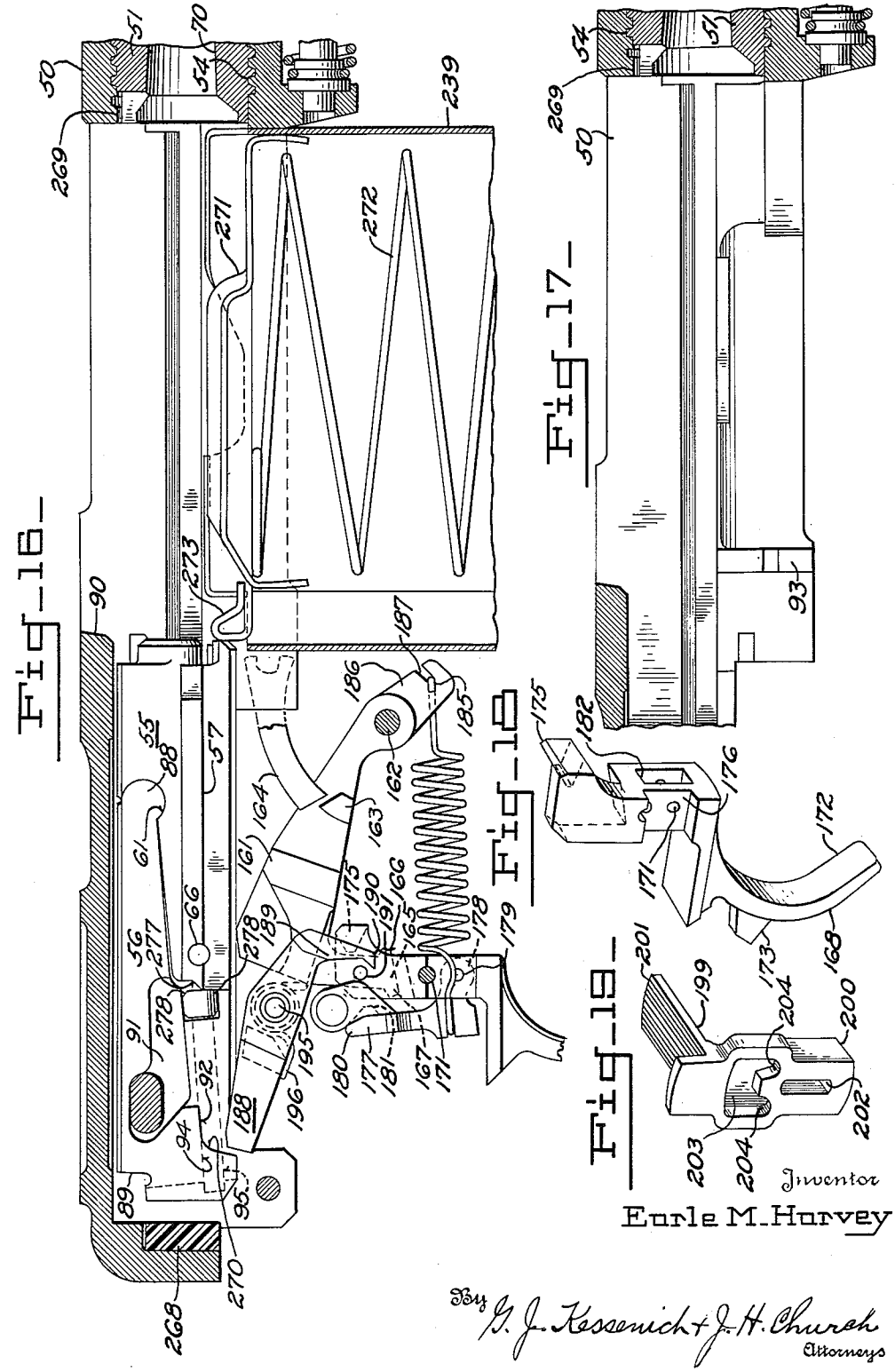
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Aug. 2, 1955 E. M. HARVEY 2,714,334

BREECH BOLT LOCK FOR AUTOMATIC FIREARMS

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BREECH BOLT LOCK FOR AUTOMATIC FIREARMS

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Fig. 20.

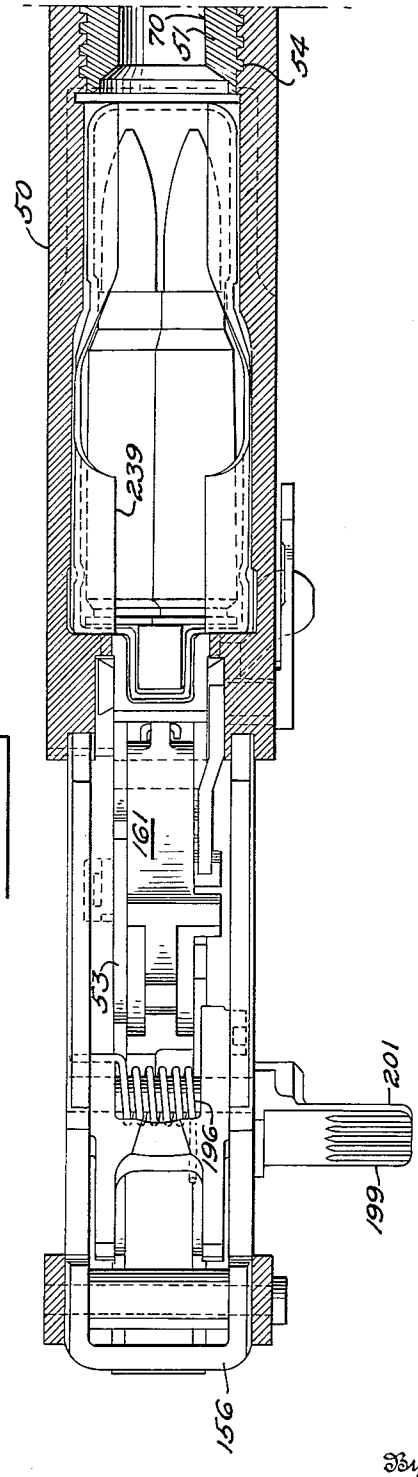
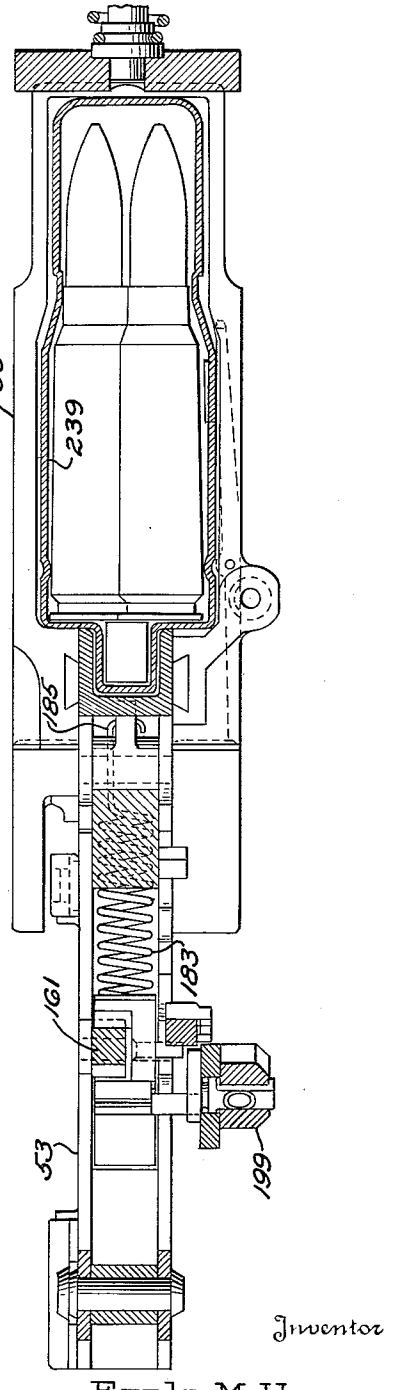


Fig. 21.



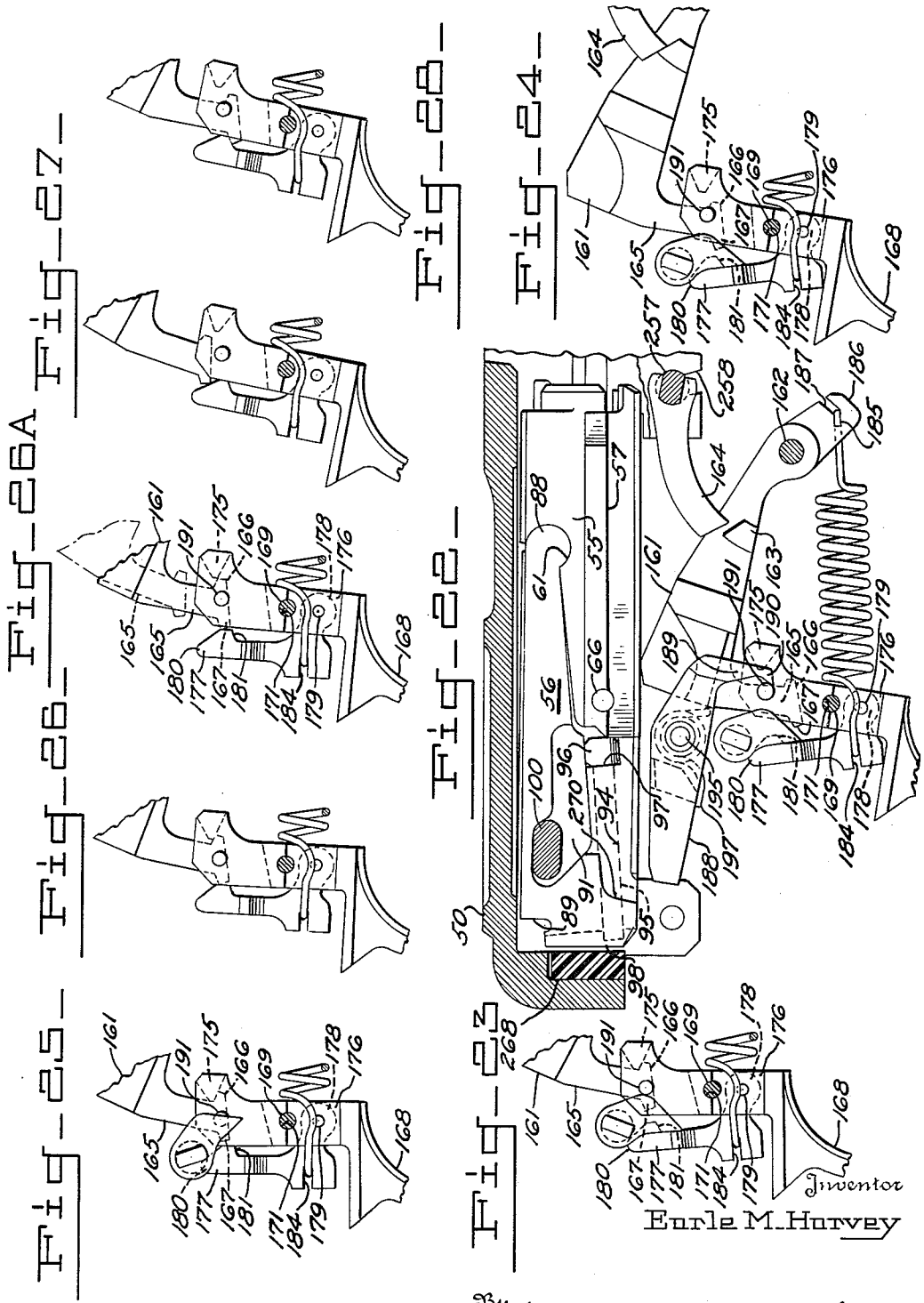
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BREECH BOLT LOCK FOR AUTOMATIC FIREARMS

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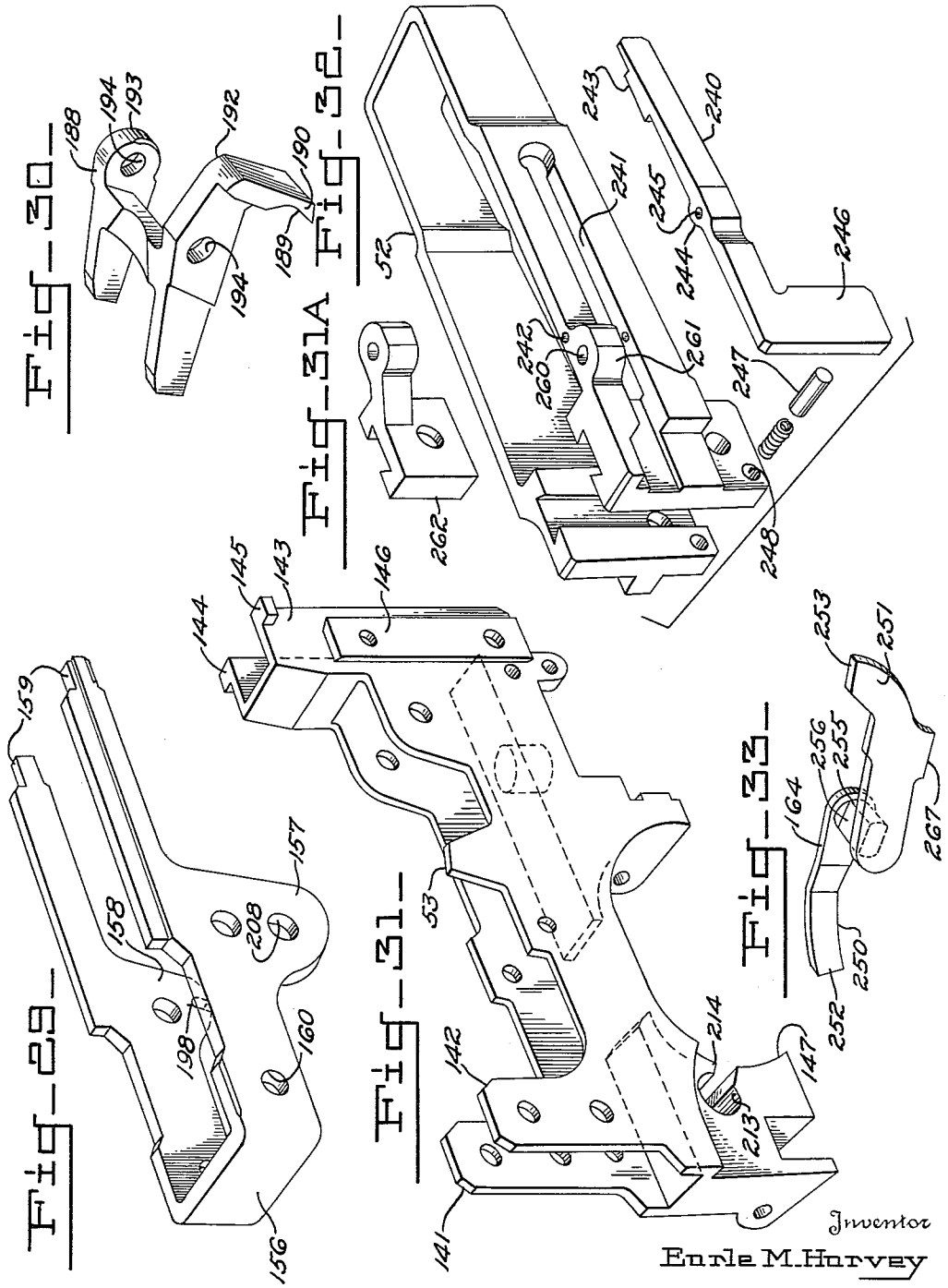
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Aug. 2, 1955 E. M. HARVEY 2,714,334

BREECH BOLT LOCK FOR AUTOMATIC FIREARMS

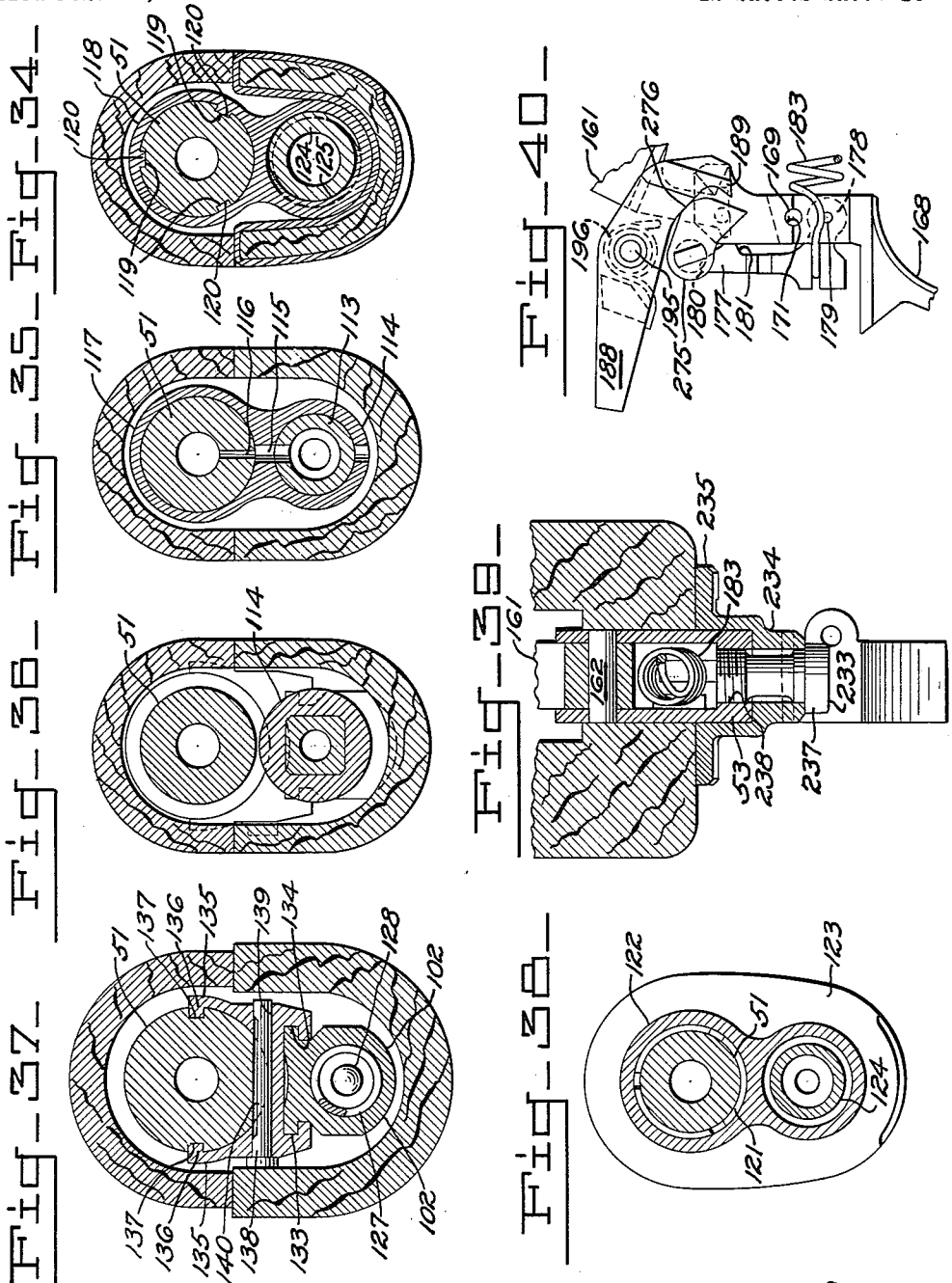
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BREECH BOLT LOCK FOR AUTOMATIC FIREARMS

Filed Feb. 11, 1949 12 Sheets-Sheet 10



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BREECH BOLT LOCK FOR AUTOMATIC FIREARMS

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Fig-42-

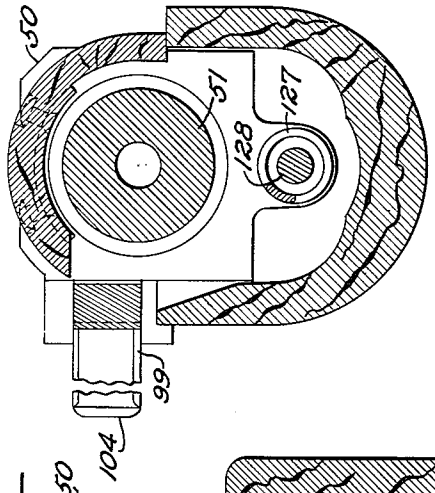


Fig-41-

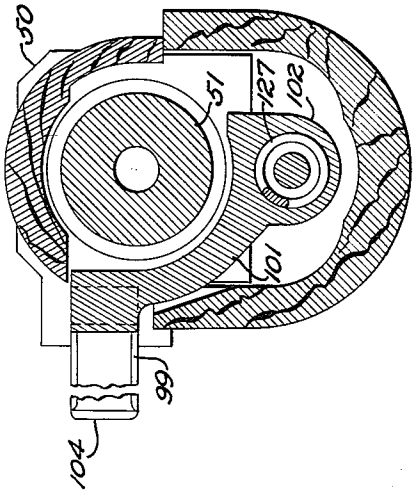


Fig-43-

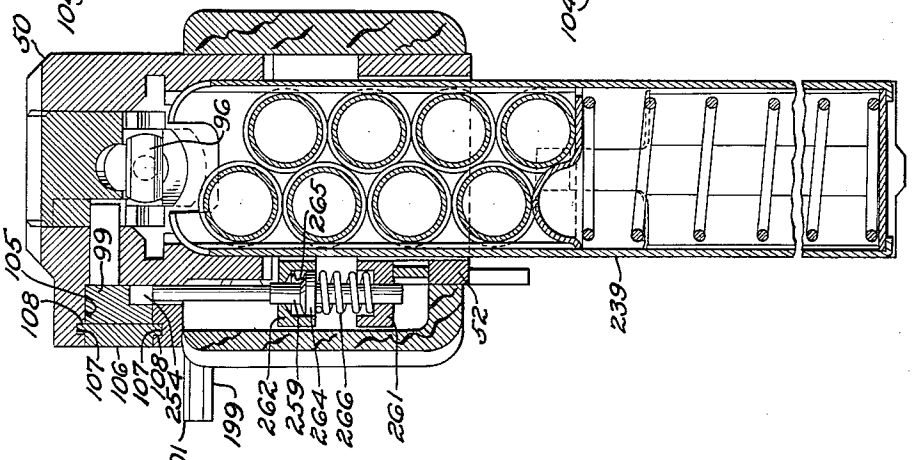
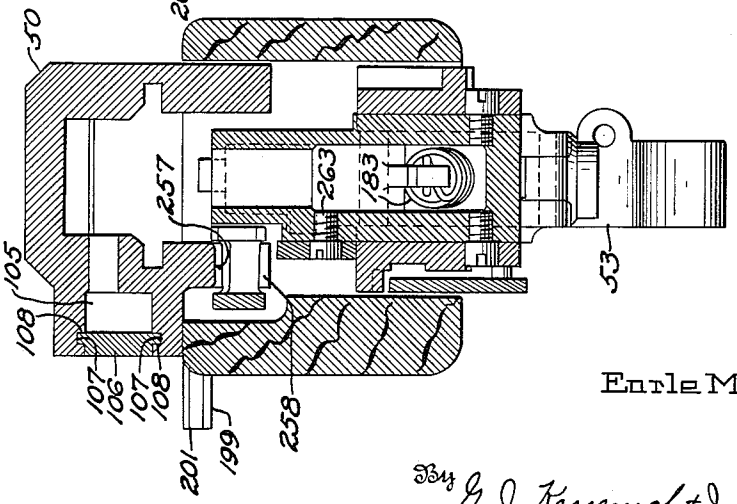


Fig-44-



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BREECH BOLT LOCK FOR AUTOMATIC FIREARMS

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Fig-47-

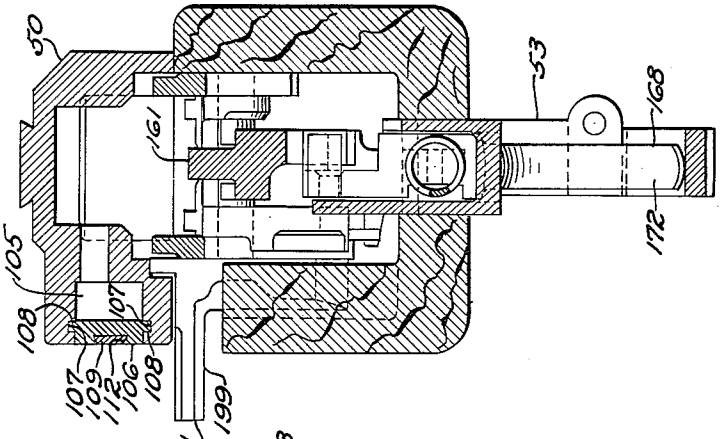


Fig-46-

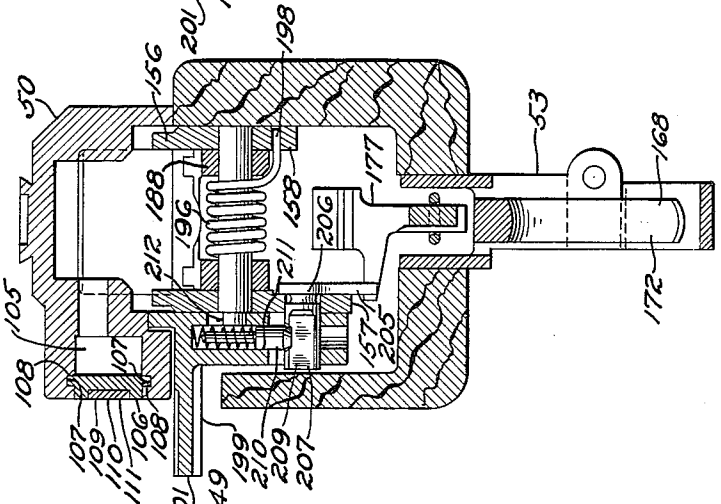
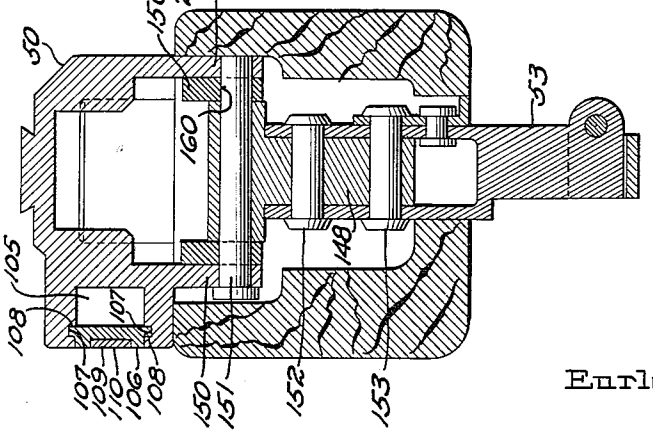


Fig-45-



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United States Patent Office

2,714,334

Patented Aug. 2, 1955

2,714,334

BREECH BOLT LOCK FOR AUTOMATIC FIREARMS

Earle M. Harvey, Agawam, Mass., assignor to the United States of America as represented by the Secretary of the Army

Application February 11, 1949, Serial No. 75,921

3 Claims. (Cl. 89—190)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described in the specification and claims may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to a light weight firearm capable of being selectively fired semi-automatically or full automatically.

It has long been the aim of firearm designers to produce an automatic firearm which combines light weight with accuracy, rapidity of fire and dependability of operation. While some prior art firearms are quite dependable and function satisfactorily, such firearms are prone to be exceedingly heavy. Obviously excessive weight of the firearm greatly reduces the efficiency of the individual carrying the arm and in addition, limits the amount of ammunition that can be conveniently carried, thereby reducing the firepower of such individual.

Accordingly it is an object of this invention to provide a light weight firearm which can be selectively discharged for either semi or full automatic fire.

Another object of this invention is to provide a firearm having a positively locked breech block at the time of discharge of the cartridge.

Still another object of this invention is to provide a unique fire control mechanism for a firearm capable of selectively producing full or semi-automatic fire.

Another object of this invention is to provide a device for a firearm of the automatic type which effectively blocks the hammer until the bolt is in the breeched locked battery position.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings in which:

Fig. 1 is a longitudinal sectional view of the main elements of the firearm including the receiver and the fire control mechanism.

Fig. 2 is a continuation of Fig. 1 showing the barrel and gas cylinder and piston arrangement.

Fig. 3 is an enlarged detail longitudinal sectional view of the receiver showing the breech elements contained therein with the bolt in the battery position.

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 3.

Fig. 5 is a top view of the firearm receiver showing the bolt in the locked battery position.

Fig. 6 is a longitudinal sectional view taken along the line 6—6 of Fig. 5.

Fig. 7 is a view similar to Fig. 6 but showing the bolt in the unlocked position.

Fig. 8 is a fragmentary detail view of the firearm bolt and receiver showing the extractor about to engage the head of a cartridge.

Fig. 9 is a detail side view of the bolt and lock member.

Fig. 10 is a view similar to Fig. 9 but showing the locking element in the raised or locked position.

Fig. 11 is a cross sectional view taken along the line 11—11 of Fig. 6.

Fig. 12 is a view similar to Fig. 7 showing the position of the locking element and bolt after the gun has been fired and with the bolt in the partially unlocked position illustrating the rearward camming thereof for exerting a primary extracting force on the fired cartridge.

Fig. 13 is a cross sectional view taken along the line 13—13 of Fig. 7.

Fig. 14 is a cross sectional view taken along the line 14—14 of Fig. 7.

Fig. 15 is a cross sectional view taken along the line 15—15 of Fig. 6.

Fig. 16 is a longitudinal sectional view showing the fire control mechanism set for full automatic fire with the bolt and locking element in the recoil position and held therein by the automatic sear.

Fig. 17 is a fragmentary detail view of the receiver showing the various cuts therein.

Fig. 18 is a perspective view of the trigger.

Fig. 19 is a perspective view of the selector.

Fig. 20 is a horizontal sectional view of the receiver showing the mounting of the fire control elements in the trigger guard.

Fig. 21 is a bottom view of the receiver showing the magazine retained within such receiver.

Fig. 22 is a detail view of the rear end of the receiver shown in longitudinal section illustrating the position of the fire control mechanism elements when set for full automatic fire.

Fig. 23 is a fragmentary detail view showing the hammer held in the cocked position by the trigger when set for full automatic fire.

Fig. 24 is a view similar to Fig. 23 but showing the trigger in the pulled position with the hammer held cocked by the hammer lock.

Figs. 25 through 28 show the positions of the fire control mechanism when set for semi-automatic fire from the normal or unpulled position of the trigger through the pulled position showing the release of the hammer and the re-cocking of the hammer and engagement thereof by the secondary sear as shown in Fig. 28.

Fig. 29 is a perspective view of the bolt retainer.

Fig. 30 is a perspective view of the automatic sear.

Fig. 31 is a perspective view of the trigger housing.

Fig. 31*a* is a perspective view of the trigger housing bracket.

Fig. 32 is an exploded perspective view of the magazine guard showing the magazine catch and hammer lock plunger guide which are assembled to the magazine guard.

Fig. 33 is a perspective view of the hammer lock.

Fig. 34 is a cross sectional view taken along the line 34—34 of Fig. 2.

Fig. 35 is a cross sectional view taken along the line 35—35 of Fig. 2.

Fig. 36 is a cross sectional view taken along the line 36—36 of Fig. 2.

Fig. 37 is a cross sectional view taken along the line 37—37 of Fig. 2.

Fig. 38 is a cross sectional view taken along the line 38—38 of Fig. 2.

Fig. 39 is a sectional view taken along the line 39—39 of Fig. 1.

Fig. 40 illustrates a modified form of selector cam for holding the rear end of the automatic sear downwardly during semi-automatic fire.

Fig. 41 is a cross sectional view taken along the line 41—41 of Fig. 2.

Fig. 42 is a cross sectional view taken along the line 42—42 of Fig. 1.

Fig. 43 is a cross sectional view taken along the line 43—43 of Fig. 1.

Fig. 44 is a cross sectional view taken along the line 44—44 of Fig. 1.

Fig. 45 is a cross sectional view taken along the line 45—45 of Fig. 1.

Fig. 46 is a cross sectional view taken along the line 46—46 of Fig. 1.

Fig. 47 is a cross sectional view taken along the line 47—47 of Fig. 1.

In Figs. 1, 2 and 3 there is shown in assembled relation the firearm of this invention. Such firearm comprises mainly a receiver 50, a barrel 51, a magazine guard 52 and a trigger housing 53. Barrel 51 is horizontally secured to receiver 50 by threads 54. A substantially rectangular bolt 55 and a locking block 56 pivotally secured thereto are mounted in receiver 50 for longitudinal reciprocating movement.

Bolt 55 is provided with a pair of opposed integral ribs 57 and 58 which slidably engage corresponding ways 59 and 60 in receiver 50. An axial hole 62 is provided in bolt 55 of suitable configuration to receive a headed firing pin 63. Hole 62 is counterbored at the rear end thereof as shown at 64 to accommodate the head of such firing pin. A spring 65 contained within counterbore 64 surrounds firing pin 63 and acts between the bottom of such counterbore and the head of pin 63. Firing pin 63 is retained within hole 62 by a transverse pin 66 and such pin cooperates with a longitudinally cut-away portion 67 provided in the head of pin 63 to permit limited longitudinal movement of such firing pin. Firing pin 63 is arranged to be struck by a striker 95 contained in locking block 56 and such striker cooperates with a transverse sloped shoulder 277 on bolt 55 during the unlocking movement of locking block 56 as will be later described.

The face of bolt 55 is recessed as shown at 68 to receive the base of a cartridge 69 shown in a chamber 70 of barrel 51. Directly underneath firing pin hole 62 there is provided a longitudinally disposed hole 71. The forward end of hole 71 is of reduced diameter as shown at 72 and communicates with recess 68. A cartridge ejector 73 is placed in hole 71 and such ejector projects through the reduced diameter portion 72 of hole 71 and into recess 68. Ejector 73 is provided with an integral head 74 which abuts the bottom of hole 71 thereby retaining ejector 73 within hole 71. A spring 75 is placed within hole 71 and acts against ejector 73. A cylindrical spring retainer 76 is placed in the rear end of hole 71 and such retainer is secured to bolt 55 by pin 66 which also secures the firing pin as mentioned, a notch 77 in retainer 76 permitting such function.

On the forward end of bolt 55 above firing pin hole 62 there is provided a recess 78 communicating with recess 68. An extractor 79 is inserted in recess 78 and such extractor is provided with a cartridge engaging, arcuately shaped hook 80. A rib 81 is provided on each side of extractor 79 and such ribs cooperate with ways 82 in bolt 55 as shown in Fig. 5. A conical recess 83 is provided in the rear of extractor 79 which is engageable by a conical point 84 of a detent 85. Detent 85 is longitudinally disposed in a counterbored hole 86 near the top of bolt 55. A spring 87 surrounds such detent to bias the detent into recess 83 whereby the extractor is yieldingly secured in recess 78 to provide the necessary vertical movement of extractor 79 to permit engaging of the cartridge head. An opening 269 is provided between barrel 51 and receiver 50 as shown in Fig. 7 to admit the extractor and to limit the upward movement thereof while engaging the head of a cartridge. This extractor mechanism is disclosed and claimed in my divisional application Serial No. 164,579, filed May 26, 1950.

Bolt 55 is cut away to form a stepped down portion 280 and at the junction thereof with the remaining bolt portion 281 there is provided a transverse arcuate recess 61 as shown in Fig. 10. Locking block 56 is provided with a forwardly extending portion 283 terminating in a substantially semi-cylindrical end 88 arranged to mate with and engage in recess 61. Due to the fact that the

diameter of end 88 is slightly greater than the linear distance across the rear open portion of the periphery of arcuate recess 61, assembly and disassembly of locking block 56 to and from bolt 55 can be accomplished only by laterally inserting end 88 into recess 61 from either side of bolt 55. As a result of the foregoing construction, the pivotal joint of this invention effectively eliminates any objectionable longitudinal movement of locking block 56 relative to bolt 55 while at the same time permits unrestricted pivotal movement of the former between the unlocked position shown in Fig. 7 and the locked position shown in Fig. 6.

A portion of the top surface of stepped-down bolt portion 280 projects upwardly as indicated at 284 in Fig. 10 and is arranged to engage in a suitable mating recess 285 formed on the underside of forwardly extending locking block portion 283 when locking block 56 is disposed in the unlocked position thereby preventing possible lateral movement thereof relative to bolt 55 during the unitary longitudinal reciprocal movement of two members. When in the unlocked position of Fig. 7, locking block 56 serves to complete and extend rearwardly the generally rectangular configuration of bolt 55. A sloped locking shoulder 89 is provided on the rear of locking block 56 and such locking shoulder cooperates with a corresponding locking surface 90 on receiver 50 in a manner as will be later described. On the side of locking block 56 there is provided a cam groove 91 to raise locking block 56 into the locked position as will be later described. Locking block 56 is cut away on each side thereof to form oppositely disposed cam surfaces 92 each being simultaneously engageable by a locking rib 93 vertically disposed in receiver 50 as shown in Figs. 7 and 12 to provide the initial upward camming movement of locking block 56 to raise such locking block to the locked position. Such arrangement also provides a primary extractive force on a fired case which breaks the seal and permits easier extraction thereof. An oblique hole 94 is longitudinally disposed in locking block 56 and striker 95 is contained therein. Such striker is provided with an integral substantially rectangular head 96 on the forward end thereof and is accommodated by a recess 97 provided in the forward end of hole 94. The upper and lower forward edges of head 96 are beveled as shown at 278 so that striker 95 can be assembled into locking block 56 with either side uppermost whereby one of beveled surfaces 278 will be engageable with shoulder 277 on the rear of bolt 55 as the bolt is unlocked to cam the striker rearwardly. Head 96 strikes the rear end of firing pin 63 in a manner to be later described. A rear surface 98 of locking block 56 arrests the forward movement of a hammer 161 as will be later described.

Bolt 55 and locking block 56 are actuated by an operating slide 99. Operating slide 99 is disposed longitudinally on the side of receiver 50 as shown in Figs. 1 and 5. Slide 99 is provided with a transversely disposed lug 100 which engages cam slot 91 in locking block 56. On the forward end of slide 99 there is provided a depending integrally formed arm 101 as shown in Fig. 41 which partially surrounds barrel 51.

A tube-like member 102 having a closed forward end as shown at 103 in Fig. 2, is longitudinally welded or otherwise secured to depending arm 101. A T-shaped rib 133 is provided on top of tube 102 which slidably engages a correspondingly shaped groove 134 in a band 135 secured to barrel 51 as shown in Fig. 37. Band 135 comprises a substantially U-shaped member having opposed ribs 136 on the top thereof inwardly disposed. Such ribs engage opposed longitudinal ways 137 in barrel 51. Band 135 is secured to barrel 51 by a transverse pin 138 and such pin is assembled through a transverse hole 139 in band 135 and contacts a flat portion 140 on the bottom of barrel 51 thereby slidably securing tube 102 to barrel 51.

To retract slide 99, an outwardly projecting handle 104 is provided for such purpose as shown in Fig. 5. The end of slide 99 on which lug 100 is formed is slidably contained within a longitudinally disposed rectangular slot 105 provided on the left side of receiver 50 as shown in Figs. 43 and 44. Slide 99 is retained in slot 105 by a cover 106. Such cover is provided with vertically opposed ribs 108 which engage corresponding ways 107 adjacent slide 99 in slot 105. A latch 109 comprising a horizontally disposed leaf type spring 111 and an integral vertically disposed head 110 secures such cover to the receiver. Leaf 111 is dovetailed within a suitable slot 112 on the side of the cover, while head portion 110 is engageable with a notch (not shown) in the receiver to releasably secure cover 106 to receiver 50.

The slide 99 is driven rearwardly by the action of the propulsion gases against a piston 113 contained in a gas cylinder 114 secured to the underside of barrel 51 as shown in Fig. 2. The rear end of piston 113 projects rearwardly out of gas cylinder 114 to normally contact closed end 103 of tube 102 when the action of the firearm is in the battery position. Piston 113 is hollow and a radially disposed gas port 115 aligns with a gas port 116 provided in barrel 51 when in the position shown in Fig. 2. The principle of operation of this piston utilizes a modification of the White gas expansion system.

Gas cylinder 114 is provided with a pair of upstanding opposed cylindrical bands 117 and 118 which surround barrel 51. Band 118 is provided with a plurality of longitudinally disposed keys 119 on the interior thereof which engage corresponding longitudinal grooves 120 in barrel 51. The cylinder is thus prevented from rotating when in position on such barrel. A threaded portion 121 on barrel 51 permits a nut 122 to be screwed thereon and to tightly clamp a stock ferrule 123 placed between band 118 and nut 122. A hollow screw 124 is threaded into the front end of cylinder 114 which is provided with interior threads 125 to receive screw 124. An integral head 126 is provided on screw 124. The head 126 of screw 124 is of somewhat larger diameter than the body thereof and is arranged to abut nut 122 to lock such nut to barrel 51.

A spring 127 returns operating slide 99 to the position shown in Fig. 2 on the counter-recoil stroke of the firearm of such member. A spring guide 128 is longitudinally disposed under barrel 51 and spring 127 surrounds such guide. An integral collar 129 is provided on the rear end of such guide and abuts a lug 130 depending from receiver 50. A reduced diameter end portion 131 on spring guide 128 engages a longitudinally disposed hole 132 in lug 130 to secure such guide to lug 130. One end of spring 127 abuts the closed end 103 of tube 102 while the other end of the spring abuts collar 129 on spring guide 128.

Trigger housing 53 shown in perspective in Fig. 31 is generally rectangular in outline. A pair of opposed upstanding lugs 141 and 142 are provided on the rear of such housing. On the forward end of housing 53 there is provided a vertically disposed integral channel-like member 143 and on the upper edge thereof there is provided a pair of oppositely disposed lugs 144 and 145 which project outwardly from channel-like member 143. On each side of channel-like member 143 there is provided a vertically disposed dovetail shaped rib 146. An arcuately shaped opening 147 is provided in the bottom of trigger housing 53 to furnish an opening for the trigger and trigger finger as will be later described.

Trigger housing 53 is secured to the underside of receiver 50, lugs 144 and 145 each engaging an opposed way 274 in receiver 50 as shown in Fig. 14, lugs 141 and 142 securing the rear end of housing 53 to receiver 50. Such is effected by mounting a spacer 148 between two integral opposed lugs 149 and 150 depending from receiver 50 as shown in Fig. 45 and secured therebetween by a transverse headed pin 151. Lugs 141 and 142 of trigger housing 53 are secured to spacer 148 by a pair of rivets 152 and 153.

A bolt retainer 156 is secured within receiver 50 and just above housing 53 to support bolt 55 and locking block 56 in such receiver when in the recoiled position. Retainer 156 is essentially a U-shaped member having a pair of depending integral oppositely disposed lugs 157 and 158. The forward ends 159 on bolt retainer 156, as shown in Fig. 29, are of reduced section. Such ends are insertable in opposed slots 154 in receiver 50 to mount the forward end of such retainer in the receiver. A transverse hole 160 is provided in retainer 156 whereby such retainer is mounted on pin 151 thus securing the rear end of such retainer to receiver 50. Retainer 156 straddles spacer 148 and fits between lugs 149 and 150.

A transversely disposed pin 162 pivotally mounts hammer 161 on trigger housing 53 near the forward end of such housing as shown in Fig. 3. Hammer 161 is provided with a lug 163 on the side thereof which is engageable by a hammer lock 164 as will be later described. A depending arm 165 is integrally formed with the head of such hammer as shown in Fig. 24 and such arm is provided on the end thereof with a forwardly projecting transverse trigger engaging slug 166 and a transverse rearwardly projecting sear engaging lug 167. Lug 166 is engageable with a trigger 168. Locking block 56 cams hammer 161 rearwardly during the initial opening movement of such block as shown in Fig. 12 thereby effectively preventing the hammer from contacting striker 95 in any but the locked battery position of the locking block.

Trigger 168 is mounted to trigger housing 53 by a transverse pin 169. Pin 169 passes through a transverse hole 170 in trigger guard 53 and through a hole 171 provided in trigger 168. Trigger 168 is provided with the usual curved finger engaging portion 172. A rearwardly projecting lug 173 is provided on the back of finger portion 172 and integral therewith for engagement by a safety 174 to be later described. On the top of trigger 168 and to one side thereof there is provided a substantially triangularly shaped sear lug 175. Such lug acts as a primary sear and is engageable with lug 166 provided on hammer 161, Figs. 25, 26 and 26*a* showing the engagement of such lug.

Trigger 168 is provided with a longitudinally disposed slot 182. A secondary sear 177 of substantially L-shaped construction is provided with a base terminating in a round end 178 which is placed within slot 182 and is pivotally secured therein by a transverse pin 179. The upper end of sear 177 is provided with a lug 180 having a hammer engaging surface 181 on the underside of such lug, such surface being engageable with lug 167 on hammer 161. A longitudinal groove 176 of rectangular configuration is provided in trigger 168 adjacent slot 182 to permit one end of a hammer spring 183 to pass therethrough and surround secondary sear 177. A groove 184 is provided in sear 177 to accommodate the rounded end of spring 183 to secure such end to such sear. Spring 183 is a helical spring and the other end thereof is provided with a loop 185. Hammer 161 is provided with a depending lug 186 integrally formed therewith and a slot 187 is provided on the forward edge of such lug as shown in Fig. 22 to receive loop 185 of spring 183 to secure such spring 183 to hammer 161.

The primary and secondary sears above described are used together to produce semi-automatic fire as will be described under "Operation" in a subsequent paragraph. To obtain automatic fire an automatic sear 188 of substantially H-shaped construction is horizontally mounted in the firearm. On one of the legs of such sear there is provided a depending lug 189 as shown in Fig. 30 and such lug has a wedge-like end 190 for engaging a transverse pin 191 as shown on trigger 168 in Fig. 22, as will be presently described. In each of opposed legs 192 and 193, shown in Fig. 30, of automatic sear 188 there is provided a hole 194 opposed to one another. Automatic sear 188 is pivotally mounted in bolt retainer 156 by a transverse

pin 195 as shown in Figs. 1 and 3. A coil spring 196 surrounds pin 195 and one end 197 of such spring is engageable with the underside of automatic sear 188 as shown in Fig. 22 while the other end of such spring is engageable with a slot 198 in lug 158 of bolt retainer 156 as shown in Fig. 46. Thus spring 196 biases automatic sear 188 in a clockwise direction as shown in Fig. 3.

A selector 199 shown in Figs. 3 and 19 is provided to selectively engage or disengage the automatic sear 188 whereby semi-automatic fire or full automatic fire may be obtained. Such selector comprises a substantially rectangular body portion 200 and a thumb engaging handle 201 near the top thereof, integrally formed with body portion 200 and at right angles thereto. A vertically disposed slot 202 is provided in body portion 200 near the lower end thereof as shown in Fig. 19 and a substantially rectangular recess 203 is provided above slot 202, the lower corners of such slot being arcuately formed as shown at 204 for a purpose to presently appear.

A selector cam 205 is pivotally secured to lug 157 of bolt retainer 156. Selector cam 205 comprises an arm-like cam portion 206 and a pin 207 disposed at right angles to the cam portion 206. Such pin projects through a hole 208 in lug 157 and the projecting end is shaped to form a substantially rectangular portion 209. With pin 207 placed in hole 208 of lug 157, cam portion 206 then lies adjacent lug 157 of bolt retainer 156 as shown in Fig. 46. The lower end of cam 206 projects into the path of sear 177. Selector 199 is assembled to retainer 156 by placing such selector over the flattened portion 209 of pin 207. Such flattened portion is engageable with slot 202. Selector 199 is secured in position on pin 207 by a spring biased detent 210. Such spring biased detent is retained within a longitudinally disposed hole 211 as shown in Fig. 46.

A reduced diameter end portion 212 of pin 195 projects slightly beyond the side lug 157 of bolt retainer 156 and is engageable with either of the arcuate corners 204 provided on selector 199. End 212 of pin 195 then acts as a lock to selectively secure selector 199 in either of the two positions. The selector 199 may be rotated to the other position by depressing handle 201 thereby compressing detent 210 so that corner 204 is dropped below reduced diameter end 212 of pin 195 whereby selector 199 may be rotated in a clockwise or counterclockwise direction depending upon which position it is desired to move selector 199. Slot 202 is of sufficient length to permit such movement. Selector 199 may be rotated to engage cam 206 with lug 180 of sear 177 to position the fire control mechanism for full automatic fire, conversely, in the other position of selector 199 such mechanism is positioned for semi-automatic fire. In the full automatic position, selector cam 206 maintains secondary sear 177 out of engagement with hammer 161 at all times.

A modified form of selector cam 275 is shown in Fig. 40. Such cam is provided with a decided hump as shown at 276 in such figure which contacts the underside of automatic sear 188 when the selector 199 is set for semi-automatic fire. Thus the rear end of such sear is maintained downwardly out of the path of locking block 56.

A transverse hole 213 is provided in trigger housing 53 near the rear end of arcuate opening 147 as shown in Figs. 3 and 31. A transverse slot 214 communicates hole 213 with opening 147 and safety 174 is insertable therein. Safety 174 comprises a cylindrical body portion 215 provided with a transverse substantially rectangular lug 216 integrally formed with the cylindrical body portion 215. Lug 216 projects through slot 214 and is adjacent lug 173 provided on the rear of trigger 168. Lug 216 is provided with a notch 218 as shown in Fig. 4, such notch being provided to receive lug 173 of trigger 168 when such safety is in the "on" or firing position. A spring biased detent 219 is provided in an obliquely disposed hole 220 in trigger housing 53 which intersects transverse hole 213 as shown in Fig. 3. The end of detent 219 is engageable with either of two suitable shallow recesses 221. Thus by means of recesses 221, the safety 174 may be yieldingly positioned for selectively blocking the trigger to prevent accidental discharge of the firearm or moved to the other position whereby the firearm may be discharged.

A rotatable trigger guard portion 222 depends from the bottom of trigger housing 53 as shown in Fig. 3. Such rotatable guard portion is shaped to provide the usual trigger finger opening in the trigger housing as shown in such figure. The forward end of trigger guard portion 222 terminates in an upstanding end portion 223. A transverse groove 224 is provided on the inside of such end and receives an integral rectangular lug 225 provided on the trigger guard 53. A longitudinally disposed pin 226 is provided with opposed integral arcuately shaped lugs 227 and 228 and each of such members pivotally secures the front end of trigger guard portion 222 to trigger housing 53. The rear end of trigger guard portion 222 is similarly secured by a pin 229. A spring 230 is placed between the rear end of trigger guard portion 222 and housing 53 within a suitable transverse slot 231 to maintain a bias on trigger guard portion 222 to maintain lug 225 in engagement with groove 224 thereby normally maintaining the trigger guard portion 222 in the position shown in Figure 3. Forward pressure against the bottom of trigger guard portion 222 compresses spring 230 thereby disengaging groove 224 from lug 225 whereupon trigger guard portion 222 may be rotated out of the way of trigger 168, thus permitting access to the trigger with a mittened or heavily gloved hand.

A firearm stock 232 is secured to the action of the firearm at a point approximately below the pivot point of hammer 161 by a clamping device 233. Such clamping device comprises a substantially U-shaped member 234 having outwardly flared pad members 235 which rest on the outside of stock 232. Clamp member 234 is pivotally secured to trigger housing 53 as shown at 236. A screw 237 is rotatably secured to clamp 234 and when the clamp is in the position shown in Fig. 1, such screw enters a threaded hole 238 in housing 53 thereby exerting considerable compressive force against clamp member 234 whereby the stock is secured to the action of the firearm.

Magazine guard 52, which is secured to trigger housing 53 and projects forwardly therefrom, is provided to receive a magazine 239. Magazine 239 is retained in position by a catch 240 so that the bolt can readily scoop a cartridge from the magazine and chamber such cartridge. Catch 240 is pivotally mounted within a slot 241 in magazine guard 52 by a vertically disposed pin 242. Catch 240 is a lever-like means provided on one end with a magazine engaging lug 243, as shown in Fig. 32. A boss-like enlargement 244 is substantially centrally provided on catch 240 in which there is provided a vertically disposed hole 245 whereby such catch is pivotally mounted on pin 242. A depending thumb portion 246 is provided on the other end of catch 240 for moving lug 243 out of engagement with magazine 239. A spring biased plunger 247 is seated in a transverse hole 248 in magazine guard 52 to normally bias lug 243 into engagement with magazine 239. Pressure of the thumb against depending portion 246 depresses spring biased plunger 247 thereby rocking catch 240 about pin 242 to disengage lug 243 from the magazine.

With the fire control mechanism set for full automatic fire, as will be later described, hammer lock 164 is utilized to hold the hammer in the cocked position as the bolt 55 travels forwardly to the locked battery position. As the bolt goes into such battery position, the hammer lock is disengaged from the hammer thereby permitting the hammer to swing forwardly to discharge a cartridge.

Hammer lock 164 comprises a two-part member as

shown in perspective in Fig. 33 consisting of a hammer engaging arm portion 250 and a slide engaging arm 251. The hammer engaging portion is provided with a substantially squared end 252 which contacts lug 163 on hammer 161. The slide engaging arm 251 of hammer lock 164 terminates in an upwardly projecting end portion 253 which engages a cam track 254 in slide 99. Arm 250 and arm 251 are joined together in spaced relationship by a transverse substantially cylindrical body portion 255 having parallel flattened surfaces 256. A transverse hole 257 is provided in receiver 50 to receive the body portion 255 of such hammer lock. A slot 258 communicates with hole 257 with the bottom of receiver 50 as shown in Fig. 44 so that the flat surfaces 256 on the body portion 255 may be passed through such slot in order that the body portion may be seated in hole 257. Thus hammer lock 164 is assembled to receiver 50. Arm 250 of such hammer lock is placed adjacent the inner face of receiver 50, while arm 251 lies along the outside of receiver 50 in order that end 253 may be engageable with slide 99.

Slide engaging arm 251 of hammer lock 164 is raised upwardly into contact with slide 99 by a spring biased plunger 259. Such plunger is vertically mounted on magazine guard 52, the lower end of such plunger being supported in a vertically disposed hole 260 provided in an integral arcuately shaped lug 261 as shown in Figs. 32 and 43. The other end of plunger 259 is supported by a bracket 262 which is secured to trigger guard 53 by a screw 263. Plunger 259 is provided with an integral collar 264 as shown in Fig. 43 which cooperates with a cylindrical recess 265 in bracket 262 to retain plunger 259. A helical spring 266 surrounds plunger 259 below collar 264 and acts between lug 261 and collar 264 of plunger 259 to bias such plunger upwardly against a flat bottom surface 267 of arm 251 of hammer lock 249.

Operation

When selector 199 is rotated to the position shown in Fig. 1, the fire control mechanism is set for semi-automatic fire. Hammer 161 is rotated in a counterclockwise direction to the cocked position by retraction of bolt 55 and locking block 56 by a rearward pull on slide 99, utilizing handle 104 for such purpose. A loaded magazine 239 having been previously inserted in magazine guard 52 positions a cartridge for chambering in barrel 51 upon release of operating slide 99. Spring 127 forces such slide forwardly carrying therewith the bolt and locking block to the locked battery position. Lug 100 on slide 99 cooperating with cam groove 91 raises locking block 56 to the locked battery position as shown in Fig. 1. In the breeched battery position of bolt 55 and locking block 56, shoulder 89 of such block firmly rests against locking shoulder 90 on receiver 50.

In the locked battery position of bolt 55 and with the selector set for semi-automatic fire, sear lug 175 on trigger 168 is engaged with hammer lug 166 as shown in Fig. 25. Upon release of trigger 168, sear lug 175 slips off of lug 166 thereby permitting hammer 161 to rotate in a clockwise direction under the bias of spring 183 to strike firing pin extension 95 and hence actuate firing pin 63 to discharge a cartridge 69.

Upon discharge of the cartridge, a portion of the propulsion gases flow through gas port 116 into port 115 thence into the hollow interior of gas piston 113 thereby driving such piston rearwardly to strike the closed end 103 of the tubular portion 102 of slide 99. Slide 99 is then driven rearwardly thereby compressing operating spring 127. Lug 100 in engagement with cam groove 91 in block 56 moves through the dwell period of such cam groove to permit the breech pressure to descend to a safe value before unlocking the locking block from receiver 50. Just prior to complete unlocking of bolt 55, the cam surface 92 of block 56 rides along the arcuate upper end of rib 93 to effect an initial rearward movement of bolt 55 thereby exerting a primary extracting force on the fired cartridge case contained in the chamber of barrel 51. Continued rearward travel of slide 99 effects complete unlocking of locking block 56 from receiver 50 whereupon slide 99, locking block 56 and bolt 55 recoil to the extreme rear position being there arrested when surface 98 of locking block 56 contacts a buffer 268 contained in the back of receiver 50.

Arm 251 of hammer lock 164 has been raised upwardly by the bias of spring pressed plunger 259 into cam track 254 on slide 99 thereby lowering end 252 of arm 250 of such hammer lock into engagement with lug 163 of hammer 161. When bolt 55 and locking block 56 are returned to the battery position by the bias of operating spring 127, the shoulder provided at the rear of cam track 254 then strikes the upper end of arm 251 thereby rotating the hammer lock in a clockwise direction whereupon end 252 of hammer lock 164 is disengaged from lug 163 of hammer 161. Sear lug 175 of trigger 168 then engages lug 166 of hammer 161 to hold such hammer in the cocked position until release of the trigger. Bolt 55 and locking block 56 then proceed forwardly into battery position, bolt 55 meanwhile scooping off the uppermost cartridge contained in magazine 239, and thus chambering the round in barrel 51. Lug 100 of operating slide 99 engaged in cam groove 91 raises locking block 56 to the locked position as shown in Fig. 3.

Pulling trigger 168 rearwardly, releases lug 175 from lug 166 thereby permitting hammer 161 to rotate in a clockwise direction under the bias of spring 183 to hit striker 95 and in turn transmit the blow to firing pin 63 thereby discharging cartridge 69, whereupon the cycle of operation as above described is repeated. This time however, with the trigger held in the pulled position, hammer lug 167 is engaged by secondary sear 177 which holds the hammer in the cocked position until the bolt has reached the locked battery position. Before the hammer can again be released, trigger 168 is allowed to return to the normal position whereupon sear 177 slips off of lug 167 and sear lug 175 of trigger 168 then engages hammer lug 166, thus holding the hammer in the cocked position until release thereof is desired. In this fashion semi-automatic fire of the firearm herein described is attained.

When selector 199 has been rotated to the position shown in Fig. 3, the fire control mechanism is set for full automatic fire. Selector cam portion 206 then contacts lug 180 of sear 177 to rotate such sear in a counterclockwise direction as shown in Fig. 3, away from hammer 161 so that hammer lugs 167 will not be engaged by secondary sear 177. With secondary sear 177 made inoperative by selector 199, automatic sear 188 then comes into play and is engageable with a shoulder 270 provided on each side of locking block 56 in the battery position of such locking block as shown in Fig. 16.

Hammer lock 164 is operative in the automatic setting of the fire control mechanism to engage hammer 161 as previously explained. With a loaded magazine in place and bolt 55 in the position shown in Fig. 16 with the hammer cocked, release of sear 188 is effected by a rearward pull on trigger 168. Bolt 55 will then move forwardly under the bias of spring 127 to chamber a round in the barrel. When trigger 168 is pulled rearwardly, pin 191 being in engagement with wedge-like end 190 of automatic sear 188, rotates such sear in a counterclockwise direction, as shown in Fig. 16, against the bias of spring 196. Hammer lock 164 releases hammer 161 shortly after the bolt is in the locked battery position as previously explained. Automatic fire may be readily stopped at will merely by releasing trigger 168, whereupon spring 196 will bias sear 188 in a clockwise direction as shown in Fig. 16, to engage the end thereof with shoulders 270 on locking block 56 to retain the block 56 and bolt 55 in the open bolt position.

Upon discharge of the last cartridge contained in magazine 239, a follower 271 is raised upwardly into the path

of bolt 55 by a magazine follower spring 272. A rearwardly projecting lug 273 integrally formed with follower 271 is likewise raised upwardly and projects directly into the path of bolt 55 thereby holding bolt 55 in the open position shown in Fig. 16 even though automatic sear 188 is disengaged from locking block 56. Thus the operator of the firearm will appreciate that the magazine is empty when further manipulation of the trigger will not fire the gun. The gun is made ready to fire again by pulling backward sufficiently on slide 99 by means of handle 104 whereupon automatic sear 188 engages shoulders 270 thus holding the bolt in the fully retracted position. Empty magazine 239 may then be released from receiver 50 whereupon a loaded magazine may then be inserted without danger of bolt 55 proceeding to the closed battery position.

It will be appreciated from the above description, to those skilled in the art, that the firearm herein disclosed incorporates unique features not before found in any of the prior art firearms. The unlocking arrangement for the locking block and bolt is of rugged construction and positive in operation. Further, the reciprocating breech elements of the firearm are positively and securely locked at the time of discharge of a cartridge. The hammer is positively locked at all times by the hammer lock to prevent accidental discharge of a cartridge in any but the locked battery position of the locking block and bolt, thus eliminating any possibility of premature discharge. The firearm is selectively adjustable to conveniently obtain semi or full automatic fire as may be desired. The bolt is held in a retracted position by the automatic sear when firing full automatically to admit air to the barrel for cooling purposes between relatively long bursts of fire, thereby reducing the tendency of the barrel to overheat. All of the elements of the firearm coact in a way not heretofore known, to produce a firearm of positive operation and one that is of light weight while retaining desirable strength characteristics along with reliability of operation and accuracy of firing.

I claim:

1. In an automatic firearm, a receiver having a locking shoulder, a bolt slidably mounted in the receiver for reciprocating movement between a battery position and a recoil position, a locking block mounted in the receiver for reciprocating movement between a locked battery position and a recoil position, said locking block having a cam groove, means on said locking block pivotally connecting said locking block to said bolt, an operating rod slidably mounted on the receiver, means on said operating rod cooperating with said cam groove to raise said locking block into engagement with said locking shoulder whereby said bolt is locked relative to the receiver in the battery position of said bolt, and means on said receiver cooperating with said locking block for initially raising said locking block into engagement with said locking shoulder.

2. The combination defined in claim 1 wherein said last mentioned means comprises a rib on said receiver, said rib having a cam surface arranged to engage said locking block when substantially in the battery position whereby said locking block is initially cammed upwardly for engagement with said locking shoulder.

3. The combination defined in claim 1 wherein said last mentioned means comprises a pair of vertically disposed ribs on either side within said receiver, each of said ribs having a cam surface arranged to engage said locking block when substantially in the battery position whereby said locking block is initially cammed upwardly for engagement with said locking shoulder.

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