

[54] COMPRESSED GAS GUN WITH TRIGGER
OPERATED HAMMER RELEASE
LATCHING STRUCTURE

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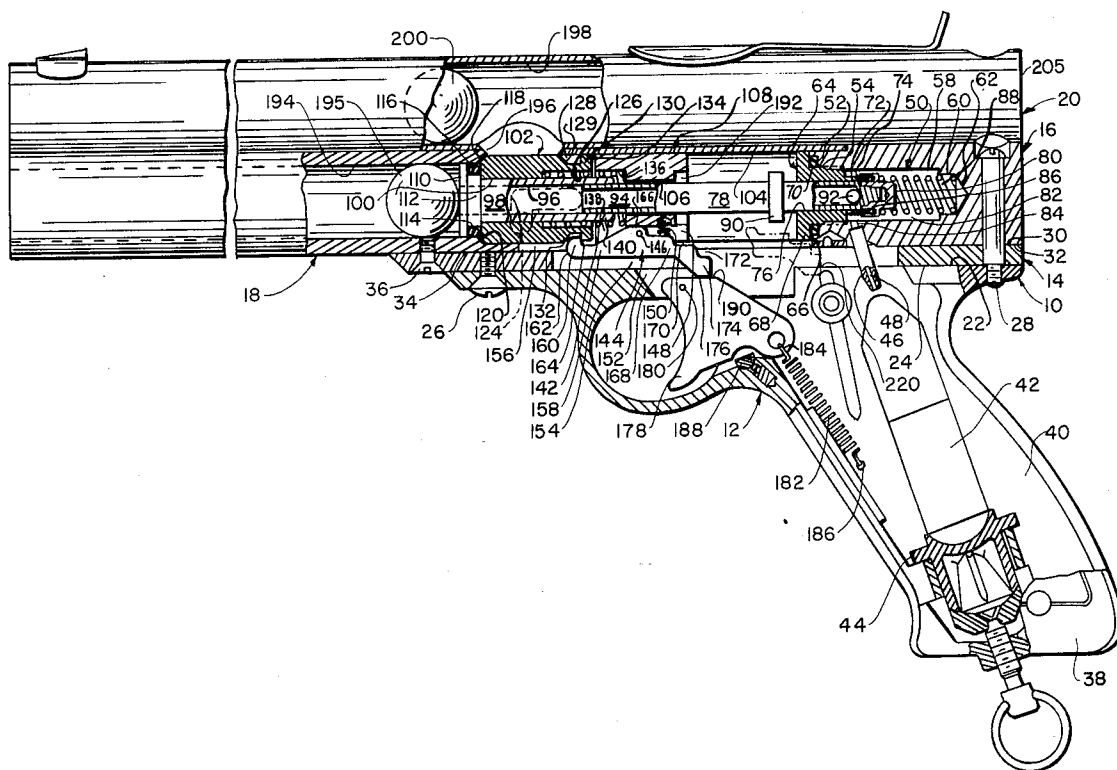
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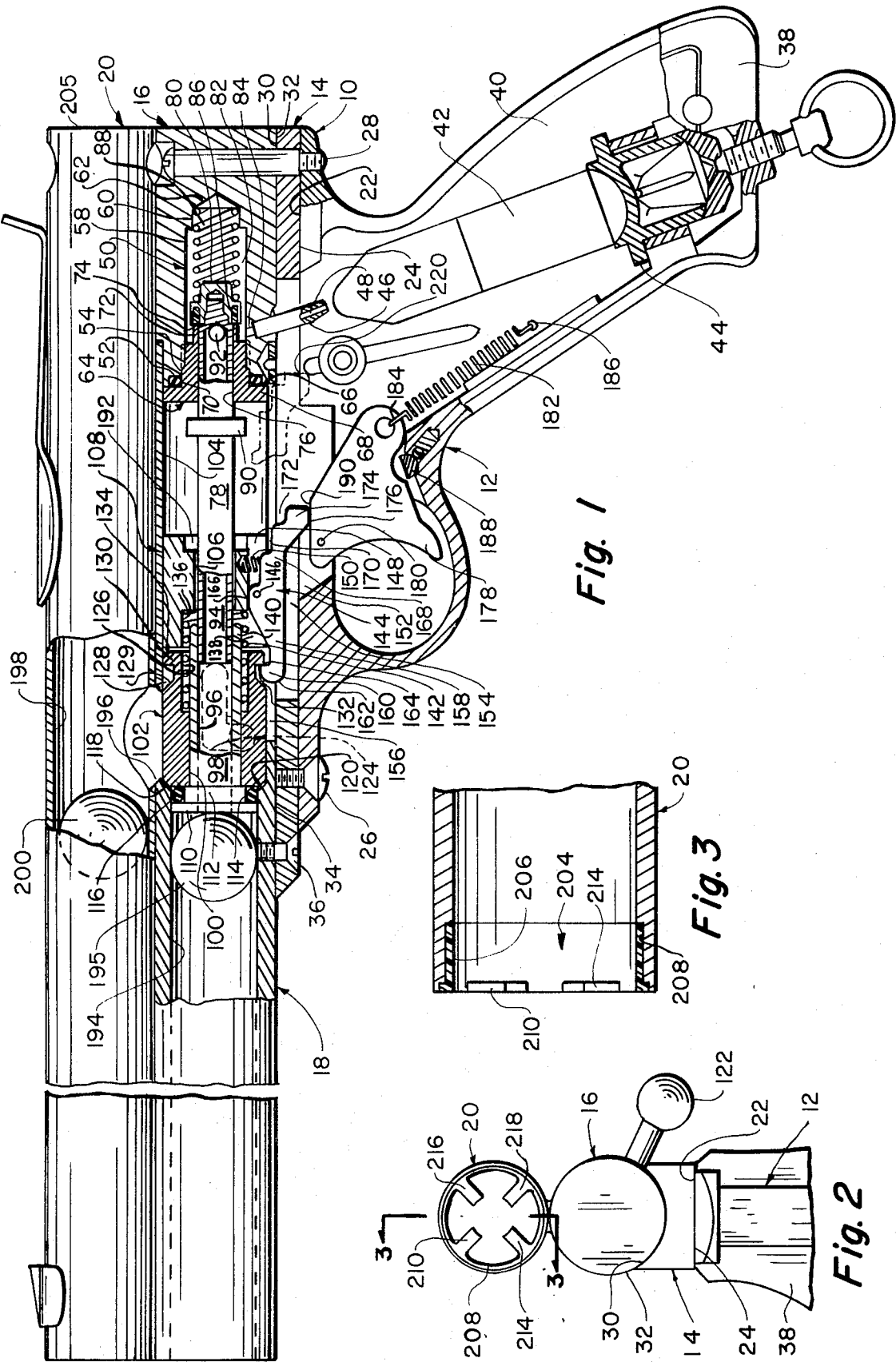
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[57] ABSTRACT

A gun operable by compressed gas held in a storage chamber by a selectively releasable valve and having valve operating structure comprising: a bolt member manually movable between a firing position and a loading position, a hammer member releasably held to the bolt member in the firing position against the bias of a compression spring operable to drive the hammer member away from the bolt member to a valve opening position, a valve operating stem engageable by the hammer member during movement to the valve opening position, and trigger operated releasable latching structure to releasably hold the hammer member to the bolt member.

14 Claims, 3 Drawing Figures





COMPRESSED GAS GUN WITH TRIGGER OPERATED HAMMER RELEASE LATCHING STRUCTURE

SUMMARY AND BACKGROUND OF THE INVENTION

This invention relates generally to guns operable by compressed gas to fire a projectile and, more particularly, to a gun operable by a compressed or liquefied gas, such as CO₂ supplied from a storage cylinder, to fire hollow plastic or gelatin balls filled with a liquid such as paint. While a gun of this type has particular application in marking of trees in forestry projects and marking of animals in conservation or farming projects, the invention is not limited to such applications or to the specific type of projectile. Indeed, in its broadest aspects, the invention is applicable to any type of gun operated by gas, such as CO₂ compressed externally of the gun or such as air compressed within the gun.

The invention resides in the provision of new and improved means for operating a control valve in a gas storage chamber to quickly release only a predetermined amount of gas. The invention further resides in the provision of new and improved magazine, loading, and firing chambers means for hollow plastic balls filled with paint or the like.

DRAWING

FIG. 1 is a side elevational view of a gas operated gun, partly in section, and with parts removed, showing a presently preferred illustrative embodiment of the invention;

FIG. 2 is a partial rear end view of the gun of FIG. 1; and

FIG. 3 is a partial sectional view taken along the line 3—3 in FIG. 2.

DETAILED DESCRIPTION

Referring to the drawing, a compressed gas operated piston 10 comprises a handle portion 12, an intermediate support plate 14, a cylindrical valve block 16, an elongated cylindrical barrel portion 18, and an elongated cylindrical magazine portion 20. A flat upper surface 22 of the handle portion is held in abutting engagement with a corresponding flat lower surface 24 on the support plate by threaded fastening elements 26, 28. An upwardly facing arcuate support surface 30 on plate 14 is held in abutting engagement with the outer cylindrical surfaces 32, 34 of valve block 16 and barrel portion 18, respectively, by the fastening element 28 and another fastening element 36.

The handle portion is hollow and includes a removable cover plate 38 to permit access to a mounting cavity 40 for a conventional compressed gas supply cylinder (not shown) which fits in a seat 42 and is mountable on a conventional adjustable seat 44 and engageable with a puncture pin 46 in a conventional manner to supply compressed gas through an inlet passage 48.

The valve block 16 comprises a stepped forwardly opening central axially extending bore 50 having a first enlarged bore portion 52 providing a part of an annular sealing ring cavity, a second enlarged bore portion 54, a main bore portion 58 threaded at the forward end, and a reduced diameter rear portion 60 providing a spring seat 62. A stepped cylindrical end plug 64 is threadably mounted in the bore 50 with the rear side surface 66 of a flange portion 68 abutting the front end

of the valve block and, with a cylindrical central portion 70, further defining the sealing ring cavity. A reduced diameter rim portion 72 extends rearwardly from the central portion 70 to provide a rearwardly facing, relatively thin wall, annular valve seat 74.

A valve stem support bore 76 is centrally located in the valve plug and slidably supports the rear end of an elongated cylindrical hollow valve stem 78. A valve head 80 is threadably mounted on the rear end of the valve stem which extends rearwardly beyond the rim 72 into a gas storage chamber 82 provided by bore 50 and connected to the gas cylinder 42 by an inlet passage 84. A resilient annular sealing member 86 is mounted in the valve head for abutting sealing engagement with the rim 72 in a closed position under the bias of a compression spring 88. A locating flange 90 is engageable with the front surface of the valve plug 64 to locate the valve stem in a rearwardly displaced position (not shown) with valve head 80 in the open position permitting the compressed gas to flow from storage chamber 82 through a transverse passage 92 in the valve stem to a central axially extending gas passage 94 therein. The front end of the valve stem 78 is slidably supported in a central bore 96 of a cylindrical sleeve member 98 fixed in a central bore 100 of a cylindrical slidable bolt member 102 slidably supported in a cylindrical bore 104 of the barrel portion 18. The front end of the valve stem freely extends through a central cylindrical bore 106 of a hammer member 108.

The sleeve member 98 has a flange 110 at the forward end and a rim 112 defining a sealing ring groove 114 mounting a barrel bore sealing ring 116. The front edge 118 of the bolt member is tapered for engagement with a correspondingly tapered seat 120. An operating handle 122, FIG. 2, is attached to the bolt member and extends transversely outwardly through an L-shaped guide and latch groove 124 in the side of the barrel. A rearwardly opening counter bore 126 and the rear end of sleeve 98 provide a spring well. An annular latch groove 128 having a rearwardly facing tapered clearance surface 129 provides a radially extending rim 130 having a flat forwardly facing abutment surface 132 and a rearwardly facing tapered cam surface 134.

A forwardly facing counter bore 136 and the front end of the valve stem in hammer 108 define a well and opening 138 for the rear end 140 of sleeve 98 and a compression spring 142 mounted circumjacent the sleeve end. A sear member 144 is pivotally mounted on a pin 146 in a slot 148 on the bottom of the hammer 108 and thus supported and carried by the hammer. A compression spring 150 is mounted between the hammer and the rear end of the sear member which is slidably movable with the hammer in axially aligned slots 152, 154, 156, provided in the handle 12, support plate 14 and the barrel member 18, respectively. A forwardly extending finger portion 158 of the sear member terminates in an upwardly extending lug 160 having a rounded forwardly facing cam surface 162 and a transverse flat latch surface 164 abuttingly releasably engageable with surface 132 of the bolt member. An upwardly facing abutment surface 166 normally holds the sear member in a latching position as shown in FIG. 1. A rearwardly and downwardly extending finger portion 168 includes notches 170, 172 and a cam portion 174 having a cam surface 176 engageable with a trigger member 178 for moving the sear member from the

latching position to a release position against the bias of the compression spring 150.

Trigger member 178 is pivotally mounted by pin 180 in slot 152 for manual movement between a cocked firing position, FIG. 1, to a rearwardly displaced hammer released position (not shown) against the bias of a tension spring 182 attached at one end 184 to the trigger and at the other end 186 to the handle. A conventional push type safety pin 188 may be provided to prevent rearward movement of the trigger. An upwardly facing cam surface 190 engages the cam surface 176 of sear member whereby upward pivotal movement of the trigger causes upward pivotal movement of the sear member and downward pivotal movement of the finger portion 158 to release the lug 160 from notch 128 whereupon spring 142 will drive the valve hammer 108 rearwardly to engage valve stem flange 90 in counter bore 192 and move the valve stem rearwardly to open passage 92 to storage chamber 82 to permit high pressure gas to flow forwardly through passage 94 in the valve stem, through passage 96 in sleeve 98, and into the barrel bore 194 behind a projectile 195 which has been positioned in the rear end thereof against flange 110. Rearward movement of the valve stem is limited by engagement of the rear surface of flange 90 with the front surface of plug 64. As soon as the rearward movement of hammer 108 ceases, the spring 88, which has been compressed by the rearward movement, along with the force of gas pressure in chamber 82 (which has the larger effect) will be effective to move the valve stem to the closed position so that the valve head is only momentarily open for a time period sufficient to fire the projectile.

The firing chamber is loaded and the gun is cocked by rearward sliding movement of the bolt 102 to open a loading port 196 connected to magazine chamber 198 in which projectiles 200 in the form of conventional gelatin balls filled with paint are stored. During rearward movement of the bolt 102, the sear lug 160 is again located in the notch 128 by cam action between surfaces 134, 162 and the action of spring 150. Thus, when the bolt is manually returned to the firing position by forward sliding movement, the hammer member and sear member will be carried forwardly to the cocked firing position. The arrangement is such that the bolt member may be slightly rotated to locate the bolt handle in the transverse notch at the forward end of the L-shaped slot 124 to lock the bolt member and the hammer member in the firing position.

The magazine chamber is closed at one front end and has a flexible loading gate 204 at the other end 205 to permit the projectiles to be manually inserted and removed from the magazine. In the presently preferred form, the flexible gate comprises a one-piece molded plastic member having an axially extending portion 206 fixed in counter bore 208 with a plurality of radially inwardly extending flexible fingers 210, 214, 216, 218.

In operation, to load the magazine chamber 198, a number of projectiles 200 may be pushed through the loading opening and past the fingers 210-218 provided in the loading gate 204. The projectiles are of a size relative to the chamber 198 to permit rolling or sliding therewithin so that a projectile may be located over the loading opening 196. In order to locate a projectile in a firing position at the rear of the barrel bore 194, the bolt member handle 122 is manually moved circumferentially in the transverse circumferentially extending

portion of slot 124 from the latched firing position to an unlatched position located in axial alignment with the axially extending portion of slot 124. The bolt member 102 will rotate in bore 104 relative to the hammer member 108 and sear member 144 to permit the circumferential movement of the handle 122. Then the handle is pulled rearwardly in the axially extending portion of the slot 124 which causes the bolt member 102 to be slidably rearwardly displaced to open the loading port 196 so that a projectile 200 may fall into the front end of chamber 104 in front of the flange 110 of sleeve 98 attached to and movable with the bolt member.

Assuming the hammer member to be in the rearwardly displaced firing position (not shown) and disengaged from the bolt member and the sear member 144, the rearwardly facing cam surface 134 on the bolt member will be brought into engagement with the cam surface 162 on the sear member causing downward pivotal movement of the front end of the sear member about pin 146 against the bias of spring 150 until the lug 160 is aligned with slot 128 whereupon the spring will cause upward pivotal movement of the front end of the sear member to locate the lug in the slot with sear surface 164 engaging bolt member surface 132 to latch the bolt member to the hammer member. At the same time, spring 142 is compressed between the hammer member and the bolt member.

When the bolt handle is pulled forwardly, the bolt member will slide forwardly and drag along the hammer member and the sear member to locate all three parts in the forwardly displaced firing position. The projectile in the forward end of the chamber 104 will be pushed into firing position in the rear of the barrel bore by flange 110. The projectile is slightly larger in diameter than the barrel bore and is made of a compressible gelatin outer skin so as to be frictionally, sealingly retained in the firing position until subject to the high pressure gas. The firing chamber between the projectile and the bore 104 is sealed by ring 116. The bolt member is latched in the firing position by rotational movement to position the handle in the circumferentially extending portion of the slot 124. During forward movement of the sear member, sear cam surface 176 will engage trigger cam surface 190 to enable the gun to be subsequently fired.

Assuming that a cylinder of compressed gas is in place in the gun and supplying compressed gas to the storage chamber 82 through passages 48, 84 with valve head sealingly seated on rim 72 by compression spring 88 and gas pressure in chamber 82, the gun is ready to be fired by rearward pivotal movement of trigger 178 which causes upward pivotal movement of the rear end of the sear due to engagement of cam surfaces 190, 176 and downward pivotal movement of the latch lug 160 at the forward end of the sear to clear latch surfaces 132, 164. The hammer member 108 and sear member 144 are immediately driven rearwardly toward the rearwardly displaced firing position, shown partially in phantom at 220 in FIG. 1, at a high velocity by compression spring 142. Flange 90 on valve stem 78 is engaged by the rear end of the hammer in counter bore 192 before the hammer reaches the end of its rearward travel and is carried rearwardly by the hammer to the rearwardly displaced position. In this manner, the valve head is suddenly moved off of the valve seat on rim 72 against the bias of the spring 88 and gas pressure to permit compressed gas in the storage chamber to rush

through port 92 and along passages 94, 96 to the firing chamber to drive the projectile from the gun through barrel bore 194. As soon as the momentum and inertia of the hammer are lost, the valve head is immediately reseated by spring 88 and gas pressure to close port 92 to the storage chamber. Thus, only a controlled amount of the compressed gas is permitted to escape during any one firing cycle. It will be seen that the axial length of the relatively slidable sealingly engaged portions of the rear end 140 of the sleeve member 98 and the front end of the valve stem is greater than the axial distance between the rear end of the flange 90 and the front end of plug 64 so that the gas flow passage means 92, 94, 96 always sealingly connect the storage chamber to the firing chamber.

Since the various inventive concepts and features have been hereinbefore illustratively disclosed by reference to a presently preferred embodiment which may be subject to various modifications and changes without departing from the spirit and scope of the invention as a whole, it is intended that the claims be construed to cover alternative embodiments except insofar as limited by the prior art.

1. A gun for firing projectiles by compressed gas comprising:

barrel means through which a projectile is fired,
 firing chamber means located at one end of said barrel means to hold a projectile in a firing position,
 a gas storage chamber for holding a supply of compressed gas,
 gas passage means connecting said storage chamber to said firing chamber means,
 selectively operable valve means associated with said passage means to control flow of compressed gas to the firing chamber and being movable between open and closed positions relative thereto,
 guide means in said gun,
 bolt means manually movable on said guide means between an extended firing position and a retracted loading position relative to said firing chamber,
 hammer means movable on said guide means between a retracted firing position and an extended valve opening position and being locatable relative to said bolt means in a position closely adjacent thereto and in a position axially spaced therefrom,
 hammer operating spring means between said bolt means and said hammer means being compressed therebetween when said bolt means is located closely adjacent said hammer means,
 releasable latch means to hold said hammer means in the position closely adjacent said bolt means with said compression spring means compressed therebetween,
 selectively operable trigger means operatively connected to said releasable latch means to release said hammer means relative to said bolt means to permit said compression spring means to drive said hammer means away from said bolt means from the retracted firing position to the extended valve opening position in a position axially spaced therefrom,
 valve stem means operatively connected to said valve means and being slidably movable between a valve opening position and a valve closing position, valve return means operatively associated with said valve stem means and exerting a continuous valve closing

force on said valve stem and normally locating said valve stem in the valve closing position,

abutment means operatively connecting said hammer means to said valve stem means during a portion of the movement of said hammer means to the extended valve opening position to cause said valve stem means to be driven by said hammer means from the valve closing position to the valve opening position,

said valve return means being immediately effective upon termination of movement of said hammer means toward the valve opening position to return said valve stem means to the valve closing position, manually operable handle means connected to said bolt means to move said bolt means from the extended firing position to the retracted loading position in closely spaced relationship to said hammer means and to compress said hammer spring means therebetween and to operate said latch means to connect said hammer means to said bolt means and to return said bolt means and said hammer means to the firing position.

2. The invention as defined in claim 1 and wherein said valve return means comprising a spring and gas pressure in said gas storage chamber.

3. The invention as defined in claim 1 and wherein: said hammer means and said bolt means are slidably mounted circumjacent said valve stem means.

4. The invention as defined in claim 3 and wherein: said passage means extends axially through said valve stem and hammer means and said bolt means.

5. The invention as defined in claim 4 and wherein: said bolt means comprising a sleeve member having a central bore extending through said bolt means, one end of said opening into said firing chamber means, the other end of said bore slidably sealingly receiving one end of said valve stem.

6. The invention as defined in claim 5 and wherein: said bolt means having a spring well circumjacent said sleeve member and opening toward said hammer means,

said hammer means having a spring well circumjacent said valve stem means and opening toward said bolt member.

7. The invention as defined in claim 5 and wherein: said sleeve member having a flange portion providing a rear wall of said firing chamber means and being located in said barrel bore in the firing position.

8. The invention as defined in claim 7 and wherein said sleeve member having sealing means between said flange portion and said bolt means to seal the rear end of said barrel bore relative to said bolt member.

9. The invention as defined in claim 5 and wherein: said guide means comprising a cylindrical chamber, said bolt means being cylindrical and having an outside diameter approximately equal to said cylindrical chamber so as to be slidably supported there-within.

10. The invention as defined in claim 9 and wherein: said hammer means being cylindrical and having an outside diameter approximately equal to said cylindrical chamber so as to be slidably supported there-within.

11. The invention as defined in claim 9 wherein: said latch means comprises an annular peripheral groove on said bolt means, and

7

lug means carried by said hammer means and engageable with said bolt means in said groove whereby said bolt means is rotatable relative to said hammer means.

12. The invention as defined in claim 11 and wherein: 5
slot means on said gun having an axially extending portion and a circumferentially extending portion, said bolt means having a manually operable handle extending through said slot means to rotatably move said bolt means with the handle in the circumferentially extending portion between a locked firing position and an unlocked transfer position and to axially move said bolt means with the handle in the axially extending portion between an extended firing position. 10

13. The invention as defined in claim 10 and wherein: 15
said hammer means having an axially extending slot, said latch means comprising a sear member pivotally mounted in said slot and carried by said hammer means between the retracted firing position and the extended valve opening position, 20

one end of said sear member being engageable with said bolt means,

spring means effective between said hammer means and said sear member to bias said sear member to the latching position, and 25

said trigger means being engageable with said sear member to counteract said spring means and release said sear member relative to said bolt means.

14. A gun for firing a projectile by compressed gas 30 comprising:

a barrel having a bore through which the projectile is fired,

a storage chamber for compressed gas,

a gas passage connecting said storage chamber to 35 said barrel,

8

a valve in said storage chamber to open and close said passage,

a valve stem operatively connected to said valve and extending beyond said storage chamber and being slidably supported relative thereto for movement between a valve opening and a valve closing position,

valve return means biasing said valve and said valve stem to the valve closing position,

a hammer member slidably mounted relative to said valve stem for movement relative thereto and having abutment means thereon engageable with said valve stem to slidably move said valve stem to the valve opening position,

a bolt member slidably mounted relative to said valve stem for movement relative thereto and relative to said hammer member between a closed firing position and an open loading position,

spring means mounted between said hammer member and said bolt member,

a sear member pivotally mounted on and movable with said hammer member,

releasable latch means between said sear member and said bolt member to hold said hammer member in firing position adjacent said bolt member with said spring means compressed therebetween, and

trigger means to pivotally displace said sear member relative to said hammer member and said bolt member to release said latch means,

said spring means being effective to drive said hammer member away from said bolt member and into driving engagement with said valve stem to move said valve stem to the valve opening position against the bias of said valve return means.

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