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

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[58] **Field of Search** ..... 124/11 R, 13 A, 31

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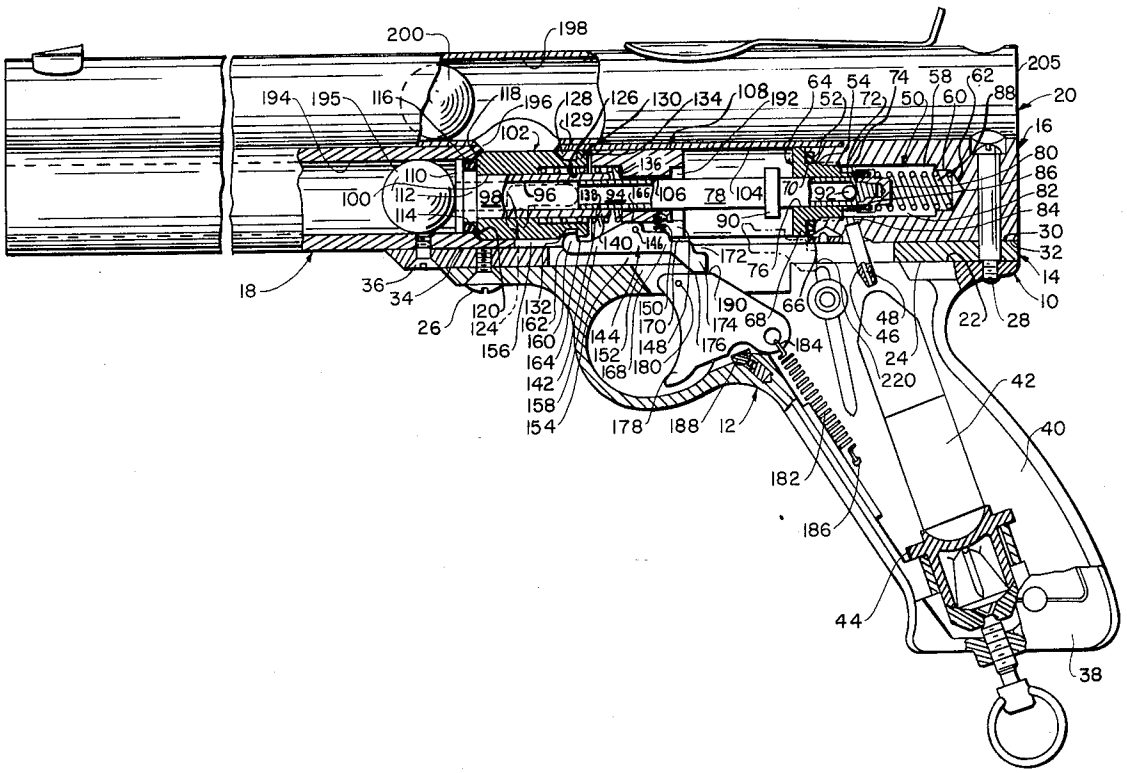
[57] **ABSTRACT**

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



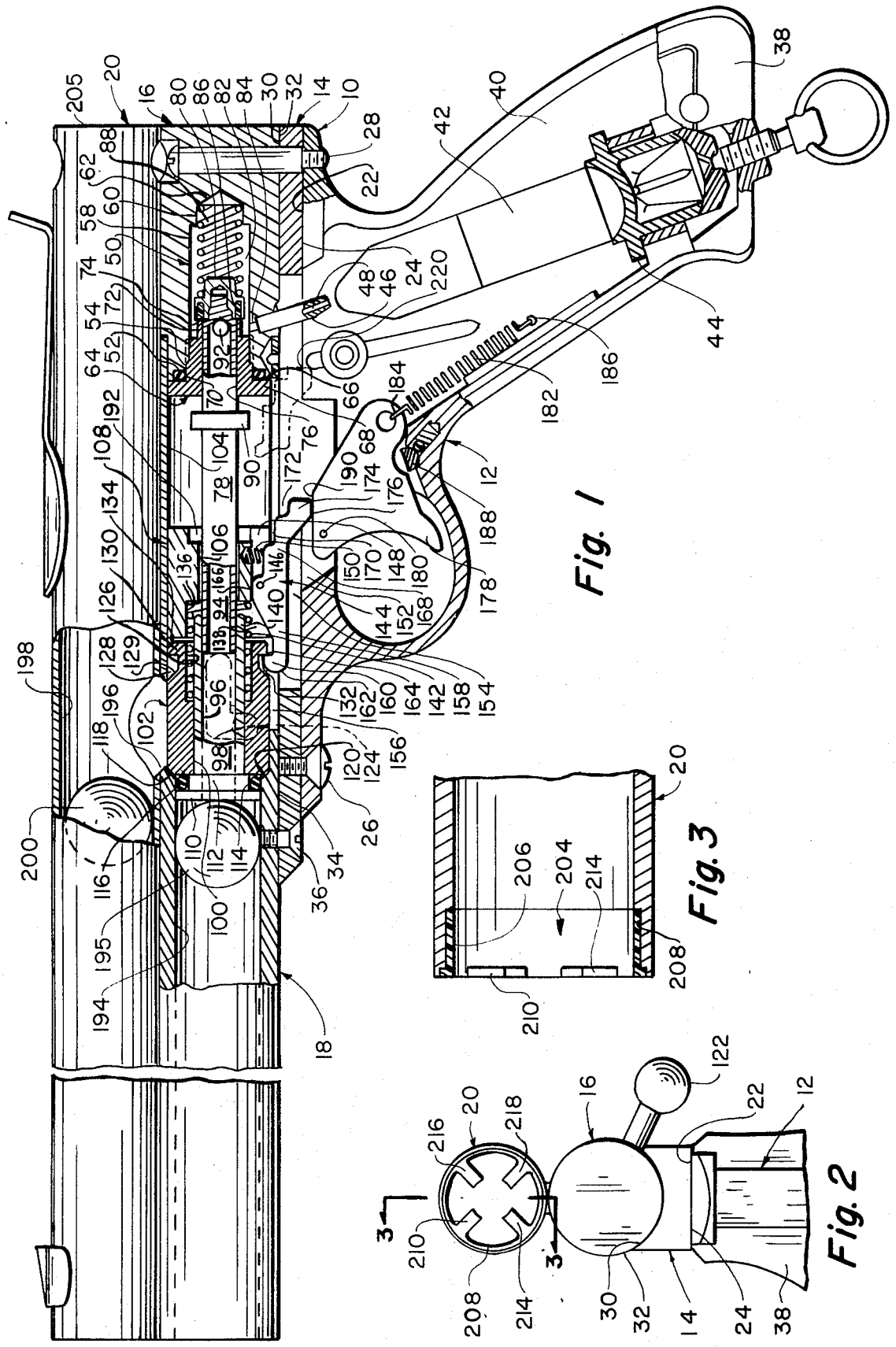


Fig. 1

Fig. 3

Fig. 2

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 CO_2 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 CO_2 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 threadly 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 si 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 rearwadly 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 fired 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 spriit 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 piror 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 therewithin.

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 therewithin.

11. The invention as defined in claim **9** wherein:

said latch means comprises an annular peripheral groove on said bolt means, and

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:

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 un unlocked transfer position and to axially move said bolt means with the handle in the axially extending portion between an extended firing position.

13. The invention as defined in claim **10** and wherein:

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,

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

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 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 said barrel,

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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