Sept. 7, 1965 B. G. SHEPHERD 3,204,625

GAS-OPERATED PISTOL

Filed March 22, 1963 2 Sheets-Sheet 1

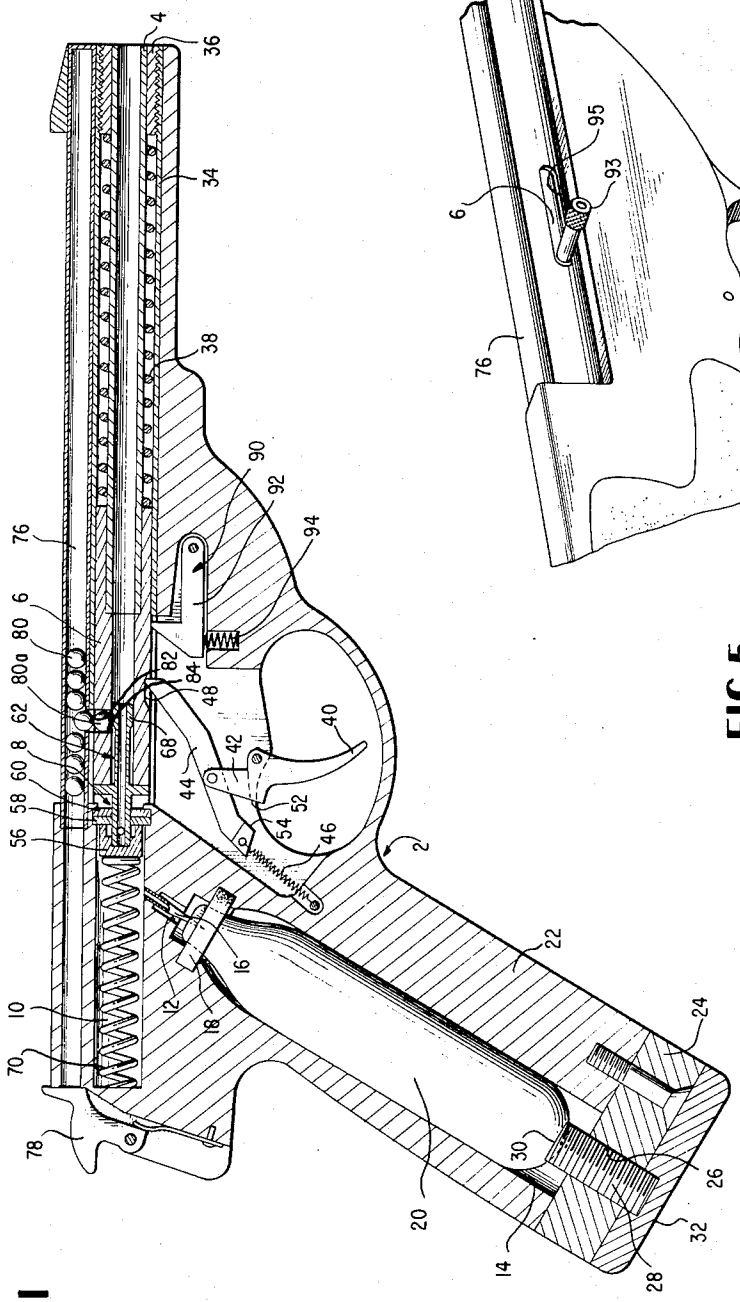


FIG. 1

FIG. 5

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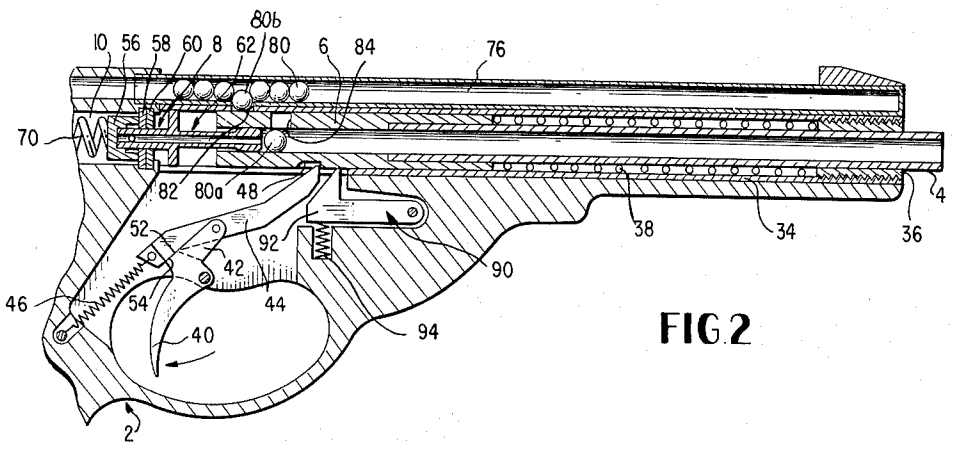
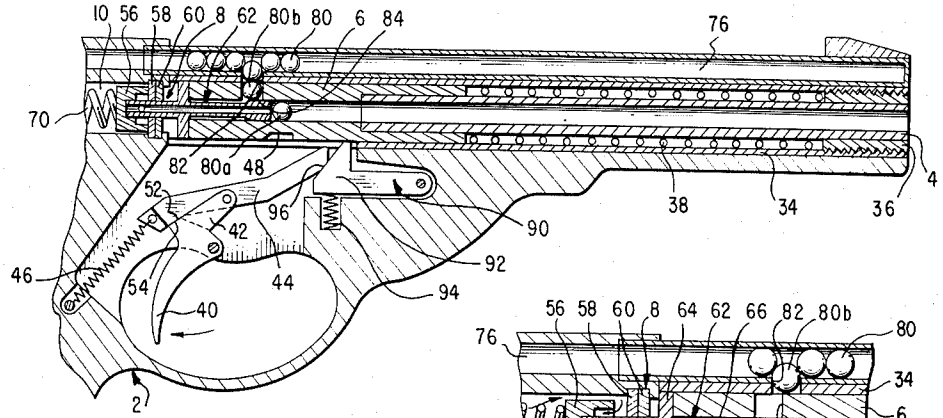


FIG. 2

FIG. 3



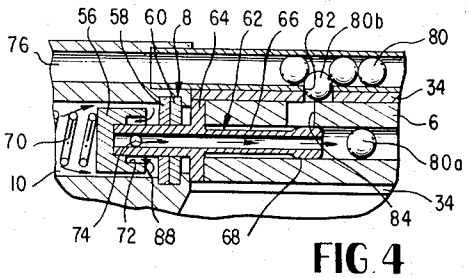


FIG. 4

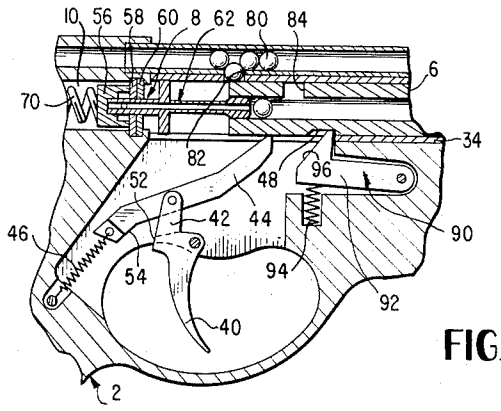


FIG. 6

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United States Patent Office 3,204,625 Patented Sept. 7, 1965

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GAS-OPERATED PISTOL

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Filed Mar. 22, 1963, Ser. No. 267,305
6 Claims. (Cl. 124—11)

An invention related generally to a gas-operated pistol and more particularly to an improved BB pistol powered by a CO_2 capsule.

Pneumatically powered guns or "pump guns" are well known in the prior art and have been used for years as target practice devices and sports weapons for hunting small game. A more recent development in this class of guns has been realized by the inclusion of a pressurized gas capsule such as the widely used CO_2 capsule as a power source in the gun, both for providing a source of power for the projectile and, in some cases, as a motivating force for re-cocking the gun between firings.

The inclusion of CO_2 or like compressed gases as an energy source in a pneumatic gun has induced difficulties unknown in the earlier class of guns such as the tendency of the gun valves to freeze due to the low temperature of the gas after expansion from the compressed state. Also, as stated above, some of the guns in use at present utilize a portion of the pressurized gas for re-cocking the gun between shots. This, of course, results in a more rapid exhaustion of the contents of the pressurized capsule and resulting in a smaller number of shots per capsule. Some other guns in use at present, which do not utilize the pressure source as a cocking means, require that the gun be cocked by hand between each firing thereof.

The invention relates to the gas capsule type of pneumatic gun and has as an object the provision of an improved and simplified mechanism for providing semi-automatic operation of the gun without utilizing the pressure source for re-cocking the gun between shots. The invention also has as an object the provision of a simple, easily fabricated and reliable mechanism for providing a semi-automatic gas-operated gun. A further object of this invention is the provision of a new and improved inertia-operated valve which is simple, inexpensive, and reliable and which is not susceptible to jamming or freezing in the presence of the low temperatures generated by expanding gas. It is still another object of the invention to provide a gas-operated gun in which a realistic recoil impulse, simulating an explosive propellent gun, is provided by expanding gas.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings in which like reference numbers designate like parts throughout the figures thereof and wherein:

FIG. 1 is a side elevational view in section of a pistol embodying the elements of this invention prior to actuation of the mechanism for firing a projectile therefrom;

FIG. 2 is a fragmentary view of the device of FIG. 1 showing the mechanism in an intermediate state immediately prior to firing thereof;

FIG. 3 is a view of FIG. 2 showing the disposition of the mechanism immediately preceding the instant firing of a projectile therefrom;

FIG. 4 is an enlarged sectional view of the valve position of the device at the instant of firing;

FIG. 5 is a perspective view of the device of FIG. 1 partly broken away;

FIG. 6 is a fragmentary sectional view of the device of FIG. 1 showing the operation of an alternative portion of the device.

In general the invention provides a barrel slidably

mounted in the frame of the gun around the rear portion of which a weighted hammer element is mounted, the barrel and hammer assembly being spring biased rearwardly and abutting a longitudinally opening valve. This valve is biased closed in a forward direction against the bias of the barrel and hammer assembly by the pressure in the system. Actuation of the device is accomplished through a trigger and sear mechanism which, by utilization of the force expended in pulling the trigger, moves the barrel and hammer assembly forward. The geometry of the trigger and sear is such that the hammer is automatically released at a forward point of travel allowing the assembly to impact against the closed valve system. The impact of the assembly momentarily overcomes the pressure-biasing force of the valve and allows a burst of pressure from a compressed gas cartridge located therebehind to be injected into the barrel of the gun providing the motivating force for a projectile located therein. This impact also provides a recoil-like "kick" in the gun resulting in a realistic simulation of a powder-type gun.

Referring now to the drawings for a more complete description of the invention, the figures show the stepwise operation of a preferred embodiment of the invention.

The complete assembly is shown in FIG. 1 and comprises a housing shown generally at 2 in which is slidably mounted a barrel 4 having a hammer 6 fixedly attached to the rear portion thereof. A valve assembly shown generally at 8 is disposed behind the barrel and hammer assembly and provides a sealing means between expansion chamber 10 and barrel 4. A bore 12 provides a passageway between the expansion chamber and capsule receptacle chamber 14. A hollow needle 16 is coaxially mounted in bore 12 and serves to puncture compressed gas capsule 20 when it is suitably inserted therein. The hollow bore of the needle provides a passageway for the contents of the capsule to chamber 10. O ring 18 provides a seal around the mouth of capsule 20 to prevent escape of gas therefrom. As shown in the drawings, receptacle 14 is preferably disposed in handle 22 of housing 2. Closure member 24 is pivotally connected to the base of handle 22 and is preferably shaped as a cross-sectional segment of the handle. Member 24 is provided with threaded bore 26 through which threaded shaft 28 is disposed. Shaft 28 is provided with a concave base 30 which mates with the usually spherical base of capsule 20. Shaft 28 is connected at the other end thereof to butt member 32, which, in a similar fashion to member 24, is formed as a cross-sectional segment of handle 22.

The operation of the closure member as thus far described is accomplished by the pivoting of members 24 and 32 so as to expose the base of chamber 14, inserting capsule 20 into the chamber seal end first, followed by realignment of members 24 and 32. Member 32 is then rotated with respect to member 24 causing threaded shaft 28 to engage the base of capsule 20, forcing the seal portion of the capsule against needle 16 ultimately resulting in rupture of the seal portion of the capsule and communication of compressed gas to expansion chamber 10.

Referring now to the barrel portion of the structure, barrel 4 and hammer 6 are mounted within tube 34 which in turn is fixedly mounted within housing 2 as shown. Annular ring 36 is threaded in the mouth of tube 34 and serves to provide a closure for that portion of the tube and a slidable forward mount for barrel 4. Helical spring 38 is mounted between ring 36 and the forward face of hammer 6 to bias the barrel and hammer assembly in a rearward direction against valve assembly 8. The threaded mounting of ring 36 provides means to adjust the compression in spring 38. Trigger 40 is pivotally mounted in housing 2 in the usual manner and is pivotally connected through arm 42 to sear 44. The trigger and

sear assembly are biased in a forward and rearward direction respectively by helical spring 46. The forward end of sear 44 engages notch 48 in hammer 6.

In the operation of the trigger portion of the device, trigger 40 is squeezed in the usual manner causing arm 42 to move forward in an arcuate manner. This displaces sear 44 forwardly against the tension of spring 46 and causes hammer 6 and barrel 4 to move forward in tube 44 against the compressive resistance of spring 38. As trigger 40 is squeezed rearwardly, faces 52 and 54 of the trigger and sear respectively converge on one another due to the pivotal connection of their respective members (FIGS. 2 and 3). When faces 52 and 54 engage, further motion of trigger 40 in a rearward direction causes the end of sear 44 engaging notch 48 to move in a downward direction releasing hammer 6 and barrel 4. Upon release of the hammer and barrel assembly, spring 38 forces the assembly rearwardly causing it to impact with valve assembly 8 as shown in FIG. 3.

Referring now more specifically to valve assembly 8, this is comprised of cylindrical seat 56 slidably disposed in expansion chamber 10, annular seal member 58 coaxially disposed at the mouth of the expansion chamber, washer 60 coaxially disposed forward of the seal member, and valve stem generally shown at 62. Referring more particularly to FIG. 4, the valve stem is provided with an annular shoulder 64 and a tubular portion 66, the tubular portion extending coaxially through seal 58 and washer 60 in a rearwardly direction and, in a forwardly direction being telescopically disposed in the interior of barrel 4. An enlarged portion 68 is disposed at the forward end of tubular portion 66 in sliding contact with the interior of hammer 6. Helical compression spring 70 is disposed in expansion chamber 10 and serves to provide a partial bias of seat member 56 forwardly against the rearward force of spring 50, in sealing relationship to seal 58. The primary biasing force, however, is provided by the pressure from capsule 20 in chamber 10. The various components are disposed so that shoulder 64 is held in spaced relationship to washer 60 as shown. Seat 56 is provided with recessed portion 72 in the forward face thereof. Tube 66 is also provided with radially extending bores 74 disposed to communicate the interior of the tube with recess 72.

Referring again to FIG. 1, tubular shot chamber 76 is disposed along the top of housing 2 in parallel relationship with tube 34. The shot chamber is provided with a closed forward end. A rear closure member, such, for example, as simulated hammer 78, is pivotally mounted on housing 2 and spring loaded in the closed condition as shown. Spherical shots 80 are placed in shot chamber 76 by insertion through the rear end of the shot chamber with hammer 78 held open against the biasing spring. Shot chamber 76 is provided with aperture 82 in the lower portion thereof, a portion of which coincides with radially disposed bore 84 through the wall of hammer 6 when the hammer is in a rearward position. The above-mentioned aperture and bores also are aligned with the enlarged portion 68 of valve stem 62 when the hammer and barrel assembly is in its relaxed rearward position. The enlarged portion is formed to substantially close communication between the interior of barrel 4 and bore 84 in this position.

Referring now to FIG. 2, the operation of the gun is initiated with actuation of the trigger and sear assembly as outlined above. As hammer 6 moves forward, bore 84 and aperture 86 move forward displacing the shot 80*a* located therein forwardly past the end of enlarged spherical portion 68 and allowing the shot to drop into barrel 4. Another shot, 80*b*, then drops into the vacated aperture 82 in the bottom of shot chamber 76. The position assumed by shot 80*b*, prevents shots remaining in shot chamber 76 forward of the aperture from rolling to the rear of the chamber when the muzzle is elevated and visa versa where the muzzle is depressed. As is shown in FIG. 2, faces 52 and 54 of the trigger and sear respectively converge on one another as the sear moves hammer 6 and barrel 4 towards its forwardmost position against the compressive force of spring 38.

Aperture 82 may be either circular in configuration as shown, or may take the form of an elongated slot parallel with the axis of chamber 76. The elongated slot insures proper feeding of the shot into the apertue 84.

Referring now to FIG. 3 of the drawing, trigger 40 is in its rearmost position, faces 52 and 54 having converged, moving the end of sear 44 which engages notch 48 downwardly releasing the hammer and barrel assembly. Hammer 6 has moved rearwardly under the influence of the spring 38 and is about to impact valve assembly 8 to cause a burst of pressure to be released through the valve assembly into barrel 4 and start shot 80 to accelerate out of the barrel.

The operation of valve assembly 8 is shown in FIG. 4. This figure shows the assembly in the impacted, open condition. Hammer 6 contacts shoulder 64, the impact energy of the hammer causing valve stem 62 to be displaced rearwardly. Since the rearward end of tube 66 of the valve stem 62 is in contact with the face of recessed portion 72 of valve seat 56, the rearward movement of the valve stem also displaces the valve seat rearwardly against the pressure in chamber 10. Although seat 56 is slidably fitted within expansion chamber 10, the fit is sufficiently loose to allow pressure from the interior of chamber 10 to escape therearound as shown by the arrows. The sealing effect of seat 56 is achieved through biased contact of the forward annular face 88 thereof with the rearward face of seal 58. Rearward displacement of seat 56 breaks the seal between face 88 and seal 58 allowing pressure from chamber 10 to pass therebetween through bores 74 in tube 66 and thence into the interior of barrel 4. After hammer 6 has expended kinetic energy, the pressure in chamber 10 combined with the force of spring 70 is of sufficient magnitude as described above to reposition seat 56 against the seal 58 thereby terminating the flow of gas therebetween.

Upon release of trigger 40, spring 46 returns the trigger and sear assembly to the initial position and the elements of the device assume the position shown in FIG. 1.

The device may also be furnished with a secondary sear structure such as that shown generally at 90. The structure comprises a pivotally-mounted secondary sear 92 disposed in housing 2 which is spring loaded in an upward direction by spring 94 and which is engageable with notch 48 in hammer 6 when the hammer and barrel assembly are displaced forward of the normal operating position as shown in FIG. 6. Suitable means such as bolt-like extension 93 (FIG. 5) through slot 95 in the side of housing 2 may be furnished to allow displacement of the hammer and barrel assembly in the forward direction to allow sear 92 to engage notch 48. As will be noted in FIG. 3, the lower front face of sear 44 engages face 96 of secondary sear 92 when the trigger is displaced to an extreme rearward position. This provides for release of the hammer and barrel assembly from the secondary sear engaging position by a camming action between sear 44 and safety sear face 96. The incorporation of the secondary sear mechanism provides a single shot, manually cocked capability, where desired, allowing the gun to be fired with a minimum of trigger force. This feature is of particular utility in target shooting.

Of course the mechanism as hereinabove described for incorporation in a pistol could obviously be incorporated in a rifle frame or the like without changing the theory of the invention. Furthermore, the spherical projectiles shown do not constitute a necessary element of the invention, and pellets, darts or any like projectiles could be substituted without effecting the operation of the device.

The materials used in the fabrication of the gun are largely a matter of choice and convenience although portions such as the hammer member are preferably fabri-

cated of high-density material such as brass or the like to provide sufficient kinetic energy yet keep the member compact, making the member operate the valve mechanism as described. Obviously the sealing members such as the valve seat and seal should be fabricated of some suitable elastomeric material such as rubber to provide the proper sealing properties for the parts.

Preferably the elastomeric material should be sufficiently soft as to provide easy sliding and to allow small particles which may be present in the valve area to embed themselves without causing leakage. The seal should also be sufficiently thin, on the order of .050 inch for example, to avoid extrusion around the valve seat and also to prevent the seal from "following" the seat through expansion, when the seat is displaced from the seal.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

I claim:

1. A gas-powered gun comprising: a frame having a handle thereon; a projectile barrel slidably mounted in said frame and axially reciprocable between a forward and a rearward position therein, said barrel having a breach end; an annular hammer coaxially mounted on the breach end of said barrel and reciprocable therewith; a pressurized gas capsule disposed in said handle; an expansion chamber adjacent to the breach end of said barrel; means including a puncturing device to connect the pressure in said gas capsule to the interior of said chamber; means including a conduit to connect said chamber to the bore of said barrel; a valve disposed in said conduit, said valve being reciprocable between a closed position towards said barrel and an open position in the opposite direction; said valve being formed to be disposed in a sealably closed condition by the pressure in said chamber; a first spring disposed in said chamber biasing said valve toward closed position; a valve stem mounted coaxially in said valve and reciprocable therewith, said stem engaging said hammer and having an end slidably projecting into said barrel; a second spring disposed around said barrel to bias said hammer in a rearward position against said valve stem; means to adjust the bias in said second spring; trigger means to reciprocate said hammer to a forward position and automatically release said hammer for return reciprocation to said rearward position; said pressure maintaining said valve in a closed position against the static load of said second spring and said hammer but permitting opening thereof under the dynamic load of said second spring and said hammer as said hammer reengages said valve stem on return reciprocation thereof; a projectile storage chamber above said barrel; and means to sequentially feed projectile into said barrel from said storage chamber.

2. A gas-powered gun in accordance with claim 1 wherein said last-mentioned means comprises: a projectile transmitting bore vertically disposed through the wall of said hammer and communicating with the interior of said barrel; a projectile-transmitting aperture vertically disposed through the wall of said storage chamber, said bore disposed to be aligned with a portion of said aperture and with the projecting end of said valve stem when said hammer is disposed in said rearward position; whereby a projectile from said storage chamber is gravity fed through said aperture into said bore and retained therein by the projecting end of said valve stem while said hammer is disposed in said rearward position and said projectile is gravity fed into said barred when said hammer is displaced toward said forward position.

3. A gas-powered gun in accordance with claim 2 wherein said trigger means comprises: a trigger member having an upper and lower end thereto, said trigger being pivotally mounted at an intermediate portion thereof to said frame; a sear having a forward and a rearward end thereto, said sear being pivotally connected at an intermediate portion thereof to the upper end of said trigger, said sear being reciprocable between a rearward and a forward position by pivoting of said trigger between a forward and a rearward position; biasing means disposed to constantly urge said sear toward said rearward position and the forward end thereof in an upward direction, the forward end of said sear engaging said hammer for forward reciprocation thereof when said sear is in a rearward position and during substantial portion of the forward reciprocation of said hammer, the rear end of said sear engaging said trigger as the sear nears the forward position thereof, thereby blocking the pivotal connection between said trigger and said sear to cause withdrawal of said sear from engagement with said hammer by further rearward pivoting of said trigger; the withdrawal of said sear from said hammer thereby automatically releasing said hammer for return reciprocation by said second spring.

4. In a gas-powered gun, an inertia-operated pressure release system comprising: a frame having a cylindrical chamber therein; a cylindrical valve seat slidably mounted in said chamber for reciprocation therein; a pressure source connected to said chamber on one side of said valve seat; an annular seal coaxially disposed on the other side of said valve seat at the mouth of said chamber; means defining a recess coaxially disposed in the face of said seat adjacent to said seal; a valve spring mounted in said chamber to bias said seat toward a sealing relationship against said seal; a tubular valve stem disposed through said seal coaxial therewith and engaging the recess of said seat; means defining a plurality of transverse bores through said stem adjacent said seat; a flange mounted at an intermediate portion of said stem in spaced relation to said seal, said frame further having an enlarged bore coaxial with and adjacent to the mouth of said chamber; a projectile barrel reciprocably mounted in said bore, said projectile barrel being slidably disposed around the forward portion of said valve stem coaxial therewith; an annular hammer member coaxially mounted on said barrel and engageable with said flange; a barrel spring urging said hammer toward engagement with said flange, the pressure from said pressure source against said seat and the force of said valve spring being such that said seat is sealingly engaged with said seal against the static load imposed by said hammer and said barrel spring through said valve stem; means to reciprocate said hammer away from said valve stem and release said hammer for re-engagement with said flange under the influence of said barrel spring, the kinetic energy in said hammer being such that engagement with said flange overcomes the pressure from said source and the force of said valve spring and displaces said valve stem rearwardly to displace said seat from said seal to release a burst of gas pressure therebetween through the bore of said stem into said barrel.

5. A gas powered gun comprising:

a frame;

a projectile barrel slidably mounted in same said frame and axially movable between a forward cocked position and a rearward position therein;

a source of gas pressure, means including a valve for controllably connecting said source of pressure to the bore of said barrel, said valve being movable between a closed position towards said barrel and an open position in the opposite direction;

a first biasing means including pressure from said source for constantly urging said valve toward the closed position;

a second biasing means constantly urging said barrel toward said valve;

a trigger member pivotally mounted on said frame for movement between a forward and rearward location, a sear means pivotally mounted to said trigger,

said sear means engaging said barrel to move said barrel to said forward cocked position when said trigger is moved toward a rearward location, means to withdraw said sear means from engagement with said barrel when said trigger reaches said rearward location to release said barrel for return movement to said rearward position under the influence of said second biasing means;

said first biasing means maintaining said valve in a closed position against the static load of said second biasing means and said barrel but permitting opening thereof under the dynamic load of said second biasing means and said barrel as said barrel re-engages said valve on return movement thereof;

and means to feed projectiles to said barrel.

6. A gas powered gun comprising:

a frame;

a projectile barrel slidably mounted in said frame and axially movable between a forward cocked position and a rearward position therein, said barrel having a breech end;

an annular hammer mounted on the beech end of said barrel and movable therewith;

a source of gas pressure;

a chamber communicating with said source of pressure coaxially disposed with respect to said barrel;

a conduit between said chamber and said barrel for conveying pressure therebetween;

a valve mounted in said conduit and axially movable between a closed position towards said barrel and an open position in an opposite direction;

said valve being formed to be disposed in a sealably closed condition by the pressure in said chamber;

a first spring means mounted in said chamber disposed to urge said valve toward said barrel;

a hammer-engaging valve actuator coaxially connected to said valve and movable therewith;

a spring means biasing said hammer toward a rearward position against said valve actuator;

a trigger member pivotally mounted on said frame for movement between a forward and a rearward location, a sear means pivotally mounted to said trigger, said sear means pivotally moving with respect to said

trigger and simultaneously moving between a rearward and a forward configuration when said trigger is moved toward said rearward location, said sear means engaging said hammer in said rearward configuration and during a substantial portion of the movement thereof to move said hammer and said barrel to said forward cocked position when said trigger is moved towards said rearward location, means on said trigger adapted to engage said sear means to terminate pivotal movement therebetween proximate said rearward location to provide withdrawal of said sear means from engagement with said hammer when said trigger reaches said rearward location to thereby release said hammer for return movement to said rearward position under the influence of said second spring, and means to bias said trigger in said forward location and said sear means toward engagement with said hammer;

said pressure maintaining said valve in a closed position against the static load of said second spring and said hammer but permitting opening thereof under the dynamic load of said second spring and said hammer as said hammer re-engages said actuator on return movement thereof;

a tubular projectile storage chamber disposed in parallel relationship above said barrel;

and means including a valve to sequentially feed projectiles into said barrel.

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