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GAS SYSTEM FOR FIREARMS

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Fig-1-

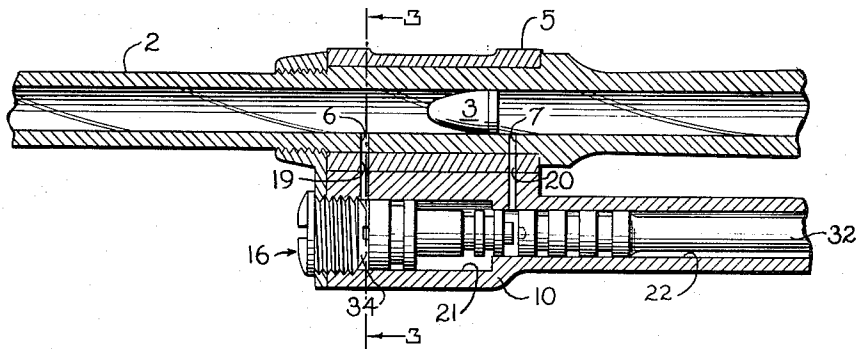


Fig 2.

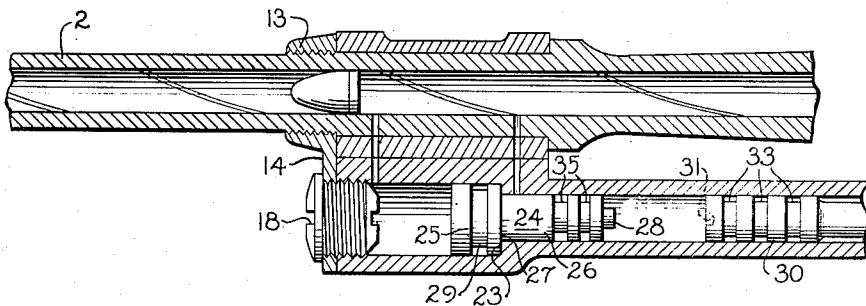


Fig 3.

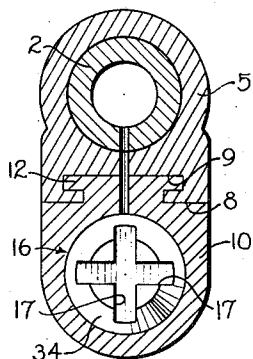
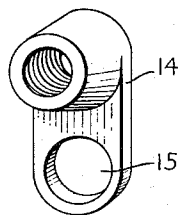


Fig-4-



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GAS SYSTEM FOR FIREARMS

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4 Claims. (Cl. 89-191)

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

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty thereon.

This invention relates to a gas system for a firearm and particularly to a mechanism for providing automatic operation of a firearm from the expansion of a confined and predetermined quantity of gases developed within the barrel by the discharge of a cartridge.

While not limited thereto, this invention is particularly applicable to automatic firearms wherein the gas is taken from the barrel close to the chamber end, as, for example, the U. S. carbine, cal. .30 M2. The location of the gas port in the barrel adjacent to the breech end is obviously desirable as it reduces the length of the operating rod that transmits the force from the gas system to the breech mechanism and hence the weight of the firearm. However, with conventional gas systems comprising only a piston and cylinder and with the impact of the gases from the barrel received directly by the piston the bringing of the gas port close to the area of greatest gas pressure, near the point of explosion, is disadvantageous in that the action of the gas is very violent and of short duration. This causes an undesirably high acceleration of the piston and breech mechanism which may result in breakage of parts. Moreover, in conventional systems wherein the duration of the pressure is short, the fact that the acceleration of the breech mechanism must reach sufficient velocity to attain the full recoil position results in obvious strain and shock on the moving parts. Further, because of the variation in pressure in rounds of ammunition, there is the chance that one will produce a pressure exceeding the normal average causing such acceleration of the breech mechanism that it will open while the pressure within the barrel is above the safe limit.

Accordingly, it is an object of this invention to provide a gas system for an automatic firearm in which the breech is opened by the expansion of a predetermined volume of trapped gases rather than by an impact blow.

Another object of this invention is to provide in a gas system for automatic firearms motivated by the expansion of trapped gases, a means of producing a momentary acceleration to overcome the initial inertia of the breech mechanism.

A further object of this invention is to provide a gas system in which there is a damping of the counter-recoil return of the breech mechanism to battery position whereby the shock and wearing of the moving parts is considerably reduced.

A still further object of this invention is to delay the action of the gaseous upon the breech mechanism in order to prevent the breech from being opened while the gas pressure in the barrel is above safe limits.

A particular object of this invention is to provide an improved gas system for an automatic firearm, characterized by a simplicity of design and especially adapted

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for the utilization of gases from the high pressure region of the barrel.

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 cross-sectional view of the front portion of a firearm provided with the gas system of this invention showing the position of the parts at the moment when a bullet fired in the barrel of the firearm has passed the first of two gas ports in the barrel;

Fig. 2 is a view similar to Fig. 1 but showing the position of the two piston members of the gas system at the moment the bullet has passed the second gas port in the barrel;

Fig. 3 is a sectional view taken along the plane 3-3 of Fig. 1 looking toward the forward end of the firearm; and

Fig. 4 is a perspective view of the locking member which secures the gas cylinder to the barrel.

In Fig. 1 there is shown a barrel 2 of a firearm and a bracket 5 which encircles the barrel adjacent a gas port 6 and a gas port 7. Bracket 5 may comprise a separate member slipped over the barrel or may be integrally formed therewith. The underside of bracket 5 is provided with a flat surface 8 having a T-slot 9 parallel with the axis of barrel 2. The forward upper section of a tubular gas cylinder 10 is provided with a T-shaped portion 12 arranged to mate with slot 9 and prevent a rotational shifting of the gas cylinder with respect to bracket 5. A threaded portion 13 is provided on barrel 2 forwardly of and contiguous to bracket 5. A locking element 14, shown particularly well in Fig. 4, is threadably mounted on threaded portion 13 and snugly contacts the front end of bracket 5 and the forward face of cylinder 10. A hole 15 in the depending portion of lock 14 has a similar diameter as that of the bore of gas cylinder 10 and is axially aligned therewith.

A closure member or plug 16 having a threaded body portion and a head portion of larger diameter is received by hole 15 and screwed into the forward end of gas cylinder 10 to operate as a means of securing the cylinder to barrel 2 and for closing the forward end of the cylinder. The rear end of plug 16 is beveled, as shown at 34, and is provided with intersecting grooves 17, as shown in Fig. 3, for a purpose to be explained later. A screw driver slot 18 is provided in the front end of plug 16 to facilitate the removal thereof from gas cylinder 10. A gas port 19 is provided through bracket 5 and gas cylinder 10 so as to align with gas port 6 of barrel 2 and a gas port 20 is similarly provided in bracket 5 and gas cylinder 10 to align with gas port 7.

As previously mentioned, cylinder 10 is hollow and comprises a forward gas chamber portion 21 and a rearward gas chamber portion 22 of smaller diameter, the junction therebetween defining a shoulder 23 disposed between gas ports 6 and 7. Slidably disposed within gas cylinder 10 is a piston member 24, hereinafter referred to as the secondary piston, having a head portion 25 which snugly engages the interior cylindrical surface of gas chamber 21 and a stem portion 26 which snugly engages the interior cylindrical surface of gas chamber 22. The junction of head portion 25 and stem portion 26 provides a shoulder 27. Head portion 25 is provided with an annular groove 29 and stem portion 26 with annular grooves 35. Protruding from stem portion 26 is a rod portion 28 of smaller diameter for a purpose to be later described. An operating member 32, suitably connected to the breech mechanism (not shown), terminates in a piston 30, hereinafter referred to as the primary piston, which snugly engages the in-

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terior cylindrical surface of gas chamber 22. The face of piston 30 is provided with an indent recess 31, of smaller diameter than rod portion 28, and the periphery of piston 30 is provided with annular grooves 33.

It should be understood that the full recoil stroke of operating member 32 is preferably less than the length of gas chamber 22, thus insuring that piston 30 remains engaged therein during normal operation of the firearm. Hence, no stops are needed to retain piston 30 within gas chamber 22. An operating rod spring (not shown) is provided as part of the breech mechanism to return operating member 32 to its battery position wherein the forward end of piston 30 lies slightly rearwardly of port 20 and abuts rod portion 28.

In operation, a cartridge is fired and a bullet 3 is driven through the bore of barrel 2 by the gases thus formed. After bullet 3 passes port 7, as shown in Fig. 1, a portion of the gases are driven through port 7 and associated port 20 into the annular space provided around rod portion 28 between secondary piston 24 and primary piston 30. Through the pressure of these gases, primary piston 30 is moved rearwardly, but before so moving the space between such piston and secondary piston 24 and within recess 31 must be filled by the gases, thus introducing a delay in the initiation of movement of piston 30. It is obvious that the gases act equally against secondary piston 24, holding it forwardly against plug 16 to prevent movement thereof which would block port 7 as primary piston 30 moves away from contact therewith.

As bullet 3 continues along the bore of barrel 2 to the position shown in Fig. 2 a portion of the gases passes through port 6 and into the space in gas chamber 21 between secondary piston 24 and plug 16 established by grooves 17 and beveled portion 34. It is clearly apparent that the gas pressures at ports 6 and 7 are essentially the same but the area of the face of piston head 25 is greater than that of piston stem 26. Consequently, the greater force impinging on piston head portion 25 causes secondary piston 24 to move rearwardly until shoulder 27 thereon contacts shoulder 23 of gas cylinder 10. As secondary piston 24 moves rearwardly, stem portion 26 closes port 7 to trap in gas chamber 22 the gases that have already entered. Grooves 29, 33 and 35, in effect, act as gas seals to prevent the escape of the gases past primary piston 30 and secondary piston 24. Further action of primary piston 30 is primarily dependent upon the expansion of the trapped gases.

It is clearly apparent that the mass of secondary piston 24 is considerably less than that of primary piston 30 and the breech mechanism attached thereto. Therefore, when secondary piston 24 is moved rearwardly it will travel much faster than primary piston 30 to produce a momentary accelerating thrust to the trapped gases in gas chamber 22 by further compressing them and decreasing the volume of the chamber. This acceleration is introduced to aid the trapped gases in overcoming the initial inertia of the breech mass.

When bullet 3 leaves barrel 2 the pressure within the bore is reduced, with a corresponding reduction of pressure within gas chamber 21. It is obvious that when the pressure in gas chamber 21 becomes less than that in gas chamber 22, secondary piston 24 is forced forwardly, opening port 20 to allow a portion of the gases in gas chamber 22 to escape to the atmosphere by means of the bore of barrel 2. By this time the breech mechanism has reached full recoil position and unless stopped by the sear mechanism (not shown) will proceed to battery position by action of spring means (not shown) on operating rod member 32. The return of the breech mechanism, however, is retarded to an extent by the fact that primary piston 30 must drive the gases remaining in gas chamber 22 ahead of it through port 20, thus providing a damping effect on the counter-recoil of the breech mechanism. The compression of the gases by

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piston 30 during the return stroke also will hold secondary piston 24 against plug 16 and clear of port 20. When primary piston 30 is in full forward or battery position, it contacts secondary piston 24, hence preventing the secondary piston from accidentally covering port 20. In turn, primary piston 30 is stopped from extending too far forward to block port 20.

It is apparent that there is here provided a gas system which uses a very small volume of trapped gases, thus reducing the velocity of the moving parts and consequently the resulting shock and fatigue. The damped return of the breech mechanism further insures longer life of moving parts and also provides a smoother action of the weapon. Further, the delay in the opening of the breech assures that the pressure in the barrel does not exceed a safe limit. Moreover, the system is characterized by a simplicity of design and an ease of manufacture.

Although a particular embodiment of the invention has been described in detail herein, it is evident that many variations may be devised within the spirit and scope thereof and the following claims are intended to include such variations.

I claim:

1. For a firearm having a barrel, a cylinder attached to the barrel and provided with a cylindrical chamber open at both ends and a port for passing to said chamber a portion of the gases produced by a cartridge exploded in the barrel, a piston closing one end of said chamber and being slidably moved therein by the pressure of the gases received by said chamber, and an unattached member closing the opposite end of said chamber and being movable into said chamber by the pressure of a portion of the gases remaining in the barrel for blocking said port to entrap in said chamber the gases received therein and to increase the pressure of the entrapped gases by decreasing the size of said chamber.

2. For a firearm having a barrel and an operating breech mechanism, a gas system for powering the breech mechanism including a cylinder provided with a cylindrical chamber, a piston mounted for slidable movement in one end of said chamber and joined to the breech mechanism for actuation thereof when said piston is energized, a port leading from the barrel to said chamber for passing thereto a portion of the gases produced by a cartridge exploded in the barrel for energizing said piston, and an unattached member movable into the opposite end of said chamber by the pressure of a portion of the gases remaining in the barrel for blocking said port to entrap in said chamber the gases received therein and to increase the pressure of the entrapped gases by decreasing the size of said chamber.

3. For a firearm having a barrel and an operating breech mechanism, a gas system for actuating the breech mechanism including a gas cylinder provided with a forward gas chamber and a rearward gas chamber of smaller diameter axially aligned therewith, an annular shoulder formed by the junction of said forward and rearward gas chambers, a primary piston attached to the breech mechanism and mounted in said rearward gas chamber for reciprocation between a front and a rear position, a port for passing to said rearward chamber a portion of the gases produced by a cartridge exploded in the barrel for driving said primary piston to the rear position, an unattached secondary piston slidable in said forward chamber between rearward contact with said shoulder and forward contact with a plug closing the front end of said forward chamber, a stem portion extending from said secondary piston into said rearward chamber for blocking said port and decreasing the size of said rearward chamber when said secondary piston moves rearwardly to contact said shoulder, and a second port extending from the barrel to the front portion of said forward chamber to pass a portion of the gases remaining in the barrel into said forward chamber for

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moving said secondary piston rearwardly into contact with said shoulder.

4. For a firearm having a barrel and an operating breech mechanism, a gas system for actuating the breech mechanism including a gas cylinder provided with a forward gas chamber and a rearward gas chamber of smaller diameter axially aligned therewith, an annular shoulder formed by the junction of said forward and rearward gas chambers, a primary piston attached to the breech mechanism and mounted in said rearward gas chamber for reciprocation between a front and a rear position, a port passing to said rearward chamber a portion of the gases produced by a cartridge exploded in the barrel for driving said primary piston to the rear position, a plug for closing front end of said forward chamber, an unattached secondary piston slidable in said forward chamber between rearward contact with said shoulder and forward contact with said plug, a stem portion extending from said secondary piston into said rearward chamber for blocking said port and decreasing the size of said rearward chamber when said secondary piston moves rearwardly to contact said shoulder, a second port extending from the barrel to the front portion of said forward chamber to pass a portion of the

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gases remaining in the barrel into said forward chamber for moving said secondary piston rearwardly into contact with said shoulder, a rod portion extending rearwardly from said stem portion for engagement by said primary piston when in the forward position to hold said secondary piston in a forward position, and groove means in the rearward face of said plug cooperating with said second port for passing the gases from said second port into said forward chamber.

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