H. W. GABBETT-FAIRFAX.

AUTOMATIC OR SEMI-AUTOMATIC FIREARM.

APPLICATION FILED JULY 5, 1919.

1,338,649. **Patented Apr. 27, 1920.**

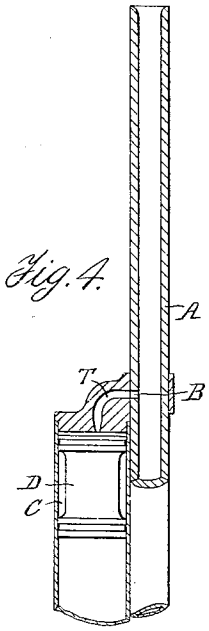


Fig. 4.

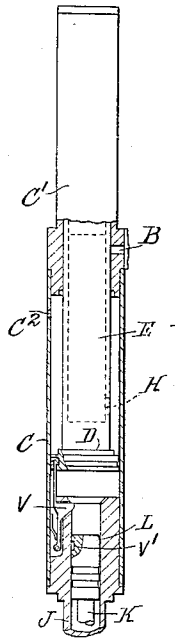
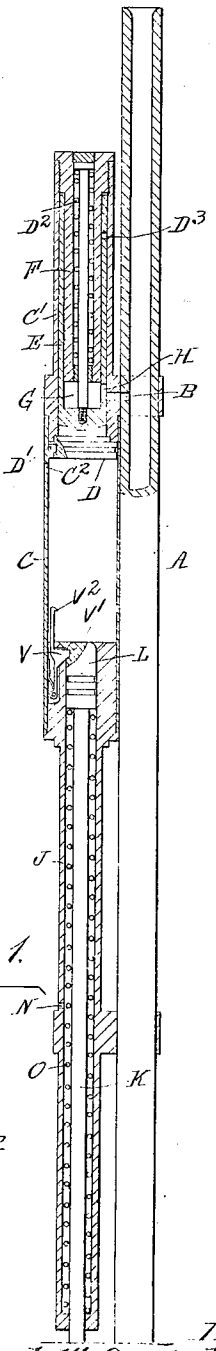


Fig. 3.



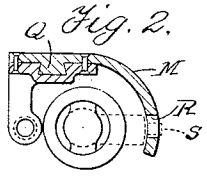


Fig. 2.

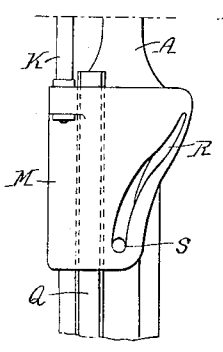


Fig. 1.

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AUTOMATIC OR SEMI-AUTOMATIC FIREARM.

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To all whom it may concern:

Be it known that I, HUGH WILLIAM GABBETT-FAIRFAX, a subject of the King of Great Britain, residing at London, England, have invented new and useful Improvements in Automatic or Semi-Automatic Firearms, of which the following is a specification.

As is well known, the principle on which many types of automatic and semi-automatic firearms are operated is one in which a portion of the gas generated by the explosive charge is allowed to escape from the barrel, prior to the exit of the projectile from the muzzle of the gun, through an opening communicating with a cylinder or other chamber.

The expansive energy of the gas so escaping has heretofore been utilized in said cylinder or chamber to actuate a piston or other movable member rigidly connected with the mechanism employed to open the breech, or the expansive energy of the gas has been made to compress suddenly and forcibly a column of air or gas of greater or less length which is in contact at the farther end with the movable member above referred to, or the expansive energy of the gas has been made to act on a piston or movable member or on two or more pistons separated by springs or other shock-absorbing devices, the piston (whether simple or composite) being directly employed to actuate a column of air which is in contact at the farther end with the movable member.

It is obvious that in a firearm in which the expansive energy of the explosive charge is utilized directly to actuate the breech-mechanism, this mechanism is subjected to violent shock, because the time available for the application of the expansive energy of the explosive charge is very small, and that if the expansive energy of the explosive charge is utilized by either of the methods outlined above or by any method whatever in which motion produced by the energy of the explosive charge is communicated successively through a chain or series of movable parts or objects (whether solid, liquid or gaseous) to the mechanism employed to open and close the breech, then the breech mechanism cannot be protected with absolute certainty from the violent shock which is characteristic of an explosion though the shock effect may be diminished by increasing the number of movable parts in the intermediate chain.

In order to obviate these disadvantages and to entirely protect the breech-closing mechanism from shock it is necessary and sufficient to introduce, as I propose, at least one fixed part between the breech-closing mechanism and the movable part or parts which is or are actuated by the expansive energy of the explosive gases, this part being held fixed during the whole period for which the aforesaid movable parts are acted upon by the expansive energy of the explosive gases, and being afterward positively liberated and displaced by mechanism actuated by the part which is moved by the action of the explosive gases, the energy stored during the action of these gases being thus liberated for the operation of the breech-closing mechanism. The introduction of such a fixed part also avoids the necessity for the employment of shock absorbers. The invention also provides a simplified and improved method of utilizing the energy of the explosive gases by compressing a column of air and afterward employing the energy thus stored up for performing all or any of the functions required in the cycle of operations of the gun.

According to my invention, I interpose between the gases and the mechanism for operating the breech-action, a cushion of air which undergoes successive compression and expansion after each shot is fired, the chamber containing the air cushion being arranged so that it has no communication with the barrel of the gun nor with any chamber or passage directly connected therewith.

To obtain the compression of the air cushion I preferably employ a floating piston impelled by the energy of the gases escaping from the barrel, and this piston compresses the body of air forming the cushion against the face of a second piston directly connected with a cam plate which actuates the breech-closing mechanism, and to attain the object of my invention it is necessary that this second piston should be fixed or locked in position during the whole period of compression of the air cushion. Any shock at the face of the second piston is thus prevented from being transmitted to the mechanism behind it.

When the compression of the air cushion is complete, the first piston becomes locked to its cylinder and no further action of the explosive gases is possible on the air which has just been compressed. The locking of the first piston automatically unlocks the second piston and the compressed air being now free to expand (while completely cut off from the barrel) the second piston is driven back taking the cam plate with it and opening the breech.

During the first stage of the action the air chamber acts purely as a receiver or storehouse for energy, and during the second stage it acts purely as a source of energy, and this action is quite distinct from that which has previously been suggested of pushing a quantity of air bodily along a tube or pipe while producing in it an indeterminate amount of expansion or contraction. In both stages, according to my method, one piston or the other is locked and interposes a solid barrier between the shock of the explosive gases and the breech-actuating mechanism.

The cam plate is so constructed that on being moved rearwardly, it first rotates and unlocks the breech-bolt and then withdraws the bolt to a distance sufficient to insure the extraction and ejection of the spent cartridge. The whole of the parts are returned by a spring or in such other manner as may be desired.

In the accompanying drawing I have shown how my invention may be carried into practice.

Figure 1 is a partial side elevation and partial longitudinal section of so much of a firearm as is necessary to illustrate the invention.

Fig. 2 is a section through the breech operating cam.

Fig. 3 shows a second position of the floating piston, and

Fig. 4 illustrates a modification of a part of the device.

A is the barrel of the firearm, B is the outlet for the gases which are required to work the breech mechanism. C is a cylinder in which works a floating piston D. C^2 is an orifice in the wall of the cylinder C just behind the piston D when in the forward position. In the arrangement shown in Fig. 1 this piston is formed with or connected to a tubular extension E which is open at the forward end. F is a fixed piston serving as a guide for the extension E, said piston guide being secured by screwing or otherwise to the forward end of an extension C′ of the cylinder C. A closed chamber G is thus formed between the rear end of the piston guide F and the inner end of the tubular extension E. Into this chamber the gases escaping from the barrel by the outlet B enter through a port H in the wall of the extension E. A tube J inclosing a rod K is secured to the rear end of the cylinder C. The forward end of said rod K is constituted by a piston L which is exposed to pressure generated in the cylinder C, and the rear end of the rod is attached to a cam M which operates the breech mechanism. N is an air outlet in the tube J, and O is a spring for returning the rod K and reclosing and locking the breech-bolt.

The cam M slides in a guide-way Q. It is curved in cross-section as seen in Fig. 2, and a spiral cam slot R therein engages a radial pin or arm S fixed to the breech-bolt. During the first part of the movement of the cam, the effect is to rotate the breech-bolt and thus unlock it, this unlocking movement being completed when the pin or arm S has traversed the full length of the cam slot. The continued movement of the cam then withdraws the breech-bolt from the breech thus insuring the extraction and ejection of the spent cartridge in the well known manner.

It will be understood that the cylinder C previous to the discharge of the firearm contains a body of air at atmospheric pressure, since the orifice C^2 is then uncovered, and that when the arm is fired the gases passing through the outlet B force the piston D rearwardly thus closing the orifice C^2 and compressing the air behind the said piston until the pressure thus produced is sufficient to operate the piston L which actuates the breech mechanism.

The piston L is retained in position by a spring catch V which engages in a notch V′ in the piston. This catch is provided with a hooked extension V^2 which is depressed by the piston D when the latter has completed its rearward movement. Such depression of the catch unlocks the piston L and allows the latter to move and perform the necessary operations on the breech mechanism. The compressed air eventually escapes through the vent hole N and the piston L is then free to be returned by its spring O. The piston D is notched at D′ as shown to engage with the hooked extension V^2 of the catch V, so that after the piston D has depressed the catch V to liberate the piston L, said piston D itself becomes locked by the hooked extension V^2. When the piston L returns to its initial position it in turn depresses the catch V and liberates the floating piston D which is then returned to its forward position by its spring D^2. When the piston D reaches its forward position, the orifice C^2 is uncovered and the air in the cylinder C is restored to atmospheric pressure. It should be noted that when the floating piston D is in its rearward position a vent hole D^3 rests opposite the hole B in the barrel and the gases in front of the piston are then free to escape.

In the modification shown in Fig. 4, the gases escaping from the outlet B pass through a curved channel T which conducts them without expansion into the cylinder C in front of the floating piston D which in this construction has no extension as in Fig. 1.

What I claim is:—

1. In a firearm of the kind in which the breech mechanism is actuated by gases generated from the explosive charge, the provision between the gases and the breech-operating mechanism of a confined column of air which is compressed by the explosive gases, a floating piston between the gases and the column of air, a second piston connected to the breech-operating mechanism and adapted to be operated by the compressed air, means for locking the second piston until the column of air is fully compressed, and means operated by the floating piston for releasing the second piston after the compression stage is complete and thus allowing the compressed air to expand and operate the breech mechanism.

2. In a firearm of the kind in which the breech mechanism is actuated by gases generated from the explosive charge, the provision between the gases and the breech-operating mechanism of a confined column of air which is compressed by the explosive gases, a cylinder for receiving said column of air, a floating piston in said cylinder between the gases and the column of air, a second piston connected to the breech-operating mechanism and adapted to be operated by the compressed air, means for locking the second piston until the column of air is fully compressed, means for releasing the second piston after the compression stage is complete and thus allowing the air to expand, and means for locking the first piston to its cylinder to prevent its return while the air is expanding.

3. In a firearm of the kind in which the breech mechanism is actuated by gases generated from the explosive charge, the provision between the gases and the breech-operating mechanism of a confined column of air which is compressed by the explosive gases, a cylinder for receiving said column of air, a floating piston in said cylinder between the gases and the column of air, a second piston connected to the breech-operating mechanism and adapted to be operated by the compressed air, means for locking the second piston until the column of air is fully compressed, means connected with the first piston for releasing the second piston when the compression stage is complete and at the same time locking the first piston to its cylinder, means for returning the second piston after it has operated the breech mechanism, means connected with the second piston for releasing the first piston after it has returned from operating the breech mechanism, and means for returning the first piston after it is released.

4. In a firearm of the kind in which the breech mechanism is actuated by gases generated from the explosive charge, the provision between the gases and the breech-operating mechanism of a confined column of air which is compressed by the explosive gases, a floating piston between the gases and the column of air, a tubular extension on said piston, ports in said extension for admitting and exhausting the explosive gases, means for returning the piston after the gases have exhausted, a second piston connected to the breech-operating mechanism and adapted to be operated by the compressed air, means for locking the second piston until the column of air is fully compressed, and means operated by the floating piston for releasing the second piston after the compression stage is complete and thus allowing the compressed air to expand and operate the breech mechanism.

5. In a firearm of the kind in which the breech mechanism is actuated by gases generated from the explosive charge, the provision between the gases and the breech-operating mechanism of a confined column of air which is compressed by the explosive gases, a floating piston between the gases and the column of air, a second piston adapted to be operated by the compressed air and serving to actuate the breech mechanism through an arc-shaped cam which when moved axially first turns and unlocks the breech bolt and then withdraws the bolt from the breech, means for locking the second piston until the column of air is fully compressed, and means operated by the floating piston for releasing the second piston after the compression stage is complete and thus allowing the compressed air to expand and operate the breech mechanism.

6. In a firearm of the kind in which the breech-mechanism is actuated by the gases generated by the explosive charge, the combination of a closed receiver for a column of air, a gas-chamber in communication with the interior of the barrel of said firearm, a movable wall separating said column of air from the interior of said gas-chamber, a second movable wall for said air-receiver, means for connecting the second movable wall to the breech-mechanism of the firearm, means for locking the second movable wall during the compression of the air-column by the action of the gases on the first movable wall, means for unlocking the second movable wall and for locking the first movable wall when the compression of the air is complete, means for releasing the compressed air when the breech-mechanism

has been actuated, means for returning the second movable wall to its initial position, means for releasing the first movable wall when the second movable wall has reached its initial position, and means for returning the first movable wall to its initial position.

7. In a firearm of the kind in which the breech-mechanism is actuated by gases generated from the explosive charge, the provision between the gases and the breech-operating mechanism of a confined column of air which is compressed by the explosive gases, a floating piston between the gases and the column of air, a tubular extension on said piston, ports in said extension for admitting and exhausting the explosive gases, means for returning the piston after the gases have exhausted, a second piston connected to the breech-operating mechanism and adapted to be operated by the compressed air, means for locking the second piston until the column of air is fully compressed, means operated by the floating piston for releasing the second piston after the compression stage is complete and thus allowing the compressed air to expand and operate the breech-mechanism, means for locking the floating piston simultaneously with the release of the second piston, and means of unlocking the floating piston by the return of the second piston in order to permit the floating piston to return to its original position after the cycle of operations is complete.

8. In a firearm of the kind in which the breech mechanism is actuated by gases generated from the explosive charge, the provision between the gases and the breech operating mechanism of a confined column of air which is compressed by the explosive gases, a floating piston between the gases and the column of air, means for locking the floating piston when the compression of the column of air is complete, a second piston adapted to be operated by the compressed air and serving to actuate the breech mechanism through an arc-shaped cam which when moved axially first turns and unlocks the breech-bolt and then withdraws the bolt from the breech, said arc-shaped cam, means for locking the second piston until the column of air is fully compressed, means for releasing the second piston after the compression stage is complete and thus allowing the compressed air to expand and operate the breech mechanism, means for exhausting the compressed air when the second piston has completed its forward stroke, means for returning the second piston to its initial position, means for releasing the floating piston when the second piston has returned to its initial position, and means for returning the floating piston to its initial position.

9. In a firearm of the kind in which the breech mechanism is actuated by the gases generated by the explosive charge, the combination of a closed receiver for a column of air, a gas-chamber in communication with the interior of the barrel of said firearm, a movable wall separating said column of air from the interior of said gas-chamber, a second movable wall to said air-receiver, means for connecting the second movable wall to the breech mechanism of the firearm, a fixed detent or stop, means for introducing said detent or stop between the second movable wall and said column of air during the period of compression of said air, means for positively removing said detent or stop when the period of compression is complete, so as to permit the compressed air to actuate the second movable wall connected with the breech mechanism, means for locking the first movable wall when the compression of the air is complete, means for releasing the compressed air when the breech mechanism has been actuated, means for returning the second movable wall to its initial position, means for returning the fixed detent or stop to its initial position between the second movable wall and the column of air, means for releasing the first movable wall when the second movable wall has reached its initial position, and means for returning the first movable wall to its initial position.

HUGH WILLIAM GABBETT-FAIRFAX.

Signed in the presence of—

ROSALIE SHANKS,

EDWARD SIDNEY ROZETOR ADAMS.