

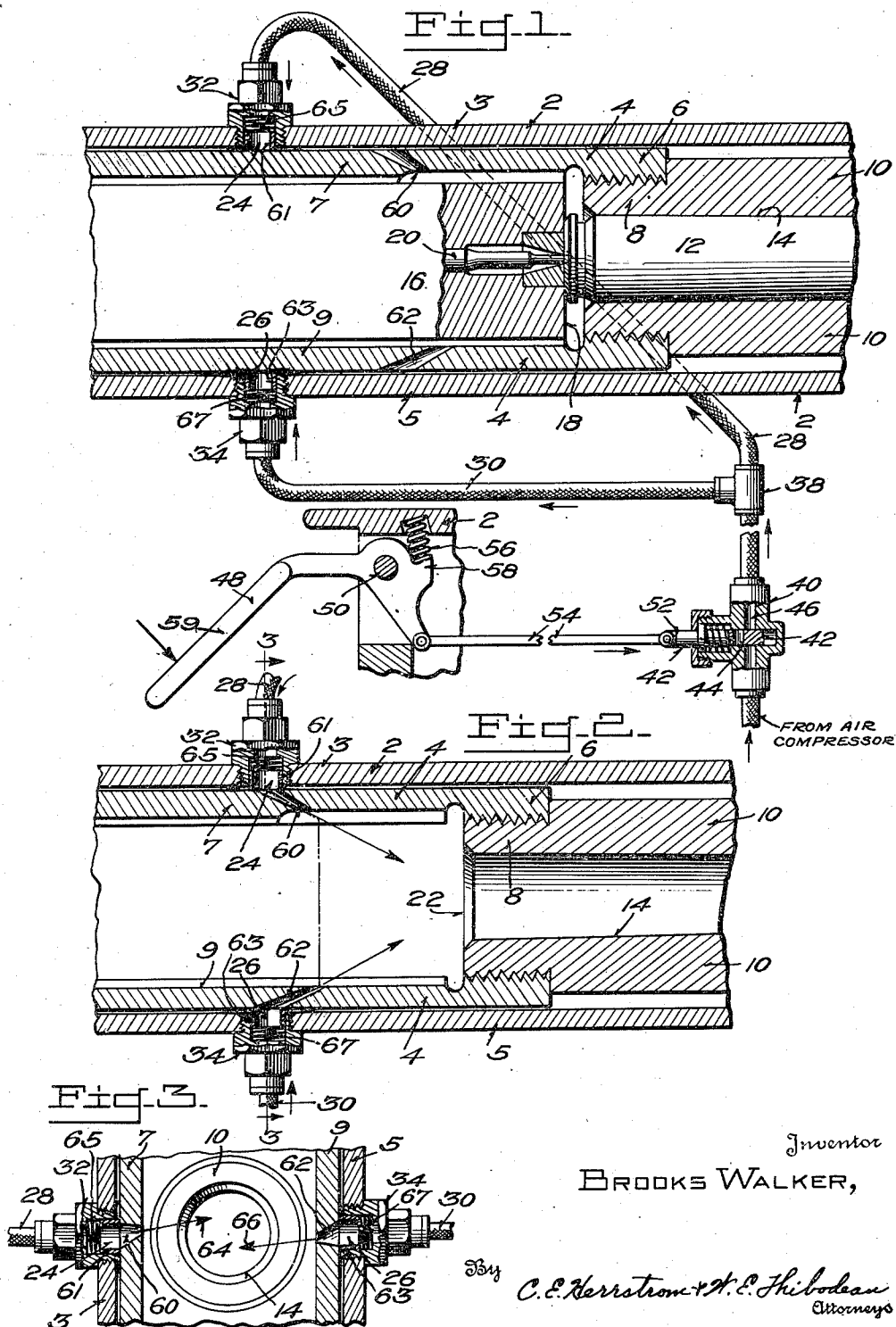
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AIR COOLED GUN

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## UNITED STATES PATENT OFFICE

2,427,374

## AIR-COOLED GUN

Brooks Walker, Piedmont, Calif.

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

My invention relates to improvements in automatic firearms, and its general object is to provide cooling means for such firearms whereby longer periods of sustained effective automatic fire may be maintained, without damage to the firearm, and particularly the barrel thereof, than can be obtained with automatic firearms employing the cooling means now in use, or in which no cooling means are employed.

A further object of my invention is to provide means of this character which may be utilized with the present standard automatic firearm, such for instance as the automatic firearm disclosed in the patent to John M. Browning, No. 1,628,226 or other similar type firearms having a recoiling breech mechanism wherein a valving action may be obtained in a port or orifice, or a combination thereof, in the side walls or casing or moving parts of the firearm by the action of such recoil mechanism in intermittently aligning such ports and orifices and/or intermittently blocking same, depending on the specific type of recoil mechanism employed by the firearm, by only slight alterations to the design of the present firearm, which alterations may be readily effected by any skilled mechanic with tools ordinarily available in any ordnance repair shop.

A still further object of my invention is to provide means of this character wherein a fluid cooling agent is employed and in which a stream or streams of the fluid are intermittently injected into the breech end of the bore of the barrel during that portion of the period of automatic fire in which the bore is unblocked by the recoil mechanism and while the bore is free of either a loaded or empty cartridge case, the intermittent injections resulting from a valving action caused by the recoil mechanism and in which the supply of the cooling agent may be controlled by movement of the trigger or other moving parts of the firearm.

It is generally well recognized in the art that sustained automatic firing or the firing of sustained bursts of shots in any automatic firearm will heat the barrel of the arm to such a temperature that the effectiveness of the fire is greatly reduced or stopped entirely and the barrel soon becomes unfit for further use. Excessively hot barrels cause trouble with ammunition resulting in "cook off" and also limits the use of high explosive bullets in machine guns when the round

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is left in the barrel at the end of a burst of fire. Furthermore, the effective functioning of the loading, extracting and ejecting mechanism is interfered with by this overheated barrel condition and various cooling devices, means and apparatus have been heretofore devised and proposed to cool the barrel or prevent overheating, but as far as applicant is aware, none of these have proved entirely satisfactory or are as simple as this design. Applicant's means and apparatus provides for the injection of a stream or streams of a cooling agent into the breech end of the bore of the barrel of the firearm from an outside source after each shot is fired and, therefore, tends to keep the bore clear of gas and minute particles created or caused by the functioning of cartridges, or carried into the bore by same, in addition to preventing overheating of the barrel and consequent mal-functioning. Another advantage is that the erosion caused by the burning gases is reduced. Cooling from the outside of the barrel involves too much time lag in transmitting heat from the bore surface to the cooled outer surface of the barrel.

The cost of altering the design of firearms now in use to permit utilization of applicant's invention will be negligible, while the cost of the additional equipment required and the installation thereof will be small compared with the benefits derived from the improved performance of the gun. While any suitable fluid may be employed as the cooling agent, it is contemplated that compressed air will be the preferred fluid, which may be supplied and replenished by power derived from the motors of airplanes, ships, armored cars, trucks, etc., when the firearm is positioned in such vehicles or ships. Where no suitable power source is available at the gun position for compressing air, suitable tanks or other containers of compressed air may obviously be employed, and when empty replaced by other tanks or containers, the empty tanks or containers being transported to a source of supply for refilling. Compressed air does not involve complications when operating at sub-freezing temperatures and also is lighter than liquids.

While the specific structure shown and described in this application is adapted for use with the standard Browning calibre .50 automatic firearm now in use, it will be obvious that same may be utilized in other automatic firearms, and may be employed to supplement the cooling of water cooled guns, if desired, wherein a water jacket surrounds all or a part of the barrel.

Slight modification of the structure shown

herein may be necessary when firearms other than the Browning guns are used, as in the Browning gun referred to, it is necessary to conduct the cooling agent through the casing of the firearm as well as the barrel extension of same before access can be had to the bore, and since the breech block is reciprocally mounted in the barrel extension and casing entry to the bore is blocked until the breech block recoils, and the orifice in the barrel extension through which the cooling agent passes is likewise blocked by the breech block until one phase of the recoil movement is completed. The barrel extension referred to is, therefore, an intermediate structure between the casing and the entrance to the bore of the barrel, and in firearms where no barrel extension is provided and where the recoil mechanism operates directly against the side walls of the casing, the opening or openings in the casing or side walls may be inwardly and forwardly inclined to inject a stream of fluid into the bore, as herein described in connection with the orifice in the barrel extension.

With the foregoing and other objects in view, as will hereinafter more fully appear and as will be more particularly pointed out in the appended claims, reference is now made to the accompanying drawings forming a part of this application, in which:

Figure 1 is a fragmentary longitudinal cross-sectional plan view of a portion of a machine gun embodying the invention, showing the cartridge still in the barrel and the breech-bolt at its forwardmost position,

Figure 2 shows the portion of the gun illustrated in Figure 1, the cartridge having been extracted from the barrel and the breech bolt retracted, and

Figure 3 is a transverse cross-sectional view taken along the line 3—3 of Figure 2.

As illustrated in Figure 1, there is a machine gun casing or housing 2, having side members 3 and 5, in which is slidably arranged a barrel extension 4 which is threadably secured at its forward end 6 to the rearward end 8 of a gun barrel 10. A cartridge case 12 is removably disposed within the rearward end 8 of the bore 14 of the barrel 10 in the usual manner. The barrel extension 4 has two side members 7 and 9 in the space between which is slidably arranged a breech-bolt 16, shown in the illustration in its forward position with its forward end 18 in contact with the rearward end of the cartridge 12. A firing pin 20 is carried by the bolt 16, for firing the cartridge 12.

When the cartridge is fired, the barrel 10, barrel extension 4 and breech-bolt 16, being locked together, recoil rearwardly for a short distance, as is well known in the art pertaining to the Browning machine guns, and then the bolt 16 is unlocked from the barrel and barrel extension, and the bolt continues its rearward motion, carrying with it the fired cartridge case, and thus exposing the rearward opening or breech end 22 of the barrel bore 14, as indicated in Figure 2.

It is proposed as a feature of the present invention, to cool the barrel bore 14 by introduction of a cooling medium during the interval when the breech bolt has been unlocked from the barrel and barrel extension and before the breech-bolt has again returned to its forward position.

For this purpose a pair of oppositely disposed openings or ports 24 and 26 are formed through side members 3 and 5 respectively of casing 2.

Hollow pipes or tubes 28 and 30 are connected

at one end to openings 24 and 26 respectively by means of any suitable tight coupling members 32 and 34. The other ends of pipes 28 and 30 are connected to a source of a cooling fluid such as an air compressor or air storage tank or container (not shown in the drawings), the pipes being connected together by a T coupling 38. A valve 40 of any usual design for quickly cutting off or turning on the air flow, is interposed in the air line between the coupling 38 and the source of air 36. The valve 40 is of a type that normally remains closed until it is actuated, and then closes again automatically when the actuating force ceases. Thus as illustrated, a plunger 42 is arranged inside the valve 40 so the bore 44 is normally out of alignment with the bore 46. A trigger 48, pivotally mounted on pivot 50, is coupled to the outer end 52 of plunger 42 by rod 54. A spring 56 disposed between the end of rearward gun housing 2 and a projection 58 of the trigger 48, serves to keep the trigger 48 in closed position. As the trigger 48 is depressed in the direction of the arrow 59, the bore 44 in the plunger 42 is aligned with the bore 46, allowing the cooling fluid to pass through the pipes 28 and 30, and the flow ceases upon release of the trigger 48, which takes bore 44 out of alignment with bore 46.

In the construction shown, the trigger 48 may be identical with the usual heavy machine gun trigger if desired, so that the cooling fluid is free to pass up to and into the openings 24 and 26 while the gun trigger is depressed for firing the gun. In order to permit the cooling fluid to flow against and into the rearward or breech end of the bore 14 of the barrel 10, a pair of nozzle shaped openings or orifices 60 and 62, inclined forwardly toward the bore 14 are formed through the side members 7 and 9 respectively, of barrel extension 4. In order to minimize leakage of air through the space between the inner surfaces of side members 3 and 5 of the housing, and side members 7 and 9 of the barrel extension, two hollow cylindrical members 64 and 66 are slidably located within the couplings 32 and 34 respectively as indicated. These members have one end in constant contact with the outer abutting surface of side members 7 and 9 respectively, being pressed toward said abutting surfaces by coil springs 68 and 70 also located within couplings 32 and 34 as shown. All piping, couplings and valves have inside diameters greater than that of the orifices. As seen in Figure 1, the barrel extension 4 and the bolt 16 and barrel 10 have not yet commenced their rearward travel in recoil—hence the cooling fluid in the openings 24 and 26 cannot flow against the rearward end of the bore 14. But when the firing pin 20 fires the cartridge 12, recoil begins, and the breech bolt and cartridge, the barrel extension and the barrel, move rearwardly to a position indicated in Figure 2 at which the openings 60 and 62 are aligned, at one end with the openings 24 and 26, allowing the cooling medium to flow into the openings 60 and 62. The barrel and barrel extension cease their rearward movement at this location, while the breech bolt 16, carrying the cartridge case 14, continues its rearward motion, leaving vacant the space between the side members 7 and 9 of the barrel extension, and the cooling medium, now unrestrained, flows into this space and against and into the rearward or breech end of the barrel bore 14, cooling same, and blowing out of it any particles of dust and unburned powder or residue and hot unburned gases remaining

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therein, which are important contributors to overheating of the gun barrel.

As the bolt 16 moves forwardly in counter-recoil and is locked to the barrel and barrel extension, the moving parts then resume the respective locations indicated in Figure 1, and the flow of cooling fluid against the rear end of the barrel bore is cut off.

The above cycle is repeated as long as the gun is firing, and serves to cool the gun barrel as indicated.

As shown in Figure 3, the nozzles 60 and 62 may be so angularly disposed as to cause the cooling fluid to flow in the direction of the arrows 64 and 66, thus also giving it a rotary motion conforming to the cylindrical interior of the barrel bore, resulting in a better washing of the barrel and thermal heat transfer from the barrel to the air. This will greatly reduce the quantity of unburned gases coming back into tanks, particularly in a head wind.

While the invention is described above in specific terms, it is to be understood that various changes may be made in the size, shape, arrangement and materials without departing from the spirit and scope of the invention.

I claim:

1. In an automatic firearm, a breech casing having side walls with a port formed therein and adapted to be connected to a supply of cooling agent, a barrel having a bore, a barrel extension on said barrel supported and guided for longitudinal movement in said casing, said barrel extension having therein an orifice, said orifice having the axis thereof intersecting the bore of the barrel and moving into and out of alignment with said port upon the reciprocal longitudinal movement of said barrel extension, whereby a cooling agent is injected into the bore of said barrel when said port and said orifice are in aligned position.

2. In an automatic firearm, a breech casing having side walls with a port formed therein and adapted to be connected to a supply of cooling agent, a barrel having a bore, a barrel extension on said barrel supported and guided for longitudinal movement in said casing, said barrel extension having therein an orifice, said orifice having the axis thereof intersecting the bore of the barrel and moving into and out of alignment with said port upon the reciprocal longitudinal movement of said barrel extension, means conducting a cooling agent to said port and means controlling the flow of the cooling agent through said last named means.

3. In an automatic firearm, a breech casing having side walls with a port therein and adapted to be connected to a supply of cooling agent, a barrel having a bore, a barrel extension on said barrel supported and guided for longitudinal movement in said casing, said barrel extension having therein an orifice, said orifice having the axis thereof intersecting the bore of the barrel and moving into and out of alignment with said port upon the reciprocal longitudinal movement of said barrel extension, a conduit conducting a cooling agent to said port, a valve in said conduit and means connected to said valve for opening and closing the same.

4. In an automatic firearm, a breech casing having side walls with a plurality of ports therein, a barrel having a bore, a barrel extension on said barrel supported and guided for longitudinal movement in said casing, said barrel extension having therein a plurality of orifices having the respective axes thereof intersecting the bore

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of the barrel, said orifices moving into and out of alignment with said ports upon the reciprocal longitudinal movement of said barrel extension, whereby a cooling agent is intermittently injected into the bore of said barrel when said ports and said orifices are in aligned position.

5. In an automatic firearm, the combination of a breech casing having side walls, a barrel having a bore, a barrel extension on said barrel supported and guided for longitudinal movement in said casing, means forming a port in said casing, said barrel extension having an orifice constructed and arranged to intermittently align with said port, said orifice having axis thereof intersecting the bore of the barrel, a cooling agent and means for injecting same into the bore of said barrel when said port and said orifice are in aligned position.

6. In an automatic firearm, the combination of a breech casing having side walls, a barrel having a bore, a barrel extension on said barrel supported and guided for longitudinal movement in said casing, means forming a port in said casing, said barrel extension having an orifice formed therein with its axis intercepting the breech entrance to the bore of said barrel, said orifice being constructed and arranged to intermittently align with said port during automatic fire of said firearm, a cooling agent and means for injecting same into said bore through said orifice.

7. In an automatic firearm, the combination of a breech casing having side walls, a barrel having a bore, a barrel extension on said barrel supported and guided for limited longitudinal reciprocal movement in said casing, a breech block supported and guided for a greater limited longitudinal reciprocal movement than said barrel extension, means forming a port in said casing, said barrel extension having an orifice therein with its axis intercepting the breech end of the bore of said barrel, said orifice being constructed and arranged to intermittently align with said port during the period in said movement in which the barrel extension and breech bolt are in their respective rearwardmost positions, a cooling agent and means for injecting same through said port and said orifice into the bore of said barrel.

8. In an automatic firearm, the combination of a breech casing having side walls, a barrel having a bore, a barrel extension on said barrel supported and guided for limited longitudinal reciprocal movement in said casing, a breech block supported and guided for a greater limited longitudinal reciprocal movement than said barrel extension, means forming a port in said casing, said barrel extension having an orifice therein with its axis intersecting the breech end of the bore of said barrel, said orifice being constructed and arranged to intermittently align with said port during the period in said movement in which the barrel extension and breech bolt are in their respective substantially rearwardmost positions, a conduit conducting a cooling agent to said port, and a valve operatively connected to said firearm for controlling the flow of the agent to said port.

9. In an automatic firearm, the combination of a breech casing having side walls, a barrel having a bore, a barrel extension on the barrel supported and guided for limited longitudinal reciprocal movement in said casing, a breech block supported and guided by said barrel extension and said casing for a greater limited longitudinal reciprocal movement than said barrel, means forming a plurality of ports in said casing, said barrel extension having a plurality of orifices therein

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with their axes intercepting the breech end of the bore of said barrel, said orifices being constructed and arranged to intermittently align with said ports during the period in said movement in which the barrel extension and breech bolt are substantially in their respective rearwardmost positions, cooling agent and means conducting the same to said ports whereby the cooling agent is ejected through said ports and said orifices into the bore of said barrel.

10. In an automatic firearm, the combination of a breech casing having side walls, a barrel having a bore, a barrel extension on said barrel supported and guided for limited longitudinal reciprocal movement in said casing, a breech block supported and guided by said barrel extension for a greater limited longitudinal reciprocal movement than said barrel extension, means forming a plurality of ports in said casing, said barrel extension having a plurality of orifices therein with their axes intercepting the breech end of the bore of said barrel, said orifices being constructed and arranged to intermittently align with said ports during the period in said movement in which the barrel extension and breech bolt are in substantially their respective rearwardmost positions, a conduit conducting a cooling agent to said ports, and a valve operatively connected to said firearm for controlling the flow of the agent to said ports.

11. In an automatic firearm, the combination of a breech casing having side walls, a barrel having a bore, a barrel extension on said barrel supported and guided for longitudinal movement in said casing, means forming a plurality of ports in said casing, said barrel extension having therein a plurality of orifices constructed and arranged to intermittently align with said ports, said orifices having the respective axes thereof intersecting the bore of the barrel, a cooling agent and means conducting the same to said ports, whereby the cooling agent is injected into the bore of said barrel when said ports and said orifices are in aligned position.

12. In an automatic firearm, the combination of a breech casing having side walls, a barrel having a bore, a barrel extension on the barrel supported and guided for longitudinal movement in said casing, with a plurality of ports in said casing, said barrel extension having a plurality of orifices therein with their axes intercepting the breech entrance to the bore of said barrel, said orifices being constructed and arranged to intermittently align with said ports during automatic fire of said firearm, a cooling agent and means for feeding same into said ports.

13. In an automatic firearm, a breech casing having oppositely disposed side walls, a barrel having a bore, a barrel extension on the barrel supported and guided for longitudinal, reciprocal movement in said casing between said walls, said walls having a port therein, said barrel extension having an orifice therein with its axis intercepting the breech entrance of the bore of said barrel, said orifice being constructed and arranged to align with said port upon rearwardmost movement of said barrel extension.

14. In an automatic firearm, a trigger therein for initiating operation thereof, a breech casing having oppositely disposed side walls, a barrel and a barrel extension supported and guided for longitudinal, reciprocal movement in said casing between said walls, said walls having a port therein, said barrel extension having an orifice therein with its axis intercepting the breech entrance of the bore of said barrel, said orifice being con-

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structed and arranged to align with said port upon rearwardmost movement of said barrel extension, a conduit connected to said port for conducting thereto a cooling agent and a valve in said conduit operatively connected to the trigger of said firearm, whereby said valve is opened and closed by the movement of said trigger.

15. In an automatic firearm, a breech casing having oppositely disposed side walls, a barrel and barrel extension supported and guided for longitudinal reciprocal movement in said casing between said walls, said walls having a port therein, said barrel extension having an orifice therein with its axis intercepting the breech entrance of the bore of said barrel, said orifice being constructed and arranged to align with said port upon rearwardmost movement of said barrel extension, the forward movement of said extension blocking said port, whereby a cooling agent is intermittently injected through said port and said orifice into the bore of said barrel.

16. In an automatic firearm, a trigger therein for initiating operation thereof, a breech casing having oppositely disposed side walls, a barrel and barrel extension supported and guided for longitudinal reciprocal movement in said casing between said walls, said walls having a port therein, said barrel extension having an orifice therein with its axis intercepting the breech entrance of the bore of said barrel, said orifice being constructed and arranged to align with said port upon rearwardmost movement of said barrel extension, the forward movement of said extension blocking said port, a cooling agent, a conduit for conducting said agent to said port, and a valve in said conduit operatively connected to the trigger of said firearm, whereby said valve is opened and closed by the movement of said trigger.

17. In an automatic firearm, the combination of a casing, a barrel having a barrel extension flanking the breech end of said barrel and supported and guided for limited reciprocal longitudinal movement in said casing, a breech block supported and guided for a greater reciprocal, longitudinal movement than said barrel extension, means forming a plurality of ports in said casing, said barrel extension having a plurality of orifices therein having their axes intercepting the breech entrance to the bore of said barrel, said orifices being constructed and arranged to intermittently align with said ports upon reciprocal movement of said barrel extension, whereby a cooling agent is injected into the breech end of the bore of said barrel when said breech block and barrel extension are substantially at the limit of their respective rearward movements.

18. In an automatic firearm, the combination of a casing having side walls, a barrel having a barrel extension comprising spaced walls connected and extending rearwardly from the breech end of said barrel parallel with the casing side walls and supported and guided for reciprocal longitudinal movement therebetween, means forming ports in said side walls and orifices in said spaced walls with their axes intercepting the entrance to the breech end of the bore of said barrel, constructed and arranged whereby said ports and said orifices intermittently align upon reciprocal movement of said barrel and barrel extension.

19. In an automatic firearm, the combination of a casing having side walls, a barrel and barrel extension supported and guided for reciprocal longitudinal movement in said casing, and a breech block supported and guided for a greater

reciprocal longitudinal movement than said barrel extension, said breech block blocking the entrance to the breech end of the bore of said barrel when in firing position and constructed and arranged to recoil for a limited distance with said barrel and barrel extension and to continue its recoil movement when the barrel and barrel extension reach their recoil limit thereby unblocking the bore of said barrel, with a port in said casing, said barrel extension having an orifice constructed and arranged to align with said port when said barrel extension reaches its recoil limit.

20. In an automatic firearm, the combination of a casing having side walls, a barrel having a bore, a barrel extension on the barrel supported and guided for reciprocal longitudinal movement in said casing, a breech block supported and guided for a greater reciprocal longitudinal movement than said barrel by said barrel extension and said casing, said breech block blocking the entrance to the breech end of the bore of said barrel when in firing position and constructed and arranged to recoil for a limited distance with said barrel and barrel extension and to continue its recoil movement when the barrel and barrel extension reach their recoil limit, thereby unblocking the bore of said barrel, means forming a port in said casing, said barrel extension having an orifice constructed and arranged to align with said port when said barrel extension reaches its recoil limit, means conducting a cooling agent to said port and manually operable means controlling the flow of the agent to said port.

21. In an automatic firearm, a casing having side walls, a barrel having a bore, a barrel extension on the barrel supported and guided for reciprocal movement in said casing, a breech block supported and guided for reciprocal movement by said barrel extension and said casing, said barrel, barrel extension and breech block being interconnected for simultaneous travel together during the beginning and ending of a reciprocal movement cycle, said barrel and barrel extension stopping their movement and remaining stationary upon completion of the rearward half of their movement cycle, while said breech block separates from said barrel and continues its rearward movement to complete the rearward half of its movement cycle, said breech block reengaging said barrel on its return movement, means forming a port in said side walls, said barrel extension having an orifice therein, said orifice moving into and out of alignment with said port upon reciprocal movement cycle of said barrel extension, said breech block blocking said orifice during engagement of said breech block with said barrel, and unblocking same during a substantial portion of that part of the movement cycle of said breech block in which the barrel is disengaged therefrom.

22. In an automatic firearm, a casing having side walls, a barrel having a bore, a barrel extension on said barrel supported and guided for reciprocal movement in said casing, and a breech block supported and guided for reciprocal movement by said barrel extension and said casing, said barrel, barrel extension and breech block being interconnected for simultaneous travel together during the beginning and ending of a reciprocal movement cycle, said barrel and barrel extension stopping their movement and remaining stationary upon completion of the rearward half of their movement cycle, while said breech

block separates from said barrel and continues its rearward movement to complete the rearward half of its movement cycle, said breech block reengaging said barrel on its return movement, said side walls having a port therein, said barrel extension having therein an orifice having the respective axes thereof intersecting the bore of the barrel, said orifice moving into and out of alignment with said port upon reciprocal movement cycle of said barrel extension, and said breech block blocking said orifice during engagement of said breech block with said barrel, and unblocking same during a substantial portion of that part of the movement cycle of said breech block in which the barrel is disengaged therefrom, whereby a cooling agent may be injected into the bore of said barrel through said port and said orifice when in aligned position and when said breech block has unblocked said orifice.

23. In an automatic firearm, a casing having side walls, a barrel and barrel extension supported and guided for reciprocal movement in said casing, a breech block supported and guided for reciprocal movement by said barrel extension and said casing, said side walls having a port therein, said barrel extension having an orifice therein constructed and arranged to intermittently align with said port upon reciprocal movement of said barrel extension, whereby a valving action of said port is effected, and said breech block intermittently blocking and unblocking said orifice, whereby a valving action on said orifice is effected.

24. In an automatic firearm, a casing having side walls, a barrel and barrel extension supported and guided for reciprocal movement in said casing, a breech block supported and guided for reciprocal movement by said barrel extension and said casing, said side walls having a plurality of ports therein, said barrel extension having a plurality of orifices therein, the reciprocal movement of said barrel extension intermittently blocking said port and intermittently aligning said orifices with said ports, whereby a cooling agent may be intermittently injected through said ports and said orifices, and said breech block intermittently blocking said orifices in its reciprocal movement, whereby a valving action of said orifices is effected.

25. In an automatic firearm, a casing having side walls, a barrel supported by said casing, a member slidably mounted between said side walls and actuated by firing pressure within said firearm, said side wall having a plurality of ports formed through it, said ports being valved by the motion of said slidably mounted member to cause said ports to be opened for a predetermined interval of time during sliding movement of said member, said ports being symmetrically arranged about said slidably mounted member whereby the side thrust on said slidably mounted member by the fluid pressure in said ports is substantially equalized.

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#### REFERENCES CITED

The following references are of record in the file of this patent:

#### UNITED STATES PATENTS

Number	Name	Date
1,351,017	Blackmore	Aug. 31, 1920
543,567	Browning	July 30, 1895