M. J. TRUMBLE.

GUN.

APPLICATION FILED JAN. 12, 1920.

1,359,295. **Patented Nov. 16, 1920.**

Fig. 1.

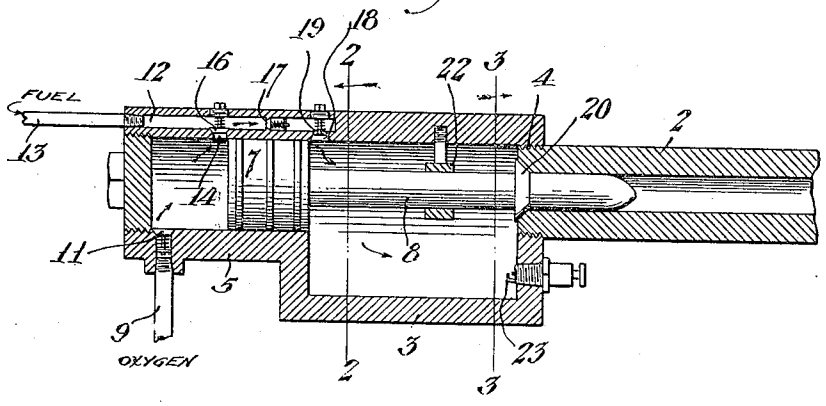


Fig. 2.

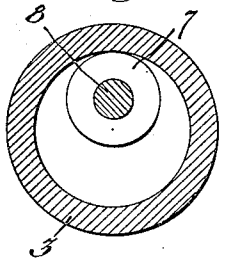
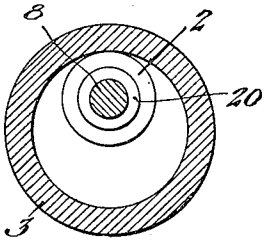


Fig. 3.



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UNITED STATES PATENT OFFICE.

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GUN.

1,359,295. Specification of Letters Patent. Patented Nov. 16, 1920.

Application filed January 12, 1920. Serial No. 351,040.

To all whom it may concern:

Be it known that I, MILON JAMES TRUMBLE, a citizen of the United States, residing at Alhambra, in the county of Los Angeles and State of California, have invented a new and useful Improvement in Guns, of which the following is a specification.

This invention relates to improvements in guns of that type in which the projectile is expelled by the explosive force due to the ignition of a combustible mixture, such, for example, as a hydrocarbon mixed with a suitable proportion of pure oxygen. The ingredients of the combustible mixture are not of the essence of this invention, and the improvements relate to means for controlling the admission of the exploded mixture to the gun barrel from a combustion chamber.

Broadly considered, the invention comprises a combustion chamber in communication with the barrel of the gun, and means for closing such communication prior to firing the projectile, and for opening such communication at the moment of discharge so as to admit the burnt and burning gases immediately to the barrel containing the projectile to eject the same. In its preferred form the controlling means referred to comprises a valve which is normally held seated by the pressure of a gas, and is opened by the force of the expanding gases at the instant that the combustible charge is ignited, the opening of the valve admitting such charge to the gun barrel.

The invention will be best understood from the following detailed description, when considered in connection with the accompanying drawings, in which:

Figure 1 is a sectional view illustrating the preferred form of my invention;

Fig. 2 is a transverse section on the line 2—2, Fig. 1, and

Fig. 3 is a transverse section on the line 3—3, Fig. 1.

The invention to be described hereinafter is applicable, not only to fire arms of small size, but equally to ordnance, and in fact to any size gun, and for the ejection of any type of projectile from such gun. As herein illustrated, a gun barrel 2 is suitably connected, as by threads 4, to a combustion chamber 3 of any suitable design, and of sufficient capacity to contain the desired quantity of a combustible charge which, when ignited, is admitted to the barrel 2 to eject a projectile therein. The projectile may be inserted in the barrel in any approved manner.

Connected with the combustion chamber 3 is a cylindrical chamber 5 of smaller diameter than the combustion chamber. The chamber 5 is bored to constitute a cylinder, and as shown said cylinder is arranged eccentrically with reference to the circumference of the combustion chamber 3, although such arrangement is not essential to my invention. A pipe or conduit 9 which is arranged for communication with a source of oxygen under high pressure, or with atmospheric air, or other suitable gas, is connected with the cylinder 5, and a check valve 11 is located in the pipe 9 and opens toward the cylinder. The upper portion of the cylinder 5 is shown as provided with a passageway 12 to which is connected a pipe 13 for supplying a suitable fuel to be combined with the oxygen, or other gas supplied by the pipe 9, said fuel and gas forming a combustible mixture. The interior of the cylinder 5 communicates with the passage 12 by an opening 14, which is closed by a spring-seated check valve 16, and an opening 18 leads from the passage 12 to the interior of the combustion chamber 3, said opening being closed by an inwardly opening spring-actuated check valve 19. Between the check valves 16 and 19, I preferably locate a check valve 17 which opens toward the combustion chamber, and serves as an additional means to that afforded by the valve 19 for preventing the escape of the gases of explosion from the combustion chamber rearwardly into the fuel passage.

A piston 7, having the usual gas-tight piston rings, is arranged in the cylinder 5 for reciprocation, said piston having a stem 8 which extends from the forward end of the piston through the combustion chamber 3, and has at its outer end a valve 20 which seats upon the gun barrel 2 and closes communication between the combustion chamber 3 and the gun barrel 2. In order to guide the valve truly to its seat suitable guiding means, as a ring 22, is provided for the stem 8, said ring being herein shown with a stem which is threaded in a socket in the wall of the combustion chamber.

The combustible charge in the chamber 3 is ignited through any suitable igniting de-

vice, as for example, a spark gap 23, within the chamber, whose terminals may be suitably connected with electrical conductors. Any desired means for completing a circuit through the terminals 23 may be employed, as is obvious.

In the operation of my gun, the pipe 13 is connected with a suitable source of fuel, such as gasolene, distillate, acetylene, and the pipe 9 is in communication with a source of pure oxygen, or other gas which when combined with the fuel will produce a combustible mixture, and suitable valves are employed to control the flow of the fuel and the oxygen. When the parts are as shown in Fig. 1 of the drawings the valve 20 is closed upon the end of the barrel 2, and the piston 7 is at the forward end of its travel in the cylinder 5, leaving a space to the rear of the piston. Upon opening the valve of the pipe 9 oxygen under high pressure is admitted to the space behind the piston, and flows thence through the opening 14 into the passage 12 where it mingles with the hydrocarbon or other fuel which is admitted to the passage 12 from a suitable source. The combustible mixture flows through the several check valves, 16, 17 and 19 into the combustion chamber 3 which is filled with such mixture under a high pressure, the amount of such pressure being dependent upon the force desired when the mixture is ignited.

Inasmuch as the rear face of the piston 7 is larger in area than the front face of the piston because of the presence of the stem 8, the valve 20 will be held seated against the rear end of the gun barrel by the force due to this differential pressure. The closure of the valve 20 upon the end of the gun barrel isolates the combustion chamber from the interior of the barrel, previous to the firing of the charge. After the combustible mixture has been admitted to the interior of the chamber 3, the circuit through the igniter 23 will be completed by the desired switch, and the charge will be exploded, the enormous pressure created in the explosion chamber 3 will then force the piston 7 rearwardly, opening the valve 20 and admitting the burnt gases to the interior of the gun barrel for ejecting the projectile therefrom. As soon as the piston 7 travels rearwardly a short distance it will cover the port 14 and cushion the gases back of the piston, thereby checking the rearward movement of the piston until the gases of combustion have fully acted upon the projectile. As soon as the pressure in front of the piston has been sufficiently diminished by the escape of the charge, the compressed gas to the rear of the piston will react upon the latter and instantly force the valve 20 to its seat, thus again closing communication between the combustion chamber and the gun barrel, and reëstablishing the condition of the parts as they were previous to the beginning of the above described operation.

The operation of the controlling means for the gases is so rapid and certain, that the gun may be fired with great rapidity. In each instance, it is only necessary to open the fuel and oxygen passages to admit a charge to the cylinder and combustion chamber, and then actuate the switch for igniting the charge to eject the projectile. Suitable mechanism may be provided for causing these operations to take place very quickly, it being of course understood that any approved means is provided for inserting a projectile previous to firing each charge.

For the purpose of effectually scavenging the combustion chamber, in the event that the burnt gases do not escape with sufficient freedon therefrom, I may connect the combustion chamber with a suitable source of water supply and flush the same out when desired. The arrangement of devices for accomplishing this result would suggest itself to any skilled mechanic and such arrangement is not a part of the present invention. This invention is susceptible of wide uses, among which may be mentioned its adaptability to guns mounted on submarine boats, where the closure between the combustion chamber and barrel renders it possible to submerge the gun with perfect safety, after each discharge, and the gun will be in condition for immediate use following a submergence.

The invention is not limited to the particular arrangement of parts, or details of construction herein illustrated by way of example only, and it is understood that variations may be made in the form, construction, or arrangement of the parts without departing from the spirit of the invention.

I claim as my invention:—

1. In a gun, a barrel, a combustion chamber, a pressure-actuated valve for closing communication between said parts, and means associated with said valve to hold it closed when an explosive gas is admitted to the chamber arranged to open the valve when said gas is ignited, and means for igniting the gas.

2. In a gun, a barrel, a combustion chamber communicating therewith, pressure-actuated means for closing communication between said parts, means for admitting a combustible charge to the chamber, and means for igniting the charge thereby causing said pressure-actuated means to open and establish communication between said chamber and barrel.

3. In a gun, a barrel, a combustion chamber communicating therewith, a valve for controlling such communication, a piston connected with said valve, a cylinder therefor, means to admit gas to said cylinder for holding the valve closed prior to firing,

means to admit a combustible charge to said chamber, and means for igniting the charge to cause the piston to open said valve.

4. In a gun, a barrel, a combustion chamber communicating therewith, a valve for controlling such communication, a piston connected with said valve, a cylinder therefor, means to admit gas to one side of said piston for holding the valve closed prior to firing, means to admit a combustible charge to said chamber upon the opposite side of the piston, and means for igniting the charge to cause the piston to open said valve.

5. In a gun, a barrel, a combustion chamber communicating therewith, a valve for controlling such communication having a piston having different sized areas, a cylinder therefor, means to admit gas to that side of the piston having the larger area to hold the valve closed, means to admit a combustible charge to the opposite side of the piston, and means to ignite the charge thereby causing the valve to open and permitting the explosive charge to enter the barrel and eject a projectile.

6. In a gun, a barrel, a combustion chamber communicating therewith, a piston-actuated valve for controlling such communication, means to admit gas under pressure to the piston for holding the valve closed, means to admit a combustible charge and means for creating a superior pressure by igniting said combustible charge to open the valve and admit said charge to the barrel.

7. In a gun, a barrel, a combustion chamber communicating therewith, a piston-actuated valve for controlling such communication, means to admit gas under pressure to the piston for holding the valve closed, means to combine a portion of said gas with fuel to form a combustible charge and to admit the charge to the combustion chamber, and means to ignite the charge to create gases of combustion to open the valve and fire a projectile from the barrel.

8. In a gun, the combination with a barrel, of a combustion chamber communicating therewith, a cylinder connected with said chamber, a piston therein having differential areas and a valve connected thereto, means for admitting gas to the cylinder for acting upon the larger area to hold the valve closed, a by-pass for admitting a combustible charge to said chamber to act upon the smaller area of the piston, and means to ignite the charge and force the piston rearwardly to open the valve, the piston closing the by-pass and being cushioned on the gas in the cylinder.

9. In a gun the combination with a barrel, of a combustion chamber communicating therewith, a cylinder connected with said chamber, a differential piston therein connected by a stem with a valve, said valve controlling communication between said barrel and chamber, means for admitting gas to the cylinder for acting upon the larger piston area to hold the valve closed, a by-pass for admitting a combustible charge to said chamber to act upon the smaller area of the piston, and means to ignite the charge within said chamber to thereby force the piston rearwardly to open the valve, the piston closing the by-pass and being cushioned on the gas in the cylinder.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 3rd day of January, 1920.

MILON JAMES TRUMBLE.