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F. T. MOORE

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GAS OPERATED AUTOMATIC FIREARM

Filed Dec. 3, 1928

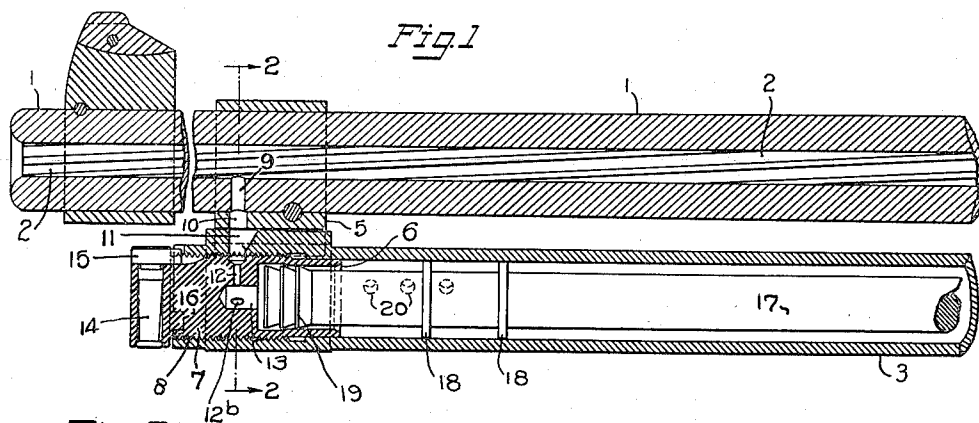


Fig. 2

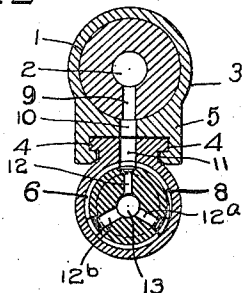


Fig. 4

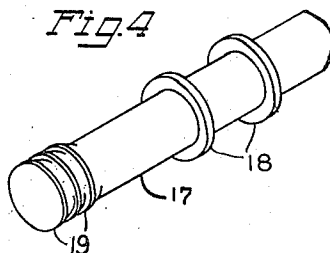
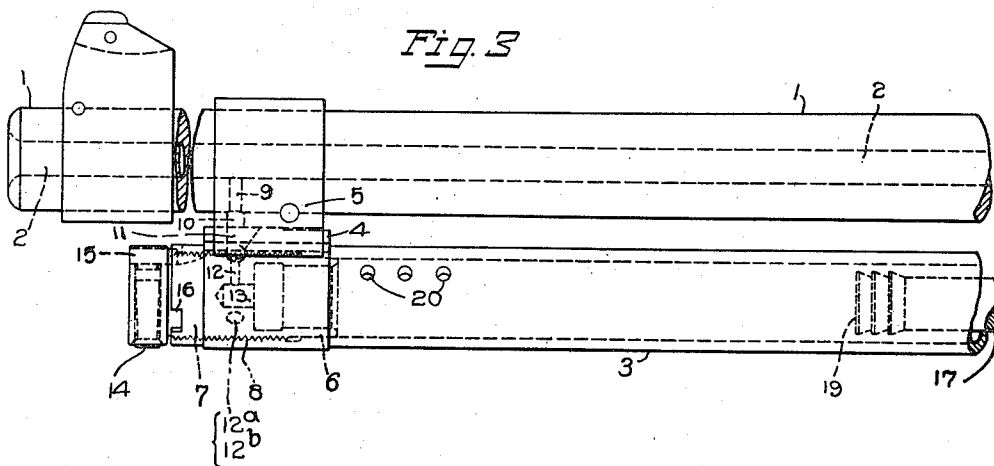


Fig. 3



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UNITED STATES PATENT OFFICE

FREDERICK T. MOORE, OF EAST HARTFORD, CONNECTICUT, ASSIGNOR TO COLT'S PATENT FIRE ARMS MANUFACTURING CO., OF HARTFORD, CONNECTICUT, A CORPORATION

GAS-OPERATED AUTOMATIC FIREARM

Application filed December 3, 1928. Serial No. 323,368.

1 This invention relates to an automatic firearm of the class wherein the mechanism of the arm is operated by means of a portion of the gases of explosion which is allowed to
5 escape from the barrel and act against a movable piston. The invention is particularly applicable to a firearm constructed as shown in detail in Patent No. 1,293,022 issued February 4, 1919, to J. M. Browning.

10 The general object of the present invention is to provide a firearm of the class described having provision for obtaining increased reliability when the arm is fired repeatedly and continuously throughout an
15 extended period. The said object of the invention is attained by providing an improved construction for the gas cylinder or for the piston or for both as will be explained in detail.

20 In the accompanying drawing I have shown the embodiment of the invention which I now deem preferable but it will be understood that the drawing is intended for illustrative purposes only and is not to be construed as defining or limiting the scope of the
25 invention the claims forming a part of this specification being relied upon for that purpose.

Of the drawing:

30 Fig. 1 is a fragmentary longitudinal vertical sectional view of the forward part of a firearm embodying the invention.

Fig. 2 is a transverse sectional view taken along the line 2—2 of Fig. 1.

35 Fig. 3 is a view similar to Fig. 1 but showing the piston in another position.

Fig. 4 is a fragmentary perspective view of the front end portion of the piston.

Referring to the drawing, 1 represents the
40 barrel of the gun having the usual longitudinal bore at 2. 3 represents the gas tube, this tube being parallel with the barrel and being rigidly connected therewith. As shown the tube 3 is formed with flanges 4, 4 thereon
45 adapted to enter a T-slot in the bottom of a bracket 5 secured to the barrel.

50 A gas cylinder 6 is provided which is closed at one end, ordinarily the forward end, as indicated at 7, the other end being open and in register with the end of the tube 3. As

shown the major portion of the cylinder 6 is located within the tube 3 being held in place by means of screw threads at 8.

In order that a portion of the gases of explosion may be admitted to the interior of the cylinder 6 and the tube 3 there are provided
55 registering holes 9, 10, 11 and 12, the hole 9 being in the barrel 1, the hole 10 being in the bracket 5, the hole 11 being in the tube 3, and the hole 12 being in the gas cylinder 6. The
60 gas cylinder 6 also has an additional longitudinal hole 13 with which the hole 12 communicates. It will be seen that by means of this series of holes some of the gases of explosion can pass from the bore of the barrel
65 directly into the gas cylinder and into the tube.

Preferably the gas cylinder has not only the radial hole 12 but also other radial holes
70 such as 12^a and 12^b all communicating with the longitudinal hole 13. These holes 12, 12^a, 12^b, etc., are of different diameters and by turning the gas cylinder on its threads any
75 one of the holes can be brought into register with the hole 11 in the tube. Thus the size of the passage from the barrel to the gas cylinder can be adjusted to regulate the rate of
80 flow of the gas. The gas cylinder 6 can be locked in position with any one of the radial holes in register with the hole 11 by means of a movable transversely extending lock pin 14
85 having a head 15 adapted to enter any one of several notches 16 in the end of the tube 3.

Longitudinally movable within the tube 3
85 is a piston 17, this piston being operatively connected at its forward end with the mechanism of the gun. The gun mechanism and the connections between the mechanism and the piston are not herein shown as they constitute no part of the present invention and
90 are fully disclosed in the patent referred to. The body portion of the piston 17 is of considerably less diameter than the diameter of either the gas tube or the cylinder, and the
95 piston is provided with one or more annular ribs 18, 18 adapted to fit or substantially fit the interior of the gas tube and with one or more annular ribs 19, 19 adapted to fit or substantially fit the interior of the gas cylinder 6.
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Fig. 1 shows the piston in the position which it occupies at the instant of firing. As soon as the bullet passes the hole 9 in the barrel some of the gases of explosion enter the gas cylinder in the manner already described thus forcing the piston 17 toward the rear to the position shown in Fig. 3. Holes 20, 20 may be provided in the tube 3 to permit the escape of the gases. The piston in moving rearward operates the mechanism of the gun, as described in detail in the aforesaid patent, extracting and ejecting the shell of the cartridge which has been fired and permitting a new cartridge to come into position ready to be forced into the firing chamber of the barrel. As soon as the piston reaches the rear position as shown in Fig. 3 it and also the connected parts of the gun mechanism are instantly returned to their normal forward position by means of the reaction spring of the gun. As the piston moves forward the cartridge is inserted into the firing chamber of the barrel and is fired at or about the time that the piston reaches the normal position shown in Fig. 1. This action is repeated automatically until all of the cartridges in the magazine have been fired. Then the gunner must replace the empty magazine with a full one and must manually cock the gun to permit the firing of the first cartridge.

The construction as thus far described is substantially that disclosed in the above mentioned patent, and rifles embodying this construction have been manufactured in large quantities and have been used to a large extent in actual service. It has been found, however, that when attempts are made to use the rifle continuously for extended periods there is sometimes in firing a tendency for the forward portion of the piston to stick or "freeze" in the gas cylinder 6 thus rendering the firearm temporarily inoperative. I have discovered that this sticking tendency is due in part to the accumulation of a film or layer on the interior surface of the gas piston, this film or layer being made up of various products of the explosion and including metallic particles abraded from the bullets. This film is very hard and it tends to reduce the effective diameter of the cylinder and to thus cause the piston to stick. The sticking tendency is further due in part to the expansive action of the parts, particularly the piston, under the extreme heat which is developed when the firearm is operated continuously. It has been found by test that this temperature at the gas cylinder may be as high as 1400° Fahrenheit.

The tendency of the piston to stick in the gas cylinder may be offset to a large extent by care on the part of the operator in always manually cocking the gun and thus withdrawing the piston to the rear position as

shown in Fig. 3 immediately upon the conclusion of the firing of each round of ammunition, that is, upon the conclusion of the firing of the cartridges contained in the magazine. With the piston withdrawn during the interval when one magazine is being removed and another one put in place there is increased opportunity for the parts to cool slightly and there is also an avoidance of actual contact between the two parts which tend to adhere, that is, the piston and the gas cylinder. It has been found, however, that many gunners fail to take the precaution referred to with the result that troublesome sticking or "freezing" occasionally occurs.

In accordance with the invention and in order to minimize any sticking tendency between the piston and the gas cylinder I form the said parts of different materials, making the cylinder of a material having a coefficient of expansion considerably greater than that of the material of the piston. When the piston is formed of steel as preferred the cylinder may be formed of a suitable non-ferrous alloy such as brass or bronze. With the piston and the cylinder constructed of materials having different coefficients of expansion as stated the parts may be originally fitted for proper operation at a low or moderate temperature. As the temperature increases as the result of protracted firing the cylinder expands more rapidly than does the piston thus making the piston operate more freely in the cylinder instead of less freely.

In order to still further reduce the possibility of sticking I may change the size and the shape of the annular ribs 19, 19 so that they are relatively narrow to provide the minimum of contact with the surface of the gas cylinder. They may have a width only about one-third that which has heretofore been used. I may further construct the said ribs 19, 19 with forward facing surfaces having sharp outer edges, the said ribs being thus in the form of cutting or reaming teeth. These teeth 19, 19 therefore tend to prevent the formation of any film or coating on the interior of the gas cylinder and they cut away any such film or coating if and as formed. I thus avoid any tendency of the accumulated coating to cause the gas cylinder to assume an effective diameter less than the diameter of the piston. On account of the reduction in the width of the teeth 19, 19 and on account of the provision of sharp cutting edges thereon I preferably form the entire piston of hardened high-speed tool steel of such character as to be adapted to remain hard at the temperature which it attains when the gun is being fired substantially continuously.

I have found that with the improvements described the firearm can be fired substantially continuously for an indefinite period without any tendency for the piston to stick.

For the most effective results the two improvements are to be used in conjunction with each other, but it will be understood that I do not so limit myself and that either may be used without the other if desired.

expansion considerably greater than that of the steel of which the piston is formed.

In testimony whereof I have hereunto set my hand this 30th day of November, 1928.

FREDERICK T. MOORE.

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What I claim is:

1. In a gas-operated firearm of the class described, the combination with the barrel and the gas tube, of a gas cylinder closed at one end and having its other end open and in register with one end of the tube, the said cylinder being in communication with the interior of the barrel to permit the gases of explosion to enter the cylinder and tube, and a longitudinally movable piston in the tube adapted to be operatively connected at the rear with the mechanism of the gun and at one portion thereof having a diameter enabling it to enter and substantially fit the gas cylinder so as to be operated by gas therein, the said piston and cylinder being of different materials and the coefficient of expansion of the material of the cylinder being considerably greater than that of the material of the piston.

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2. In a gas-operated firearm of the class described, the combination with the barrel and the gas tube, of a gas cylinder closed at one end and having its other end open and in register with one end of the tube, the said cylinder being in communication with the interior of the barrel to permit the gases of explosion to enter the cylinder and tube, and a longitudinally movable gas operated piston in the tube adapted to be operatively connected at the rear with the mechanism of the gun and formed at one portion thereof with narrow annular cutting teeth of a diameter enabling them to enter and substantially fit the gas cylinder, the said piston being formed of hardened high speed steel adapted to remain hard at the temperature which it attains when the gun is fired substantially continuously.

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3. In a gas-operated firearm of the class described, the combination with the barrel and the gas tube, of a gas cylinder closed at one end and having its other end open and in register with one end of the tube, the said cylinder being in communication with the interior of the barrel to permit the gases of explosion to enter the cylinder and tube, and a longitudinally movable gas operated piston in the tube adapted to be operatively connected at the rear with the mechanism of the gun and formed at one portion thereof with narrow annular cutting teeth of a diameter enabling them to enter and substantially fit the gas cylinder, the said piston being formed of hardened high speed steel adapted to remain hard at the temperature which it attains when the gun is fired substantially continuously and the said gas cylinder being formed of a material having a coefficient of

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