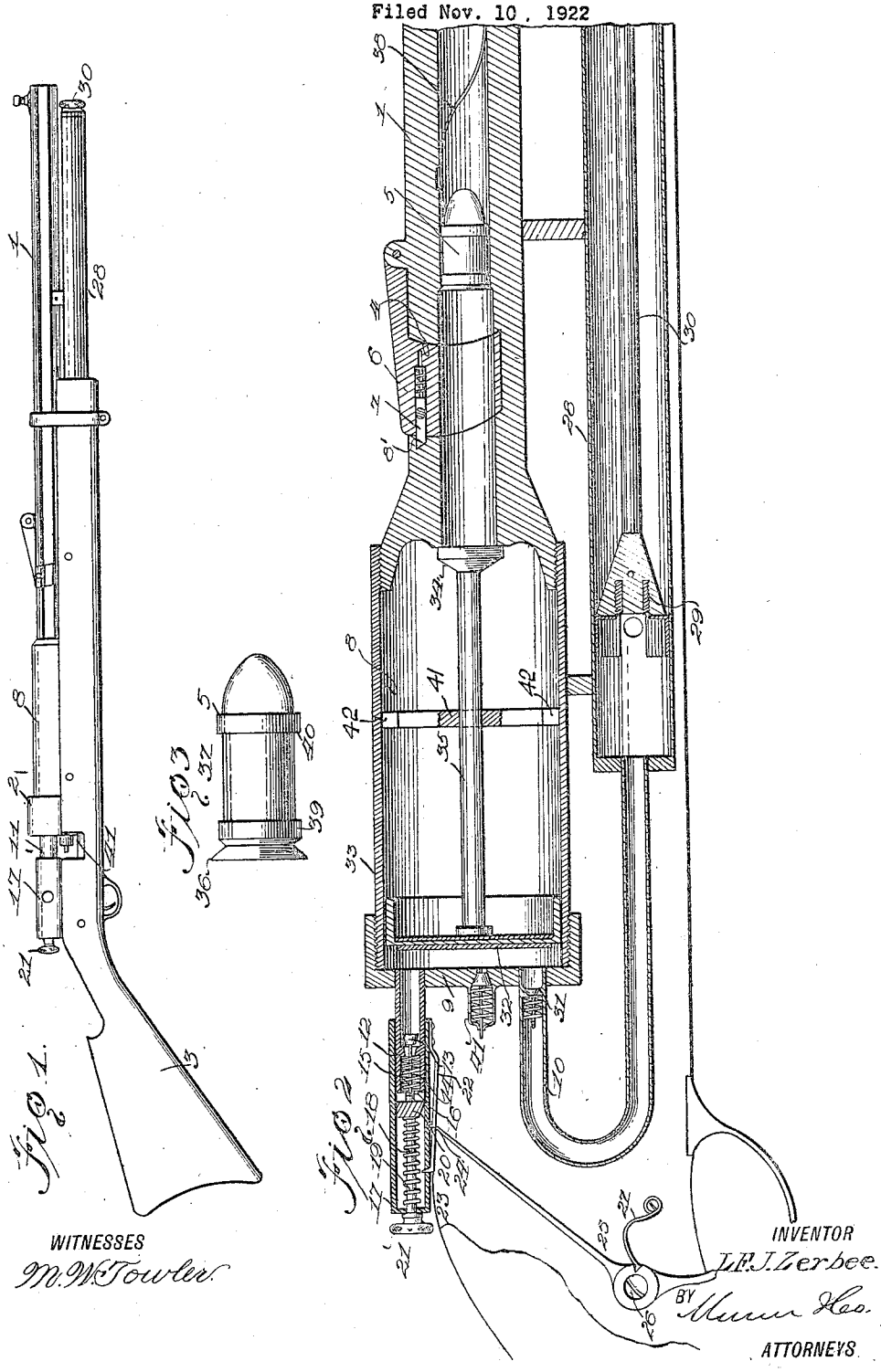
March 11, 1924. 1,486,215

L. F. J. ZERBEE

AIR GUN

Filed Nov. 10, 1922



WITNESSES

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Patented Mar. 11, 1924. 1,486,215

UNITED STATES PATENT OFFICE.

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AIR GUN.

Application filed November 10, 1922. Serial No. 600,112.

To all whom it may concern:

Be it known that I, LEIGH F. J. ZERBEE, a citizen of the United States, and resident of Bellefontaine, in the county of Logan and State of Ohio, have invented certain new and useful Improvements in Air Guns, of which the following is a specification.

My invention relates to improvements in air guns, more particularly to improvements in air rifles, and it consists in the combinations, constructions and arrangements herein described and claimed.

An object of the invention is to improve the construction of air guns so as to provide means for utilizing to a relatively great degree the expansive force of a compressed fluid to eject a projectile therefrom.

A further object of the invention is to provide in an air gun novel means for controlling the admission of a pressure fluid to the bore of the gun barrel at the rear or breech end of the latter.

Other objects and advantages will be apparent from the following description, and the novel features of the invention will be particularly outlined in the appended claims.

My invention is illustrated by way of example in the accompanying drawings, in which—

Figure 1 is a side elevation of a rifle embodying the invention,

Figure 2 is a relatively enlarged fragmentary view mainly in longitudinal vertical section and illustrating the means provided by the invention for supplying a pressure fluid to the barrel and the means for controlling the fluid conducting means, and

Figure 3 is a side elevation of a missile adapted to be ejected from the rifle exhibited in the preceding views.

In the drawings, I show a rifle barrel 1 connected by a breech-block portion indicated generally at 2 with a gun stock 3. The barrel 1 has the breech or rearward end portions thereof provided with an opening 4 in the upper part thereof through which a missile 5 may be introduced into the bore of the barrel. A swingingly supported closure may be moved into and out of position to close the opening 4 and may be releasably held in closed relation to the opening by a spring-pressed latch 7 in engagement with a socket or recess 8′ in the barrel.

The bore of the barrel 1 opens at its rearward end into a cylindrical chamber 8 which is provided in the breech-block portion of the gun. The cylindrical chamber 8 is closed at its end remote from the barrel by a head 9 through which an intake or supply conduit 10 and an exhaust conduit 11 communicate with the interior of the chamber. The exhaust conduit 11 is provided with an inwardly extending rib or flange fashioned to constitute a seat 12 for a valve 13. A stem 14 rigid with the valve 13 extends through the flange and is encircled by an expansion spring 15 reacting at its one end against the flange 12 and at its other end against a disk 16 secured on the stem and thus tending to hold the valve 13 against its seat. A frame or holder 17, which may be a cylinder closed at its rearward end, extends rearwardly of the exhaust conduit 11 and movably supports a bolt or discharging pin 18 in axial alignment with the valve stem 14. An expansion spring 19 coiled about the discharging pin reacts against a stop projection 20, and tends to urge the discharging pin 18 forwardly into contact with the rearward end of the valve stem 14. The discharging pin 18 projects rearwardly of the frame or holder 17 and is provided at its rearward extremity with a finger piece or head 21 which is adapted to be gripped between the fingers so that the discharging pin may be moved longitudinally of the holder against the action of the spring 19, thereby permitting the spring 15 to act to move the valve 13 into closing relation to the seat 12. A spring latch 22 secured at its one end to the outer wall of the holder 17 has a projection 23 at the other end thereof extending through an aperture in the wall of the holder to protrude interiorly of the latter and to engage with the projection 20 on the discharging pin when the latter has been moved rearwardly a certain distance so that the pin will be releasably held in its "cocked" position.

The spring latch 22 is inclined for the greater part of its length to the holder 17 and the upper side of the inclined portion thereof is engaged by a lateral projection 24 at the upper end of the one arm of an angular trigger 25 which is pivotally supported within the breech-block portion at the juncture of the two arms thereof, as by means of the pivot pin 26.

The lower arm of the trigger depends be-

low the breech-block portion and is adapted to be pressed to cause movement of the projection 24 along the inclined spring latch 22 toward the projection 23 at the free end of the latter and to thus effect release of the discharging pin 18. A spring 27 acts on the trigger 25 and tends to hold the latter in the position illustrated in Figure 2, whereby the spring latch 22 is permitted to return to active position.

The intake or supply conduit 10 extends to a source of pressure fluid supply which is shown as comprising a pump casing 28 extending along the underside of the barrel 1 and having a plunger 29 disposed therein, the plunger being provided with a stem or rod 30 extending beyond the forward end of the casing. A check valve 31 permits the flow of pressure fluid from the pump casing 28 through the conduit 10 into the chamber 8 but prevents return of the pressure fluid through the conduit 10.

A piston 32 is arranged for reciprocation within the chamber 8 and includes a cup leather 33 having the open end thereof confronting the breech of the barrel 1. A valve 34 is carried by a stem 35 which is rigid with the piston 32 and is held in axial alignment with the bore of the barrel, the valve 34 being adapted to abut the breech of the barrel upon a determined forward movement of the piston 32 in the chamber 8 and to then prevent communication between the latter and the bore of the barrel. Any suitable means may be employed to positively hold the stem 35 in axial alignment with the bore of the barrel. For example, I may employ a guide as shown in Figure 2 and consisting of a hub 21 rigidly secured to or integral with the stem 35 and having a plurality of radial arms 42 formed with arcuate outer faces in sliding contact with the inner wall of the cylindrical chamber 8.

From the foregoing description of the various parts of the device, the operation thereof may be readily understood. A missile such as that designated at 5 is placed within the bore of the barrel in the manner described so that an annular fin 36 at the butt end of the body 37 of the missile is in engagement with the rifling groove 38 in the bore of the barrel. At this time, spaced apart annular ribs or enlargements 39—40 respectively on the body of the missile will be in close sliding contact with the bore of the barrel. It is to be observed at this point that the diameter of the annular fin 36 is slightly greater than that of the annular bearing ribs 39 and 40 and that the fin 36 is angular in cross sectional contour, the rear face thereof lying in the plane of the rear face of the body 37 while the forward face thereof is inclined.

The missile having been placed within the bore of the barrel, the discharging pin or bolt 18 is drawn back or "cocked" and will be held in "cocked" position because of the engagment of the projection 23 with the projection 20 on the pin or bolt. At this time, the spring 15 functions to hold the valve 13 in closing relation to the seat 12 and the exhaust conduit 11 is thus closed. Pressure fluid is now introduced into the chamber 8 until a determined pressure has been reached therein. In the embodiment of the device illustrated, the pump plunger 29 is operated to force pressure fluid into the chamber 8, the check valve 31 operating to prevent return of the pressure fluid from the chamber 8 so that the plunger 29 may be reciprocated repeatedly within the pump casing 20 until a desired pressure has been attained. The relief valve 41 carried by the head 9 is adjusted to open when a desired pressure has built up within the chamber.

It is to be observed at this point that the pressure fluid enters the chamber 8 at the rear of the piston 32 and as soon as the pressure fluid strikes the piston, the latter is moved forwardly in the chamber 8, thereby moving the valve 34 against the breech end of the barrel and cutting off communication between the chamber 8 and the bore of the barrel. The pressure fluid will then leak past the piston into the forward portion of the chamber 8 so that the pressure on opposite sides of the piston will be equal as pressure builds up within the chamber 8.

When it is desired to discharge the missile, the depending arm of the trigger 25 is pressed, thereby effecting release of the bolt 18. The spring 19 thereupon drives the discharging pin or bolt forcibly against the valve stem 14 and moves the valve 13 from its seat. The pressure fluid within the chamber 8 at the rear of the piston 32 escapes through the exhaust conduit 11 and the piston 2 is instantly moved rearwardly, thereby moving the valve 34 from its seat and permitting the pressure fluid to expand against the missile 5 and to thus project the latter from the barrel. The cup leather will of course expand as soon as the pressure at the forward side of the piston exceeds that at the rearward side of the latter, and the piston will thus be moved rearwardly in a positive manner almost coincidently with the pressing of the trigger 25. As a result, the missile 5 will be ejected at a high velocity from the muzzle of the barrel by the rapidly expanding pressure fluid.

I do not wish to be restricted to the details of construction illustrated in the accompanying drawings and described herein since obviously my invention is susceptible of embodiment in forms other than that in which illustrated and described. For example, I may provide a container adapted to hold a supply of pressure fluid instead

of the pump casing 28 and the plunger 29 or I may provide other means for connecting the conduit 10 with a source of pressure fluid without departing from the spirit and scope of the invention. I therefore consider as my own all modifications and adaptations of the form of the device disclosed herein which fairly fall within the scope of the appended claims.

I claim:—

1. In an air gun, a barrel, a chamber communicating immediately with the bore of the barrel at the breech end of the latter and being adapted to receive a pressure fluid, a valve controlling communication between the chamber and the bore of the barrel, and a piston operatively connected with the valve and adapted to reciprocate within the chamber, said piston having means to permit leakage of the pressure fluid therepast in a forward direction and being adapted to be actuated by excess pressure at the rear side thereof to prevent communication between the chamber and the bore of the barrel and by excess pressure at the forward side thereof to permit such communication, means for introducing pressure fluid into the chamber at the rear of the piston, whereby the piston will be moved forwardly within the chamber until the valve is in closing relation to the barrel, and means operable at will to permit escape of pressure fluid from the space within the chamber at the rear of the piston, whereby the piston will be moved rearwardly to open the valve.

2. In an air gun, a barrel, a chamber communicating immediately with the bore of the barrel at the breech end of the latter, and being adapted to receive a pressure fluid, a valve controlling communication between the chamber and the bore of the barrel, and a piston operatively connected with the valve and adapted to reciprocate within the chamber, said piston having means to permit leakage of the pressure fluid therepast in a forward direction and being adapted to be actuated by excess pressure at the rear side thereof to prevent communication between the chamber and the bore of the barrel and by excess pressure at the forward side thereof to permit such communication, means for introducing pressure fluid into the chamber at the rear of the piston, whereby the piston will be moved forwardly within the chamber until the valve is in closing relation to the barrel, and trigger controlled means for controlling the escape of pressure from the rear of the piston to permit rearward movement of the piston within the chamber and the opening of the valve.

3. In an air gun, a barrel, a cylindrical chamber in immediate communication at one end with the bore of the barrel, said chamber being provided with a head at the end thereof opposite to the barrel, said head having an inlet for pressure fluid and an outlet, a normally closed valve controlling said outlet, a piston reciprocable within said cylindrical chamber and including a cup leather having the peripheral portion thereof extending laterally of the body of the piston toward the barrel and adapted to be expanded against the wall of the chamber by pressure to prevent leakage of the pressure fluid therepast in a rearward direction, a valve stem extending from said piston toward the adjacent end of the barrel, a valve rigid with the valve stem and adapted to abut the adjacent end of the barrel in position to close the adjacent end of the bore of the latter when the piston is at the end of its stroke toward the barrel.

4. In an air gun, a barrel, a cylindrical chamber in immediate communication at one end with the bore of the barrel, said chamber being provided with a head at the end thereof opposite to the barrel, said head having an inlet for pressure fluid and an outlet, a normally closed valve controlling said outlet, a piston reciprocable within said cylindrical chamber and including a cup leather having the peripheral portion thereof extending laterally of the body of the piston toward the barrel and adapted to be expanded against the wall of the chamber by pressure to prevent leakage of the pressure fluid therepast in a rearward direction, a valve stem extending from said piston toward the adjacent end of the barrel, a valve rigid with the valve stem and adapted to abut the adjacent end of the barrel in position to close the adjacent end of the bore of the latter when the piston is at the end of its stroke toward the barrel, and guide means carried by the stem in sliding contact with the wall of the chamber and cooperating with the latter to hold the last named valve against lateral movement in the chamber.

LEIGH F. J. ZERBEE.