Sept. 11, 1951 L. V. KAPSA 2,567,643

AIR GUN LOADING AND FIRING MECHANISM

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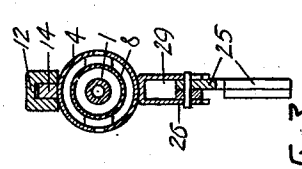


FIG. 3.

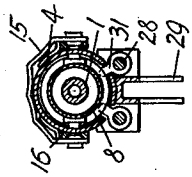


FIG. 4.

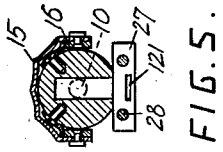


FIG. 5.

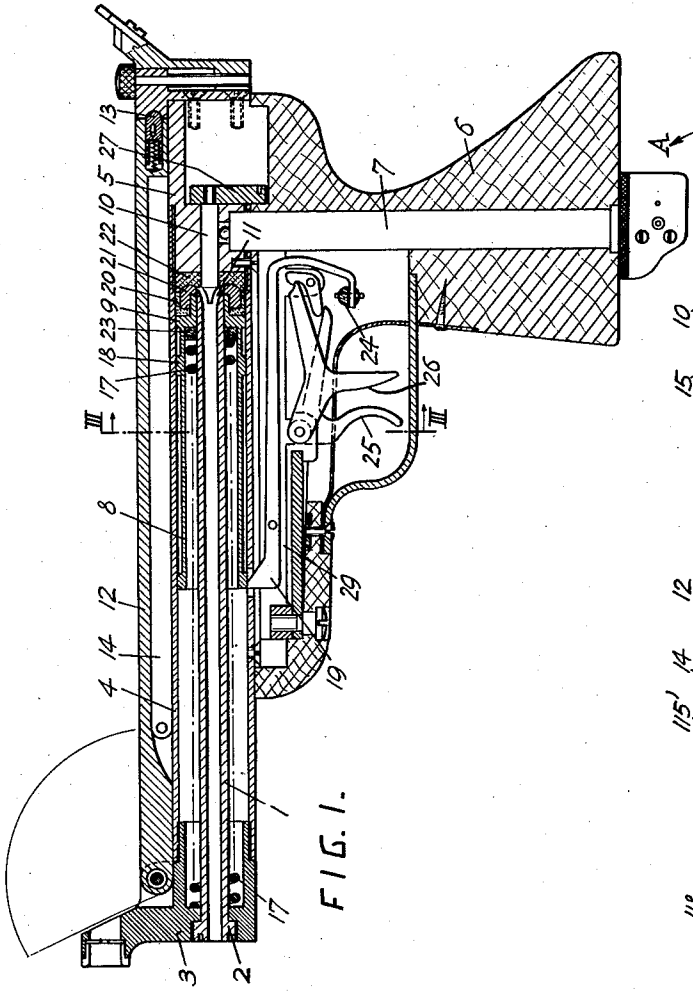


FIG. 1.

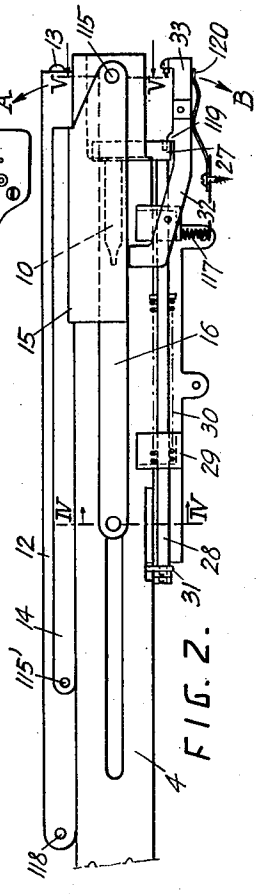


FIG. 2.

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AIR GUN LOADING AND FIRING MECHANISM

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3 Claims. (Cl. 124—15)

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The present invention relates to improvements in air-guns, and in particular to an air-gun of the kind wherein a compression cylinder is arranged on the gun for co-operation with a piston by which air is pressed into the barrel behind the projectile.

It is the principal object of this invention to provide an improved air gun having novel means to feed the projectile into the gun barrel and to convey compressed air behind the projectile at the moment of firing.

Another object of the invention is to provide an improved air gun in which the means to feed the projectile into the gun barrel also functions to provide an annular channel for the conveyance of compressed air behind the projectile at the moment of firing in a most efficient and expeditious manner.

Air-guns have already been suggested with a compression cylinder mounted usually behind the barrel, wherein a piston under the influence of a driving spring drives air in front of itself, compresses the latter and projects it into an air-lock or opening of the barrel under the projectile. Air-guns have further been suggested comprising a compression cylinder surrounding the barrel and provided with an auxiliary piston against which the main piston, together with the barrel, is projected by the influence of the driving spring.

Such a barrel transmits to the projectile its own acceleration, which is added to the acceleration of the projectile caused by compressed air. A disadvantage of such known air-guns is that of considerable diffusion owing to vibrations of the gun during the movement of the whole barrel and impacts of the barrel in forward direction, which have a tendency to pull down the muzzle even if the gun is firmly held. Moreover, compressed air does not produce the required pressure impact in the barrel, into which it is admitted through a number of apertures arranged on the circumference of the barrel, because this operation is accompanied by disturbing whirls and by a reduction in efficiency owing to so large a clearance.

The above drawbacks are eliminated in an air gun according to the present invention. The basic feature of the invention is the provision in the air gun of a projectile feeder which brings the projectile into a predetermined firing position in the barrel by pressing the projectile into the barrel, the front portion of the feeder being shaped so as to form at the moment of firing, together with the rear portion of the barrel, an annular channel similar to a Laval nozzle adjacent the end of the compression cylinder, for the admission of compressed air behind the projectile, to impart a centrally directed impact to the latter, while reducing to a minimum the dead space.

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A further feature of the invention resides in providing that the barrel is mounted adjustably in axial direction for adjusting the dimensions of the annular channel and thereby the velocity of the projectile.

In a preferred embodiment of the invention, the front end of the barrel may be permanently fixed with respect to the sights and the gun body, so as to provide a perfectly accurate fire. The rear end of the barrel is preferably freely mounted and spaced from the gun body to be surrounded by a compression cylinder with an annular piston sliding therein. Vibrations, if any, of the rear part of the barrel at the moment of firing do not interfere at all with the accuracy of fire, because the front portion, underneath the foresight, is rigidly connected with the whole gun body system.. The gunner can easily withstand the remaining impacts by holding the gun rigidly, as they remind him of the recoil shocks of a firearm.

The spaced mounting of the rear portion of the barrel makes it possible, by suitably adapting or shaping the tip of the projectile feeder which projects from the barrel lock, to achieve a nozzle-like or annular passage from the compression cylinder into the barrel. In this way a sudden and uniform air impact, free from any interfering whirls behind the projectile is achieved, said impact extending over the whole cross-section of the bore of the barrel. With such an annular passage, the bottom of the compression cylinder may be shaped so as to achieve a complete squeezing out of the air from the cylinder in order to avoid any losses of air.

The axial adjustment of the barrel may be obtained in any suitable way, for instance by means of a screw thread which enables the barrel to be moved forward or backward. In this way the cross-sectional area of the annular channel may be changed.

Further objects and advantages of the invention will be apparent with reference to the following specification and drawings, in which

Fig. 1 is a longitudinal section of a pistol air gun embodying the projectile feeder and air lock of the invention;

Fig. 2 is a detail elevation of the feeder recoil

mechanism not shown in Fig. 1 for purposes of clarity;

Fig. 3 is a cross section on the line III—III of Fig. 1;

Fig. 4 is a cross section on the line IV—IV of Fig. 2; and

Fig. 5 is a cross section on the line V—V of Fig. 2.

Figure 1 shows a pistol shaped air-gun immediately after a shot has been fired and with the trigger tensioning means cocked anew. The barrel 1 is axially screwed into the front wall 3 of the body 4 by means of an outer thread provided on a muzzle collar 2; the body serves also as a compression cylinder screwed onto the lock 5 of the weapon. The lock is fixed in the butt by means of a hollow screw 7, which is adapted to accommodate a projectile magazine. A piston 8 is slidably mounted coaxially around the barrel in the body 4, the head 9 of the piston serving simultaneously as a support for the free inner end of the barrel.

A tip of the projectile feeder 10 protrudes from the lock 5 into the inner end of the barrel 1 at the moment of firing. A nozzle channel 11 thus provided is shown between the tip of the feeder and the end of the barrel for the admission into the barrel of compressed air from the compression space behind the piston and piston head 8, 9. The cross sectional area of the channel 11 can be adjusted by rotating the barrel by means of the muzzle collar 2 that is threaded in the front wall 3 of the body 4. In this way three basic features are provided, viz., the provision of the free inner end of the barrel, the tip of the projectile feeder protruding into this end of the barrel and a nozzle like channel between the end of the projectile feeder and the barrel.

A cocking lever 12 is pivoted immediately behind the fore sight on the front wall 3 of the body 4. The free end of the lever 12 is secured to the lock of the weapon near the rear sight by means of a spring loaded catch 13. The upper side of the lever 12 represents in this way the line of sight. Mounted in the channel at the underside of the lever 12, as shown in detail by Figs. 1 to 3 of the drawings, is a rod 14 pivoted to the lever at 115', said rod embracing by its enlarged end 15 the body 4 and resting between its two pivots such as 115 against struts 16. The operative ends of the struts 16 are guided in slots in the body 4 and engage a shoulder or groove on the piston body 8. During the upward movement of the cocking lever, they push the piston against the pressure of the driving spring 17, supported at its fore end against the front wall 3 of the body 4 and at its rear end against the head 9 of the piston 8. The pushing movement continues until a catch or sear 19 engages a collar 18 provided adjacent the head of the piston 8. The annular head 9 of the piston 8 may be sealed from both ends against the inner surfaces of the cylinder and the outer surfaces of the barrel. Mounted at the outside is a leather collar 20 tightened by means of a cap 21 tightly fitted and permanently tightened by the impacts of the piston against the lock of the barrel, which, in order to reduce shocks, is provided with an elastic buffer 22 made of semi-rigid rubber. In the interior of the head 9 is a leather ring 23 covered by a washer, against which bears the driving spring 17. The free end of the sear 19 passes to the rear around the trigger and engages a notch in a cylindrical safety-catch 24. The pulling trigger 25 is provided with a tensioning member 26, which has the form of a three arm lever, one arm being pivoted to the barrel, the opposite arm being engaged by the latch of a pawl, and the third arm protruding into the trigger space. The element 26 is spring biased upwardly and the arm extending into the trigger space is a resetting arm. The other arm of the pawl stands in engagement with an extended arm of the trigger 25. Consequently, even a very light action on the trigger will cause the release by the pawl of the said arm of the member 26 so that after the trigger 25 has been pulled the pawl-engaged arm of the tensioning member 26 is projected against the free arm of the sear catch 19, to release the collar 18 of the piston, thus setting the weapon in operation.

The projectiles are removed singly, by the forward movement of the feeder 10 at each recoil movement, from the magazine, which is arranged in the hollow screw 7. The feeder moves by its tip the projectile into the barrel. The feeder 10, as shown in detail in Figs. 1, 2 and 5, is screwed into a carrier 27 rigidly mounted on guiding rods 28 supported in a double bearing 29. Supported around the rods 28 and resting at the rear end against an abutment on the said rods 28 there are provided springs 30 serving for the recoil movement of the feeder; the other end of each spring rests against a projection of the bearing 29. The free ends of the rods carry tongues 31 which are guided in recesses in the body and engage the forward or left hand face of the flange provided at the end of the piston 8. At one side of the bearing 29, underneath the enlarged end or extension 15 of the rod 14 a locking lever 32 is pivoted between its ends to the barrel. The extension 15 of the rod 14 brings the element 119 of the locking lever into engagement with the carrier 27 of the feeder 10. Pivoted to the end of the lever 32 is a spring loaded interlock catch 33.

When the cocking lever 12 is first moved counterclockwise to cock and load the gun, the extension 15 of the arm 14 releases the lever 32 to pivot clockwise sufficiently to release the carrier 27 from engagement with the element 119. The carrier 27 then moves to the right into engagement with the spring loaded interlock catch 33 which is pivoted to the right hand end of lever 32 and loaded by spring 120. Continued movement of the cocking lever 12 will release the lever 32 to move clockwise a further amount sufficient to release catch 33 from engagement with the slot 121 of carrier 27 to enable the carrier to move under the force of springs 30 to the right and enable a projectile to be positioned in front of the projectile feeder 10. A final movement of the cocking lever 12 to the fully counterclockwise position causes the flange of the piston 8 to engage the tongues 31 of the rods 28 to move the feeder back to the left to feed and position the projectile and to again compress the springs 30. This final movement continues until the carrier 27 of the feeder engages the rear edges of the lever 32, and the sear 19 engages the flange of the piston 8, the said flange then holding the rods 28 in forward position by means of the tongues 31. Thus it will be seen that the interlock catch 33 prevents the feeding of a projectile unless the cocking lever is moved fully to cock and load the gun.

In order to cock the gun the lever 12 is rotated in the direction of the arrow A, as shown in Fig. 2 around the pivot 118. The link 14 is pulled forward (to the left hand side) so that

its enlarged portion 15 moves to the left. As soon as its left hand end moves up out of engagement with the left hand uprising portion of the lever 32, the latter swings in the direction of the arrow B under the influence of the spring 117. During the forward movement of the lever 14 its pivot 115 pulls to the left the pistons 8 which in turn during the last part of its movement, moves to the left hand side, by engaging the lugs 31, the carrier 27 with the feeder 10. If the piston is fully brought home to its left hand position (cocked position) and retained by the sear, the carrier 27 and feeder 10 remain in their left hand position, being retained by the lugs 31 being held by the piston. The cocking lever 12 may then be returned to its original position. During this return movement of the cocking lever the rear end of the member 15 strikes the projecting left hand portion of the lever 32 swinging the same in anti-clockwise direction to the position shown in Figure 2. If a round is now fired, the piston is thrown by its spring 17 to the right hand side while the carrier 27 is retained by the abutment 119 on the lever 32 against the influence of the spring 30. If now the lever 12 is again actuated in the direction of the arrow A, the portion 15 of the rod 14 in the first phase of its movement starts moving the piston to the left, while the carrier 27 is still retained by the abutment 119. In the second phase of movement of the portion 15 the lever 32 is released as disclosed above so that it swings in the direction of the arrow B and sets free the carrier 27 which is thrown backwards to the right by its spring 30.

During the further phase of the movement of the piston 8 to the left the latter will engage the lug 31 and pull the carrier 27 and feeder 10 forward, as disclosed above. During this operation the feeder inserts the projectile into the barrel.

Assuming now that the piston has not been fully brought to the left hand position and, therefore, not retained by the sear, it will now return together with the cocking lever rearward (to the right). During the first phase of this movement the carrier 27 will, therefore, move also backwards together with the piston, as the lever 32 is still in its rocked position in which the abutment 119 does not engage the carrier 27. The arrangement is, however, such that the portion 15 swings the lever 32 in counter-clockwise direction so that the carrier is retained by the said catch 33 in a position in which the tip of the feeder 10 still does not admit the inserting of a further projectile into the feeding channel. In order to positively prevent the carrier 27 from slipping out of engagement with the interlock catch 33, a shallow recess 121 may be provided in the rear wall of the carrier 27, if necessary.

If, after the carrier has been retained by the interlock catch 33, the gun is cocked anew, the feeder 10 cannot push another projectile into the barrel so that double loading is positively prevented.

The invention allows an overall reduction of the dimensions of the weapon, a substantial improvement of the accuracy of fire, a considerable reduction in weight and an increase in efficiency. Not only the reduction in length, but also the overall reduction of dimensions achieved by the compact arrangement according to the invention is sufficiently evident from the drawings. The probable diffusion of hits with weapons of an average performance, at a range of 60 meters, and with weapons of a higher performance at a range of 120 meters, has the size of a circle of 15 cm. in diameter. Efficiency with a good fresh spring which with known weapons amounts to 15% for pistol guns, and to 20% with long air-guns, is increased according to the invention with pistols to 22% and with medium and long weapon to 30–35%. Thus for instance, an air-gun having a total weight of 2.800 kg., using a projectile of 0.52 g. weight, has a guaranteed muzzle velocity of V_0=220m./sec. which, however, with a good and fresh spring amounts actually to 270m./sec. Such velocities are, of course, only suitable for firing in the open. A great advantage of the weapon according to the invention also resides in the fact, that by adjusting the nozzle-like channel by a mere rotation of the barrel, the velocity, and also the impact energy of projectiles, may for the same weapon be reduced as required down to values suitable for firing in a room.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, I declare that what I claim is:

1. An air gun comprising in combination, a gun body, a barrel mounted in the gun body, a closure for the body mounted adjacent but spaced from the rear end of the barrel, a compression cylinder mounted co-axially of the barrel, a spring actuated piston in the said cylinder mounted for sliding movement therein and a projectile feeder slidably mounted in the closure and adapted to feed the projectile into the barrel, said feeder having its front portion protruding in its operative forward position from the closure of the body towards and into the barrel to such an extent as to bring the projectile into a predetermined firing position and to press the same into the barrel, said front portion of the feeder being tapered and substantially point shaped so as to form in the moment of firing together with the rear portion of the barrel an annular channel adjacent the end of the compression cylinder with increasing width towards the interior of the barrel for the admission of compressed air from the compression cylinder simultaneously through the entire cross sectional area of the channel behind the projectile to impart a centrally directed impact to the latter.

2. An air gun comprising in combination, a gun body, a barrel mounted in the said body, a closure for the body arranged adjacent the rear end of the barrel, a compression cylinder mounted co-axially of the barrel, a piston in the said cylinder mounted for sliding movement therein, and a projectile feeder slidably mounted in the closure and adapted to feed the projectile into the barrel, said feeder having its front portion protruding in its operative forward position from the closure of the body toward and into the barrel to such an extent as to bring the projectile into a predetermined firing position, the front portion of the feeder being tapered and substantially point shaped so as to form in the moment of firing together with the rear portion of the barrel an annular channed adjacent the end of the compression cylinder with increasing width towards the interior of the barrel for the admission of compressed air from the compression cylinder simultaneously through the entire cross-sectional area of the channel behind the projectile to impart a centrally directed impact to the latter, said barrel being mounted adjustably in axial direction in the gun body for ad-

justing the dimensions of the annular channel and thereby the velocity of the projectile.

3. An air gun comprising in combination, a gun body, a barrel mounted in the body, a closure for the body arranged adjacent the rear end of the barrel, a compression cylinder mounted co-axially of the barrel, a spring loaded piston in the said cylinder mounted for sliding movement therein, and a projectile feeder slidably mounted in the closure and adapted to feed the projectile into the barrel, said feeder having its front portion protruding in its operative forward position toward the barrel and into the latter to such an extent as to bring the projectile to a predetermined firing position and to press the same into the barrel, said front portion of the feeder being tapered and substantially point shaped so as to form in the moment of firing together with the rear portion of the barrel an annular channel of increasing width towards the interior of the barrel, the relative positions at the moment of firing of the end of the barrel and the feeder being axially adjustable to enable

the dimensions of said annular channel to be changed.

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