Feb. 17, 1942. C. N. WEBBY 2,273,678

REPEATING AIR GUN

Filed Sept. 23, 1940 2 Sheets-Sheet 1

FIG.1.

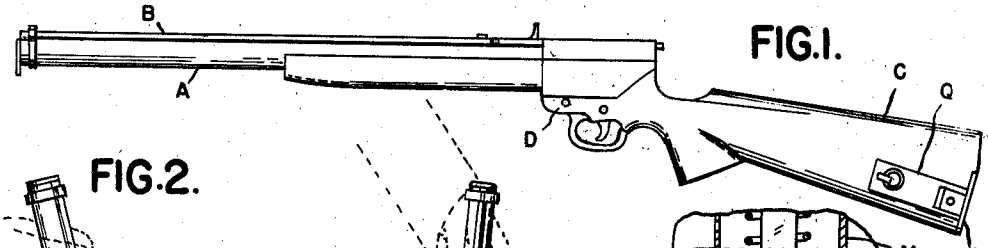


FIG.2.

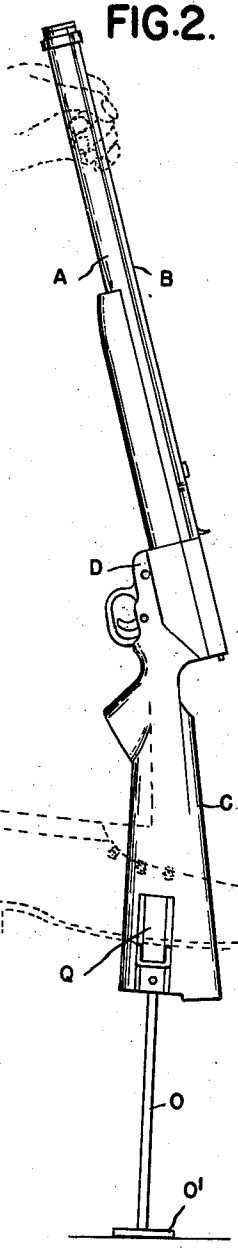


FIG.3.

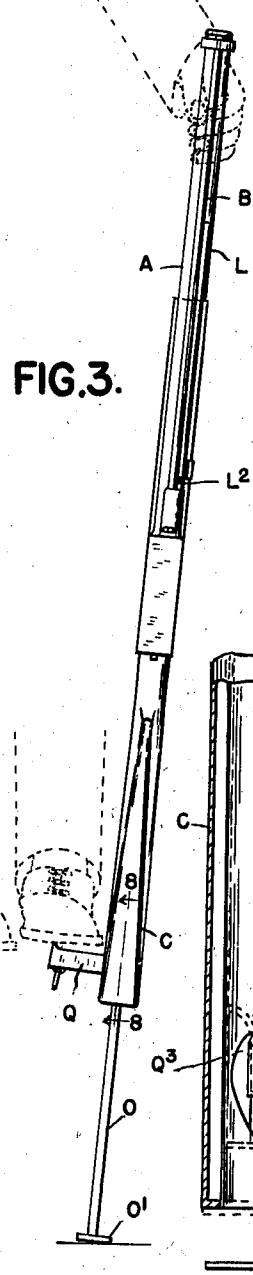


FIG.8.

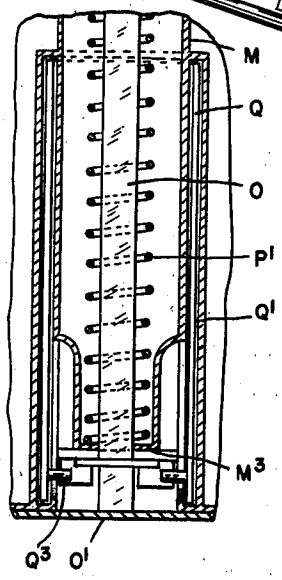
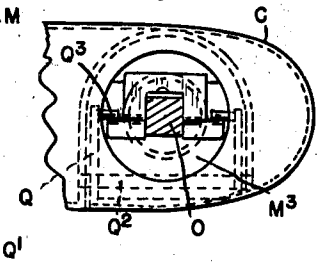


FIG.9.



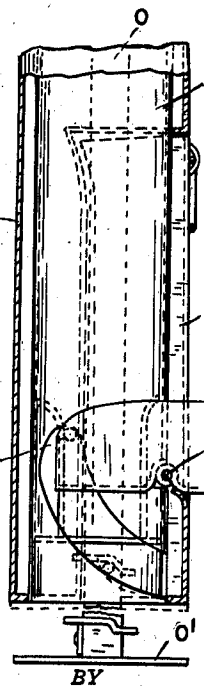
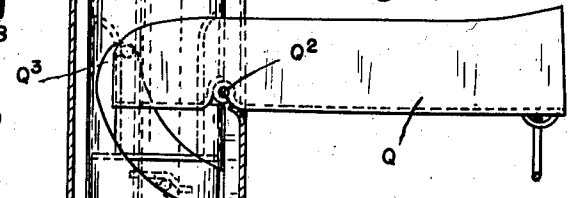


FIG.7.



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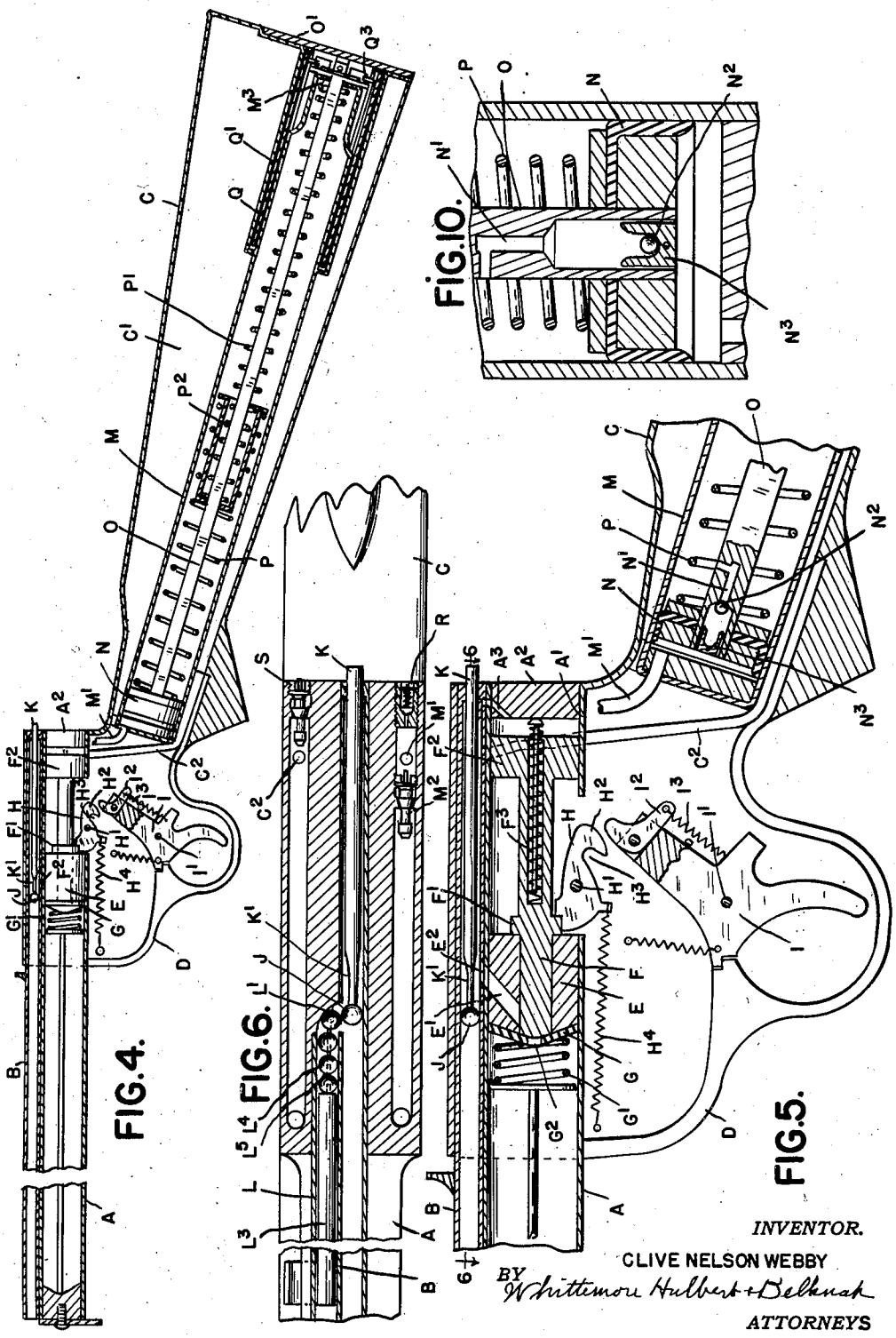


FIG.4.

FIG.6.

FIG.10.

FIG.5.

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REPEATING AIR GUN

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Application September 23, 1940, Serial No. 358,003

12 Claims. (Cl. 124—13)

The invention relates to air guns of that type in which air is compressed and stored in a container within the gun from which it is subsequently released to propel the projectile.

It is the primary object of the instant invention to obtain a construction in which a sufficient quantity of compressed air may be stored to serve for a series of successive shots.

It is a further object to accurately meter the quantity of air used for each shot so as to drive the projectile with the requisite force but without unnecessary waste of compressed air.

Still further, it is an object to obtain a construction of mechanism for compressing air with a minimum of effort on the part of the user.

With these and other minor objects in view, the invention consists in the various features of the construction as hereinafter set forth.

In the drawings:

Figure 1 is an elevation of a gun embodying my improvements;

Figure 2 is a similar view illustrating the manner of compressing the air for storage within the gun;

Figure 3 is an elevation viewed at right angles to Figure 2;

Figure 4 is a longitudinal section through the stock containing the air compressor pump and also a portion of the storage chamber for compressed air;

Figure 5 is an enlarged view of a portion of Figure 4 showing more in detail the air metering mechanism and trigger mechanism for actuating the same;

Figure 6 is a horizontal section on lines 6—6 of Figure 5;

Figure 7 is an enlarged longitudinal section through the rear portion of the stock showing the step in extended position;

Figure 8 is an enlarged longitudinal section substantially on line 8—8 of Figure 3 showing the step in collapsed position;

Figure 9 is a rear elevation of the stock with the piston rod in section;

Figure 10 is a section through the pump barrel and piston showing the relief valve in open position.

Toy air guns are usually constructed with a false barrel, which simulates the barrel of a powder operated gun, and a shooting barrel of much smaller bore placed either within or adjacent to the false barrel. With the instant construction, I employ a false barrel as an air storage reservoir which is of sufficient capacity to provide for a succession of shots. There is, however, danger that in the operation of the gun more than the necessary quantity of air may be released in one operation so as to diminish the number of successive shots that can be fired without renewal of the supply. It is, therefore, one of the features of my invention to provide an air metering device which, while released by trigger actuation, is independent of the same in its metering function.

More in detail and as illustrated in the drawings, A is the false barrel of the gun which is closed to form a storage reservoir for the compressed air. B is the firing barrel preferably arranged above the false barrel and formed of a tube of much smaller diameter. C is the stock, and D the frame for connecting the stock and barrels. Within the frame and the rear portion of the false barrel is arranged a trigger releasing and air metering mechanism of the following construction.

Compressed air releasing and metering means

E is a plug secured within the false barrel a short distance in advance of its rear end, which plug is provided with an axial bore for receiving a slidable plunger F. The forward face of the plug E is preferably slightly coned and the plunger F projects slightly forward of the same. The plug is also provided with a passage E′ which extends from the bore near its forward end obliquely rearward and upward to communicate with a port E^2 in the firing barrel. G is a disc of flexible resilient material, such as rubber, which lies against the forward face of the plug E and has its peripheral portion resiliently pressed in contact with the plug by a coil spring G′. The center of the disc has a port G^2 therethrough which is of a diameter somewhat less than the diameter of the plunger F and axial bore in the plug. Thus the portion of the disc surrounding this port will be resiliently pressed against the end of the plunger F, when the latter is in normal position, to form an air seal and to cut off communication between the reservoir and passage E′. F′ is a shoulder on the plunger F in rear of the plug E, and H is a sear for engaging this shoulder to hold the plunger in its normal position. The sear H is pivotally mounted at H′ and has a rearwardly projecting portion H^2 which extends into the path of a trigger member I. The latter is pivotally mounted within the frame at I′ and is so arranged that when the trigger is pulled, the sear H will be rocked to disengage it from the shoulder F′. The plunger F extends rearward beyond the shoulder F′ and at its rear end is provided with an enlarged head F^2 which slidably fits within the rear portion A′ of the barrel A. A^2 is a plug closing the rear end of the portion A′ but having therein a passage A^3 which is in communication with the rear end of the firing barrel B. A light coil spring F^3 placed within an axial recess in the plunger F and bearing against the plug A^2 serves to advance the plunger into engagement with the sear when there is no compressed air in the storage reservoir.

With the construction just described, assum-

ing that the storage reservoir within the barrel A has been filled with compressed air by means hereinafter to be described and also assuming that a shot or projectile J is in the firing barrel slightly in advance of the port E^2, the operation is as follows. The compressed air within the barrel A will hold the apertured disc G against the forward face of the plunger F to form an air seal, the plunger being held from displacement by the engagement of the sear H with the shoulder F'. Whenever the trigger I is pulled, the sear will be released from its engagement with the shoulder whereupon air pressure on the forward end of the plunger will move it backward away from the apertured disc G and opening communication with the passage E'. Compressed air will then flow through this passage into the firing barrel in rear of the shot J driving the latter forward to be discharged from the barrel. At the same time, the compressed air will travel rearward in the firing barrel B and through the passage A^3 into the portion A' of the barrel A where it will act against the piston head F^2. As this head is of very much greater area than the exposed area at the forward end of the plunger F, the differential pressure will return the plunger to its normal position where it will again seat against the disc G and will be held by the sear H. This action will be very rapid so that the interval within which air is permitted to discharge from the reservoir is very brief and only a sufficient quantity of air is released to fire the shot. The length of the interval will be determined by the restriction in the air passage extending to the portion A' of the barrel A and it is, therefore, essential to accurately determine this restriction. This I have accomplished by placing a rod K within the rear portion of the barrel B, said rod being only slightly less in diameter than the internal diameter of the barrel. This will produce an annular passage surrounding the rod which offers the requisite restriction but without danger of clogging by lodgment of dust particles. To avoid interference by the trigger to the instantaneous reengagement of the sear with the shoulder F', I provide the trigger with a latch member I^2 for directly engaging the sear to release the same while the sear is provided with a recess or cutaway portion H^3 for receiving the latch I^2 as soon as it has passed the portion H^2. This provides sufficient clearance so that the sear may be instantaneously returned by the actuation of a spring H^4 and before the return of the trigger. However, the trigger is permitted to return by the swinging of the latch I^2 so as to clear the portion H^2 of the sear after which the latch is returned to its normal position by a spring I^3.

Shot magazine

The shot or projectiles J are preferably placed in a magazine L which is formed of a tube arranged parallel and adjacent to the firing barrel B. The rear end of the magazine L has a curved passage L' connecting the same with the barrel B and the forward end of the rod K has a portion K' reduced in diameter forming a stop for the shot in registration with the curved passage. The shot are placed in the magazine through an aperture L^2 and a spring pressed follower L^3 serves to feed the series of shot rearward. In order that the last shot in the magazine may be fired, the rear end of the follower L^3 is provided with a flexible portion. This, as shown, comprises a plurality of balls L^4 connected to each other and to the follower by a central flexible wire L^5. Thus, the balls will follow around the curved portion L' moving the last shot into the barrel B and frictionally holding it in position against the stop K'. However, during the firing operation, the compressed air entering the barrel B will push the follower or any shot remaining in the magazine out of frictional contact with the shot in the firing barrel so as not to resist its discharge.

Air compression means

The construction as thus far described will operate the same without regard to the particular means used for supplying the compressed air to the storage reservoir. I have, however, provided air compression means of the following construction which facilitates easy operation and with the least effort on the part of the operator. M is a pump barrel which is located within the stock C preferably extending the entire length thereof and having its forward end connected to the storage reservoir by a conduit M' containing a check valve M^2. N is a piston within the barrel provided with an actuating rod O which extends rearward therefrom and through a bearing M^3 at the rear end of the pump barrel. O' is a foot member at the rear end of the rod O which normally occupies a recess in the rear face of the stock. When in this position, the piston N will be at the forward end of the pump barrel. To move the piston and rod O rearward, there is provided resilient tensioning means. This preferably comprises two helical springs P and P' sleeved about the rod O and of different diameters so that one may telescope within the other. Between these springs is a cylindrical housing P^2 of a length substantially the same as that of the springs when released from tension. The spring P surrounds the housing P^2 and is anchored to the rear end thereof while the spring P' extends within the housing and is anchored to the forward end thereof. The forward end of the spring P is attached to the piston N and the rear end of the spring P' is anchored to the bearing M^3. Thus, when the piston and rod are free to move, the springs P and P' will collapse into the length of the housing P^2 drawing the latter rearward against the bearing M^3 and the piston against the casing P^2. This will project the rod O outward from the rear end of the stock while the return movement of the rod will press the piston forward in the barrel to compress the air therein.

To facilitate this operation, I have provided the stock with a collapsible step Q normally concealed within a recess Q' in the stock but adapted to be swung outward into a position extending laterally therefrom. The operator may then hold the gun by the muzzle end of the barrel with the stock extending downward and the foot O' of the rod O resting on the ground. He next places one foot on the step and moves the gun downward thereby forcing the piston upward in the barrel and compressing the air. When the foot pressure is relieved, the gun is raised and the springs will extend the rod O, the foot portion O' still resting on the ground. This operation may be repeated as many times as necessary to raise the air pressure within the storage reservoir to a predetermined degree. At the completion of the pumping operation, the rod and piston are moved forward in the barrel until the foot member O' engages the recess in the stock and is locked therein. The locking

is preferably automatically effected by the return of the step Q into its recess Q' which is accomplished by the following construction. The step Q is of a channel-shaped cross section and is secured to the stock by a pivot pin Q^2 passing through the sides of the channel. These sides are extended rearward beyond the pivot Q^2 and have inwardly extending pintles Q^3 for cooperating with flanges O^2 on the rod O. The construction is such that when the foot O' is engaged with its recess in the stock, the swinging of the step Q into its recess Q' will move the pintles Q^3 over the outer face of the flange O^2 and will thus lock the rod O against outward movement by the springs P and P'. To relieve the piston N from any air pressure within the barrel M when the parts are returned to normal position, I provide the piston with a relief port N' and a gravity seated ball valve N^2 for closing this port. This valve will automatically find its seat when the gun is held with the stock downward or in a position for operating the compressor pump but when the gun is reversed in position with the barrel extending downward, the ball will drop away from its seat and open the port N'. Thus the air within the barrel M is permitted to escape through this port and the return of the piston and rod O is only resisted by the tension of the springs P and P' which is not excessive. To prevent the ball N^2 from being returned to its seat by the flow of air through the port N', a cup N^3 is arranged to receive the ball when it drops from its seat and to hold it out of the path of air. This cup will not, however, prevent the ball from returning to its seat when the gun is held with the stock extending downward.

Auxiliary storage reservoir

While as above described, the storage reservoir for the compressed air is formed in the false barrel of the gun, I may, if desired, increase the storage capacity by the formation of an additional storage reservoir within the stock. As shown, the stock C is formed of sheet metal and the space surrounding the barrel M forms the auxiliary storage reservoir C'. This reservoir is connected by a conduit C^2 with the reservoir within the false barrel A so that the pressure in this reservoir and that in the reservoir C' will be equalized. I also preferably provide a safety blow-off valve R which is connected at any convenient point with the storage reservoirs and will prevent the rise of pressure therein beyond a predetermined point. As shown, the valve R is located in a rearward extension of the conduit M' and when open will discharge air into the external atmosphere. A valve S at the end of the conduit C^2 may be used for exhausting the compressed air in the reservoirs.

In the specific construction illustrated, the pivot Q^2 for the step Q extends through the outer portion of the cross section of the barrel M which latter is cut away for the passage of said pivot pin. To prevent any dirt from entering the barrel at this point, I provide a thimble or bushing M^4 which passes inside of the pivot pin Q^2 and at its inner end is flanged to contact with the inner surface of the barrel M. This bushing is, however, large enough to receive the collapsed springs P and P'.

What I claim as my invention is:

1. In an air gun, the combination with a storage chamber for compressed air and a shooting barrel, of an air delivery connection between said storage chamber and barrel, a valve for normally closing said air delivery connection having a limited area exposed to the air pressure within said storage chamber and seated against said pressure, said valve being further provided with an oppositely facing portion of larger area exposed to air pressure derived from said barrel whereby said valve will be automatically closed upon delivery of a metered quantity of air to said barrel, and trigger actuated means for opening said valve.

2. In an air gun, the combination with a false barrel and a shooting barrel adjacent thereto, of a plug for closing the muzzle end of said false barrel, a plug within said false barrel slightly in advance of the rear end thereof provided with an axial bore and a passage extending laterally from said bore into communication with a port in the shooting barrel, the space between said plugs constituting a compressed air storage chamber, a flexible disc bearing against the forward face of the rear plug and having a central aperture slightly smaller in diameter than the axial bore through said plug, a valve member having a portion slidably fitting the axial bore of said plug and having at its forward end sealing contact with the portion of said flexible disc overlapping the same, said valve member having an enlarged head at its rear end fitting within the rear portion of said false barrel, a plug closing the rear end of said false barrel forming an air chamber between the same and said enlarged head and having an air connecting passage with said shooting barrel, a sear normally engaging said valve member to hold the same in sealing contact with said disc, and a trigger for disengaging said sear permitting opening of said valve member and substantially instantaneous reclosing thereof by air pressure built up in said last-mentioned air chamber.

3. In an air gun, the combination with a false barrel and a shooting barrel adjacent thereto, of closures for the forward and rear ends of said false barrel, a plug in said false barrel in advance of the rear closure, said plug having a slightly conical forward face, an axial bore and a laterally extending passage connecting said axial bore with a port in said shooting barrel, a flexible disc bearing against the conical face of said plug and having a central aperture of smaller diameter than said bore, a valve member having a portion slidably fitting said bore with its forward face in sealing contact with the overlapping portion of said disc to form a storage chamber for compressed air within said false barrel, said valve member having an enlarged head at its rear end slidably fitting said false barrel and normally in advance of the rear closure for said barrel, the space between said head and closure communicating with a second port in said shooting barrel, a rod within said shooting barrel slightly smaller than the internal diameter of said barrel to form a restricted air passage extending between the aforesaid ports, a sear normally engaging said valve to hold the same in sealing contact with said disc, and a trigger for disengaging said sear and the substantially instantaneous release of the same whereby the disengagement of said sear will permit rearward movement of said valve member and discharge of compressed air from said storage chamber into said shooting barrel while the air passing through the restricted passage in said false barrel in rear of said enlarged head will quickly return said valve member to its seat and re-engagement with said sear.

4. In an air gun, the combination with a false barrel forming a compressed air storage chamber and a shooting barrel adjacent thereto, of means for delivering a metered quantity of compressed air from said storage chamber to said shooting barrel comprising a valve member in the rear portion of said false barrel having a rear head for fitting said barrel and a forward portion of smaller diameter, a plug in said false barrel having an axial bore for receiving the smaller diameter portion of said valve and also provided with a passage extending laterally from said bore into communication with a port in said shooting barrel there being a second port in said shooting barrel communicating with the portion of said false barrel in rear of said valve head, means cooperating with the forward end of said valve member when in its forward position for sealing between the air storage chamber and said laterally extending passage, a sear for normally holding said valve member in sealing position, a trigger for releasing said sear to open said valve and permit substantially instantaneous reclosing thereof, and a rod in said shooting barrel slightly smaller than the internal diameter thereof and extending between said ports to form a restricted air passage therebetween, said rod having a portion of smaller diameter extending forward of the forward port to form a stop for a projectile in said shooting barrel.

5. In an air gun, the combination with a false barrel constituting a storage chamber for compressed air and a shooting barrel adjacent thereto and having a connecting passage therewith, of a valve for controlling the discharge of compressed air from said storage chamber into said shooting barrel, said valve having a face of relatively small area exposed to the pressure within the storage chamber and an opposite face of greater area exposed to pressure within the shooting barrel whereby said valve when open will be automatically returned by differential pressure, a sear for normally holding said valve in position to seal said storage chamber from said connecting passage, and a trigger for releasing said sear permitting automatic opening of said valve by air pressure on said small area face, said sear and trigger having cooperating portions fashioned to be operatively engaged and immediately disengaged by the pulling movement of the trigger whereby said sear after releasing said valve is permitted substantially instantaneous reengagement therewith.

6. In an air gun, the combination with a stock and a storage chamber for compressed air, of air compression means comprising a pump barrel located within said stock, a piston in said barrel, a piston rod extending out through the rear end of said stock and resiliently actuated in an outward direction, and foot engageable means on said stock for relatively actuating said piston and barrel in the opposite direction.

7. In an air gun, the combination with a stock and a false barrel forming a storage chamber for compressed air, of air compression means comprising a pump barrel located within said stock, a piston in said pump barrel, a piston rod extending out from the rear end of said stock and resiliently actuated in an outward direction, and a step normally located in a recess in said stock and adapted to be extended laterally outward therefrom for engagement by the foot of the operator to depress the gun and pump barrel relative to said rod and piston.

8. In an air gun, the combination with a stock and a false barrel forming a storage chamber for compressed air, of air compression means comprising a pump barrel located within said stock, a piston in said pump barrel, a piston rod extending out from the rear end of said stock and resiliently actuated in an outward direction, said rod having a foot portion at its lower end normally flush with the end of the stock, a step normally located in a recess in said stock and adapted to be extended laterally outward therefrom for engagement by the foot of the operator to depress the gun and pump barrel relative to said rod and piston, and means operated by said step when returned to its recess for locking said foot portion in its normal position.

9. In an air gun, the combination with a stock and a storage chamber for compressed air, of means for supplying compressed air to said storage chamber comprising a pump barrel within said stock, a piston in said pump barrel, a rod for actuating said piston in an inward direction, resilient means for actuating said piston and rod in an outward direction, and a valve for closing a vent port through said piston gravity seated when said gun is held with the stock downward and separating from its seat when the gun is reversed in position to prevent compression of air by said piston.

10. In an air gun, the combination with a stock and a storage chamber for compressed air, of means for supplying compressed air to said storage chamber comprising a pump barrel within said stock, a piston in said pump barrel, a rod for actuating said piston in an inward direction, resilient means for actuating said piston and rod in an outward direction, a ball valve for closing a vent port through said piston gravity seated when said gun is held with the stock downward and separating from its seat when the gun is reversed in position to prevent compression of air by said piston, and a cup for receiving said ball valve when separated from its seat holding the same out of the path of the air current passing through said port.

11. In an air gun, the combination with a storage chamber for compressed air and a shooting barrel, of a valve controlling discharge of air from said storage chamber into said barrel, said valve having a limited area exposed to the pressure in the storage chamber and a larger area exposed to pressure in the barrel, means for normally locking said valve closed, and a trigger for releasing said locking means, whereby said valve is automatically opened and closed by differential air pressures and a metered quantity of air is delivered into the barrel unaffected by velocity of trigger movement.

12. In an air gun, the combination with a storage chamber for compressed air and a shooting barrel, of a valve controlling discharge of air from said storage chamber into said barrel, said valve having a small area exposed to pressure in the storage chamber and a larger area exposed to pressure in the barrel, a sear for locking the valve in closed position, and a trigger for releasing said sear, whereby the valve is automatically opened and closed by differential air pressures to deliver a metered quantity of air to said barrel unaffected by the velocity of trigger movement.

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