May 19, 1953 W. S. WELLS 2,638,884

AIR GUN

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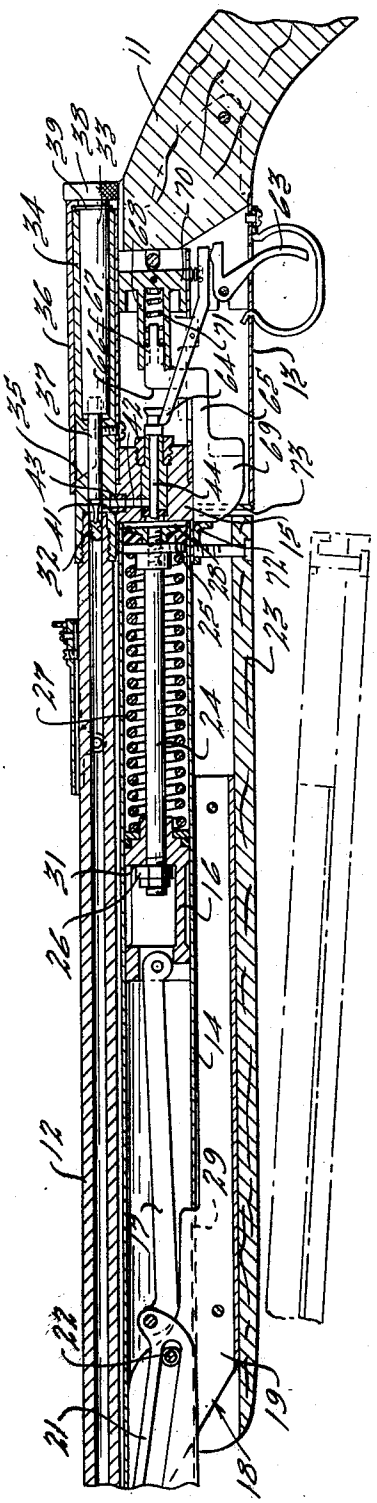


Fig. 1.

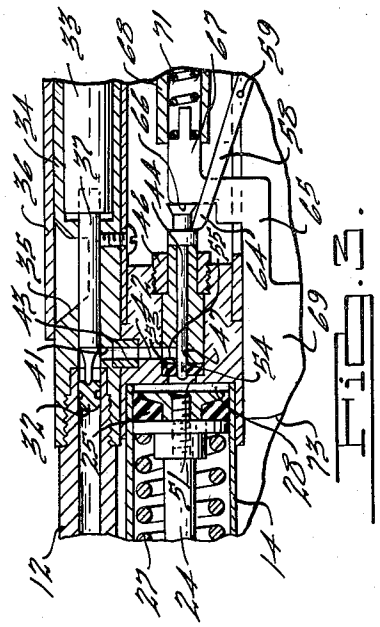


Fig. 3.

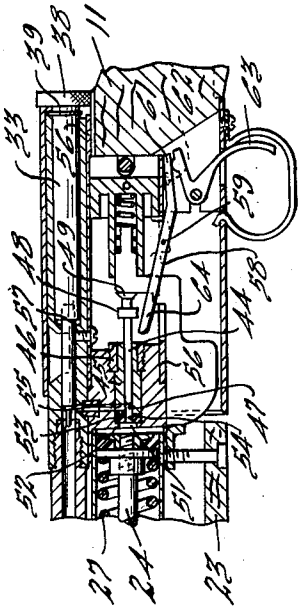


Fig. 2.

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AIR GUN

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4 Claims. (Cl. 124—15)

1

This invention relates generally to air guns and more particularly to a novel valve construction for use in controlling communication between a compressed air charge chamber and the barrel of the gun, and novel means associated with said valve construction for operating and controlling the same.

In compressed air guns such as the type shown in my copending application, Serial No. 70,528, filed January 12, 1949, and now matured into Patent Number 2,604,088, a chamber is provided for containing a charge of air, and a barrel is provided for containing a projectile to be propelled from the gun. Valve means are incorporated between the chamber and barrel so that the air charge may be communicated to the barrel behind the projectile when the valve means is open to permit such communication. In my aforementioned patent application, and in most air guns, a spring-loaded hammer mechanism is employed for striking an element in the valve structure to open the same and permit the flow of air from the chamber to the barrel.

This invention relates primarily to a novel, inexpensive valve structure for use with the gun illustrated in my aforementioned patent application, but usable also with various other types of compressed air gun structures.

It is an object of this invention to provide a simple valve mechanism or structure which will control communication between an air charge chamber and the gun barrel, and which incorporates a valve element which is adapted to be moved into open position by the air charge itself when the gun trigger is pulled, thus obviating the need for a separate hammer mechanism to open the valve.

It is a further object of this invention to provide an air gun of the aforementioned type, in which simple and inexpensive means are provided for retaining the valve element in a position to prevent communication of the air charge from the chamber to the barrel until the trigger is actuated.

It is another object to provide an air gun structure of the aforementioned type, in which novel and inexpensive means are provided for automatically returning the valve element from its open to closed position after the projectile has been fired and prior to the firing of the next projectile.

It is a still further object of this invention to provide in an air gun of the aforementioned type, a novel valve construction and operating or controlling structure therefor, which is efficient and

2

durable in operation, inexpensive to manufacture and simple in construction.

These and other objects of this invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawing, in which:

Figure 1 is a fragmentary longitudinal sectional view of the air gun of this invention, illustrating the position of the parts just prior to the firing of the gun and illustrating in dot and dash lines the position of certain of the parts after the gun has been fired and at the beginning of the compressing operation of a new air charge;

Fig. 2 is a fragmentary sectional view similar to Fig. 1, illustrating the position of the parts upon the firing of the gun; and

Fig. 3 is an enlarged fragmentary sectional view of the structure in the vicinity of the valve, showing the position of the parts during the compressing operation of a charge of air.

Referring now to the drawings, it will be seen that an air rifle is illustrated, although it will be understood that this invention is not limited to a rifle or to any particular gun design other than in the manner which will hereinafter appear. The air rifle illustrated in the drawing includes a stock 11, barrel 12, and trigger guard and housing 13, all interconnected in a suitable and conventional manner. A longitudinally extending tubular member or cylinder 14 is disposed below the barrel 12 and the rear portion thereof extends into and is supported by the forward end of a valve body 15, while the intermediate and forward portions thereof are connected to the barrel by any suitable means. A tubular cage member 16 is slidably mounted in cylinder 14 and has one end of link 17 of a scissors type pump mechanism 18 connected to the forward end thereof. The other end of link 17 is connected to an intermediate portion of a second link 19 by means of a slotted arm 21 pivoted to link 17 and to a pin 22 on link 19 engageable with the slotted arm. Link 19 has its forward end (not shown) pivotally connected to the cylinder 14, and carries a handle or forearm member 23 on the rear end thereof. The handle or forearm member 23, as can be seen in Fig. 1, is normally disposed in a flush relationship with the underside of the cylinder 14, but is movable downwardly and forwardly, as shown in dot and dash lines, so as to slide the cage member 16 forwardly in the cylinder 14.

The rear end of the cage member is provided with an axial aperture through which extends a piston rod 24, the rod having at its rear end

a piston 25 slidable within cylinder 14. The forward end of piston rod 24 has a stop member 26 disposed within cage member 16, so as to limit rearward movement of the piston rod relative to the cage member. A heavy compression coil spring 27 surrounds piston rod 24, one end of this spring resting against cage member 16 and the other end abutting piston 25. The spring 27 thus acts to urge the piston and piston rod rearwardly with respect to cage 16, this action being limited by stop 26. As will be seen in Fig. 1, when the cage is in its rearmost position, that is, when forearm member 23 is lifted, piston 25 will be adjacent the rear end of cylinder 14, leaving a small air chamber 28 between the face of the piston and valve body 15. When the forearm member 23 is moved downwardly as shown in the dot and dash lines of Fig. 1, the forward movement of cage 16 will cause forward movement of piston 25 within cylinder 14. At the end of its stroke, the piston will allow air to enter the cylinder through clearance aperture 29, and this air will be compressed when the cage is again moved rearwardly by lifting forearm 23. The compressing force will be transmitted from the cage to the piston through coil spring 27, which is preferably of substantial stiffness, but will give an amount depending on the compressive force of the air. At the end of the compression stroke the stop 26 will thus be moved away slightly from its adjacent wall 31 of the cage. Upon release of the compressed air within chamber 28, the air will be forced into barrel 12 to propel the pellet 32. During this action, the expanding movement of spring 27 will sustain the compressive force of the air throughout the travel of the pellet through the barrel, as described in detail in the aforementioned application.

Means are provided for loading the pellets 32 into the barrel, and this means preferably comprises cylindrical bolt 33 which is slidable within a tubular bolt slide 34 secured to the rear end of barrel 12. A slot or notch 35 is provided in the upper portion of bolt slide 34, and the slide is surrounded by a cover 36 which when in its forward position covers the slot 35. A pin 37 is secured to the forward end of bolt 33, and a knurled knob 38 is secured to the rear end of the bolt. When the bolt is slid rearwardly by means of knob 38, the cover 36 will move in unison with the bolt by virtue of a shoulder 39 on the bolt which holds cover 36 against axial movement relative to the bolt. This rearward sliding movement will uncover notch 35 and draw pin 37 behind the notch, allowing a pellet 32 to be dropped therein. The bolt may then be slid forwardly, positioning pellet 32 immediately forwardly of a port 41 in the bolt slide. This port communicates with a port 42 in valve body 15, a sleeve 43 being provided at the juncture of the two ports. It will thus be seen that when the compressed charge of air is allowed to pass through ports 42 and 41 into the barrel, the air will be forced against the rear end of pellet 32 to propel the pellet through the barrel, the bolt being latched in its forward position by any conventional means.

The novel and improved means for controlling communication of compression chamber 28 with the barrel 12 comprises a valve 44 slidably supported within valve body 15 by means of a concentric insert member 45. This insert member is held in place by a threaded member 46, and an axial aperture 47 in the insert member supports valve 44 for sliding movement. The valve comprises an elongated pin having a shoulder 48 thereon adjacent the rear end of the pin, and a tapered head 49 at the rear terminal. The pin is of such length as to extend entirely through valve body 15 when shoulder 48 abuts the rear end of insert 45. The forward end of the valve body is provided with an axial aperture 51 communicating with chamber 28 and a shoulder 52 surrounding this aperture. An annular valve sealing member 53 is firmly secured between the forward end of insert 45 and the shoulder 52 of the valve body. This sealing member is preferably constructed of rubber or similar resilient material and is provided with a central aperture 54 connecting aperture 51 and passageway 47. Aperture 54 is of such diameter as to allow the forward end of pin 44 to be pushed therethrough, with the sealing member engaging the pin. However, when the valve 44 is withdrawn from sealing member 53, air may pass into the passageway 47 and through a radial aperture 55 in the insert member 45, thus passing to valve body port 42 and thence into the barrel.

The rear end of the valve body is supported by a mounting member 56 of generally cylindrical shape, bolt slide 34 being also secured to this member by means of a screw 57. Means are provided for releasing valve 44 for movement into its rearward or open position and for further returning the valve into its forward or closed position. This means comprises a sear 58 pivotally supported at an intermediate point 59 by mounting member 56. The rear end 61 of the sear is normally urged downwardly by a spring 62, but is movable to an upper position by trigger 63. The forward end 64 of sear 58 is provided with a toe which engages shoulder 48 of valve 44 when the latter is in its forward position and when toe 64 is moved upwardly by the action of spring 62. This position is shown in Fig. 1, and it will be seen from this figure that any rearward force on valve 44 will be resisted by the action of sear 58. This rearward force will be created by the compression of air in chamber 28, the compressive force acting against the forward end of valve 44.

Any suitable means may be provided in order to return valve 44 from its open to its closed position after the gun is fired, just so long as the valve is closed prior to the beginning of the compression stroke of piston 25. Suitable linkage means or the like might be connected with the air compressing mechanism, for this purpose, but in the illustrated embodiment a return member 65 is provided rearwardly of the valve. This return member has an actuating face 66 which is engageable with tapered head 49 of the valve, a guide portion 67 which is slidably supported by a guide cylinder 68, and a cam portion 69 which is engageable by a portion of the forearm member 23. Guide cylinder 68 is rigidly secured to mounting member 56 by means of an annular portion 70 and has a compression coil spring 71 therein which is engageable with the rear end of guide portion 67 of the return member. The spring 71 is so arranged as to normally urge face 66 of the return member into extended position and against head 49 of the valve as shown in Fig. 3, so as to force the valve into its forward or closed position. However, when the forearm member 23 is in its upper position as shown in Fig. 1, a wear plate 72 at the rear end of the forearm member will engage the curved cam face 73 of the return member cam portion 69, thus moving the return member into retracted position against

the action of spring 71 and out of engagement with head 49 of the valve.

The cooperation of the elements may perhaps best be understood by a description of a complete cycle of events during the loading, firing and reloading of the gun. Starting from an initial position in which there is no compression in chamber 28, and assuming that a pellet 32 has been positioned in the barrel in accordance with the previous description, a charge of air will be compressed within chamber 28 by lowering and then raising forearm member 23. It will be understood that during this action the valve 44 will be in its closed position as shown in Fig. 1, and will be held against rearward movement by sear 58. When the full charge has been compressed within chamber 28, the air pressure will act against seal member 53 as well as against the end of valve 44. The pressure of air against sealing member 53 will cause this member to tightly surround the valve pin, and air will thus be prevented from leaking into the barrel. This condition will continue until trigger 63 is pulled, at which time the toe 64 will be removed from its position behind valve shoulder 48. The valve 44 will thus be instantaneously released for rearward movement, and the great pressure of air in chamber 28 will cause the valve to be driven rapidly behind aperture 55, thus allowing the compressed air to enter barrel 12 behind the pellet. It will be observed that since forearm 23 is in its upper position, return member 65 will be held in its rearward position as shown in Fig. 1 so that face 66 will be spaced rearwardly from head 49. Thus there will be substantially no resistance to the opening movement of valve 44, and this movement will occur with such rapidity as to immediately propel pellet 32 with the full compressive force. The propulsion of the pellet will be accompanied by expansion of spring 27 with the effects described in detail in the aforementioned application. Face 66 will serve as a limiting stop for valve 44, thus preventing leakage of the air through the rear of the valve body and preventing the valve from falling out of aperture 47.

After the pellet has been ejected, the valve 44 will remain in its rearmost position as shown in Fig. 2 until it is desired to reload and recharge the gun. The reloading will take place by rearward movement by bolt 33 as previously described and when the gun is recharged by movement of forearm 23 and its associated mechanism, the valve 44 is closed to trap the compressed air charge in the chamber. In this embodiment when forearm 23 is moved, plate 72 will be moved away from cam surface 73, allowing spring 71 to urge the return member 65 forwardly into the position shown in Fig. 3. The face 66 of the return member will engage head 49 of the valve, thus forcing the valve pin through sealing member 53. The valve will thus be in its closed position with shoulder 48 abutting insert 45, and during movement into this position, the toe 64 of the sear will override shoulder 48 and will engage the shoulder to prevent subsequent rearward movement of the valve. When forearm 23 is again lifted to compress the charge, return member 65 will again be moved into its retracted position by plate 72, but valve 44 will be held in place by the sear, and the gun will thus again be in condition for firing.

While it will be apparent that the preferred embodiment of the invention herein disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. In an air gun, a barrel adapted to receive a projectile, a chamber for holding a charge of compressed air, valve means disposed between said chamber and said barrel for controlling communication between the same, said valve means including a valve body having a passageway communicating with said chamber and with said barrel, a washerlike resilient sealing element connected with said valve body adjacent said chamber and having one face thereof subject to the compressive force of compressed air in said chamber, the outer periphery of said sealing element being rigidly confined against outward radial movement and the other face of said sealing element being rigidly abutted and retained against movement, said element having an aperture therein in alignment with said valve body passageway, an elongated valve element slidably disposed in said valve body and having an end portion frictionally insertable into said sealing element aperture when said valve element is in its closed position so that the compressed air in said chamber will cause said sealing element to deflect into tight sealing engagement with said valve element and prevent air from flowing from said chamber to said barrel, said valve element being adapted to be forced from engagement with said sealing element by a charge of air within said chamber so as to open said valve means and permit air to flow from said chamber to said barrel, means engageable with said valve element to retain the same in its closed position and releasable to permit said valve element to be moved from its closed to open position when it is desired to propel a projectile from said barrel, and means actuable after said value element has been moved to its open position to move the same to its closed position.

2. In an air gun, a barrel adapted to receive a projectile, a chamber for holding a charge of compressed air, valve means disposed between said chamber and said barrel for controlling communication between the same, said valve means including a valve body having a passageway communicating with said chamber, an enlarged recess in said valve body communicating with said passageway and terminating in a shoulder adjacent said passageway, a resilient sealing element disposed in said recess and abutting said shoulder, said element having an aperture therein in alignment with said passageway, an insert disposed in said recess and abutting said sealing element, means retaining said insert in said valve body recess in engagement with said sealing element, said insert having a passageway therein communicating with said barrel and in alignment with said valve body passageway and said element aperture, an elongated valve element slidably disposed in said insert and having an end portion frictionally insertable into said sealing element aperture when said valve element is in its closed position to prevent air from flowing from said chamber to said barrel, said valve element being adapted to be forced from engagement with said sealing element by a charge of air within said chamber so as to open said valve means and permit air to flow from said chamber to said barrel, means for releasably retaining said valve element in its closed position and releasable so that said valve element can move to its open position when it is desired to fire a projectile from said barrel, and actuatable means for mov-

ing said valve element from its open position to its closed position.

3. In an air gun, a barrel adapted to receive a projectile, a chamber for holding a charge of compressed air, charging mechanism for compressing air within said chamber, valve means disposed between said chamber and said barrel for controlling communication between the same, said valve means including a valve body having a passageway communicating with said chamber and with said barrel, a sealing element engaging said valve body adjacent said chamber and having an aperture therein in alignment with said valve body passageway, an elongated valve element slidably disposed in said valve body and having an end portion frictionally insertable into said sealing element aperture when said valve element is in its closed position to prevent air from flowing from said chamber to said barrel, said valve element being adapted to be forced from engagement with said sealing element by a charge of air within said chamber so as to open said valve means and permit air to flow from said chamber to said barrel, means engageable with said valve element to retain the same in said closed position and releasable to permit said valve element to open when it is desired to propel a projectile from said barrel, and actuatable means operatively connected with said charging mechanism for moving said valve element from its open position to its closed position upon actuation of said charging mechanism.

4. In an air gun, a barrel adapted to receive a projectile, means defining a chamber for holding a charge of compressed air and a passageway communicating said chamber with said barrel, a washerlike resilient sealing element connected with said means between said chamber and said passageway and having one face thereof subject to the compressive force of compressed air in said chamber, the outer periphery of said sealing element being rigidly confined against outward radial movement and the other face of said sealing element being rigidly abutted and retained against movement, said sealing element having an aperture therein in alignment with a portion of said passageway, an elongated valve element slidably disposed in said means and having one end portion frictionally insertable into said sealing element aperture so that the compressed air in said chamber will cause said sealing element to deflect into tight sealing engagement with said valve element and prevent air flowing from said chamber to said barrel when said valve element is in engagement with said sealing element, means engageable with said valve element to retain the same in its closed position in engagement with said sealing element and releasable to permit said valve element to be moved from its closed to its open position when it is desired to propel a projectile from said barrel, said valve element being adapted to be forced from engagement with said sealing element by the charge of compressed air within said chamber so as to permit the air to flow from said chamber to said barrel through said passageway, and means actuatable after said valve element has been moved to its open position to move the same to its closed position.

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