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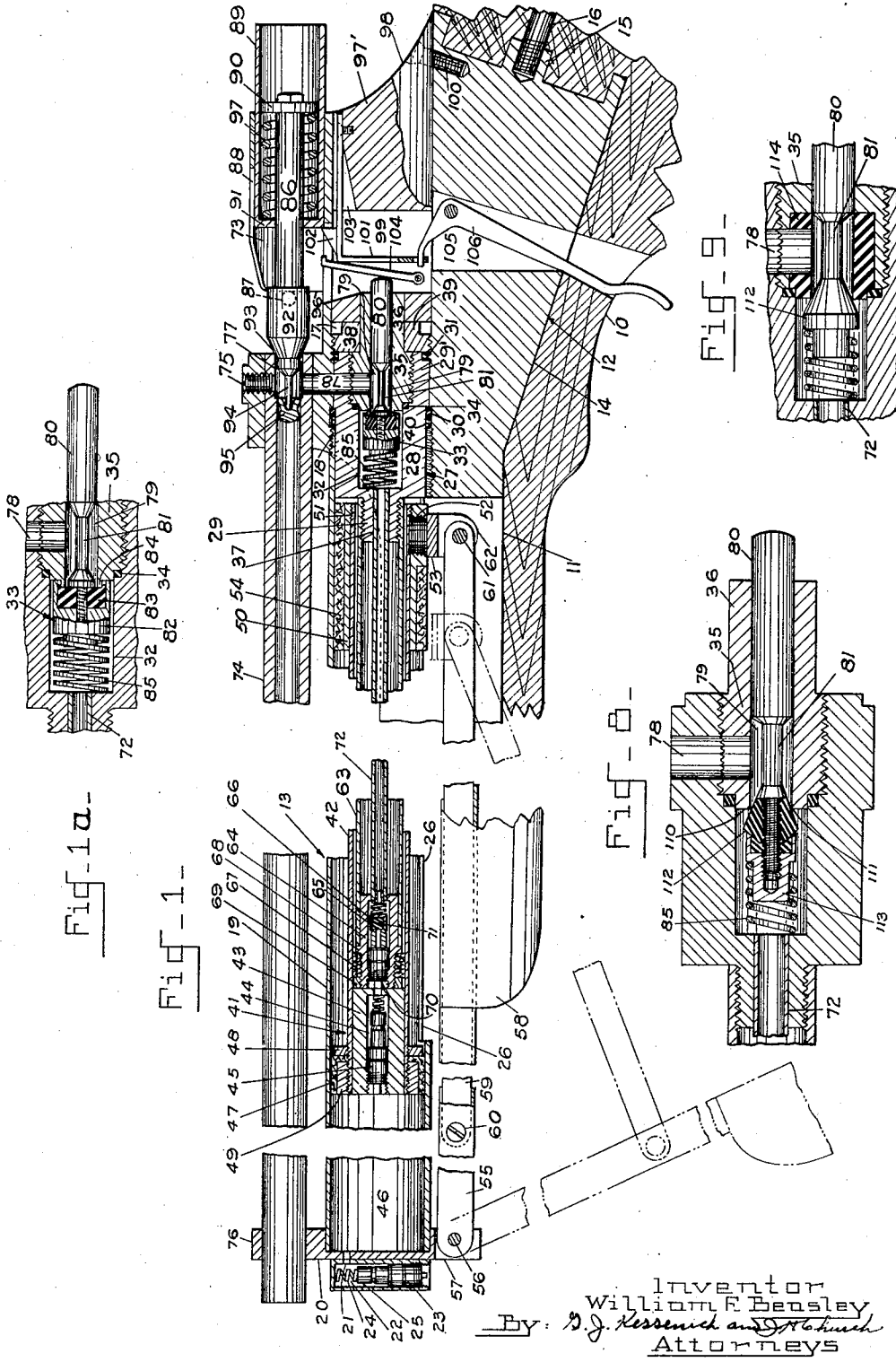
W. F. BEASLEY

2,299,073

GUN

Filed Oct. 26, 1939

2 Sheets-Sheet 1



Oct. 20, 1942.

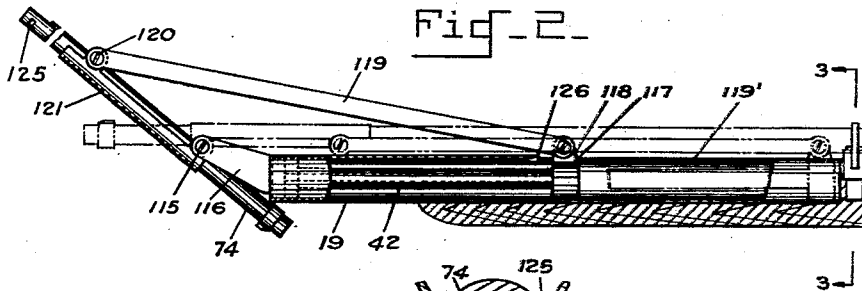
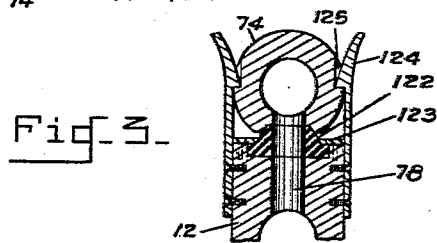
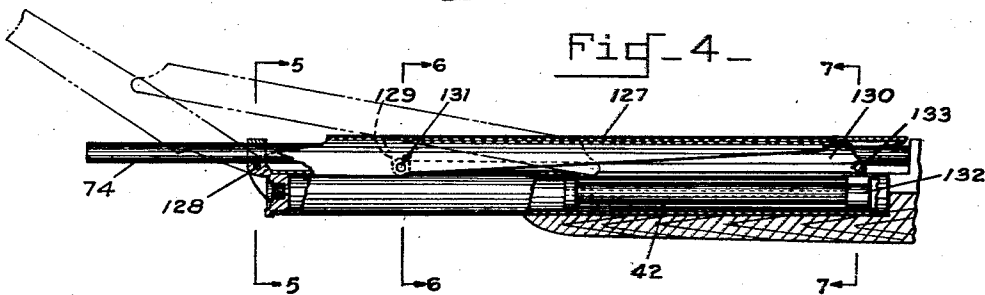
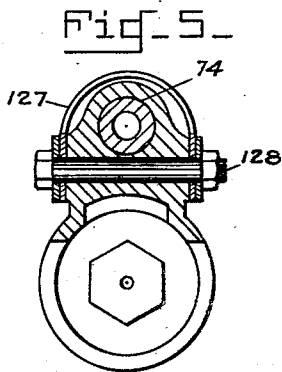
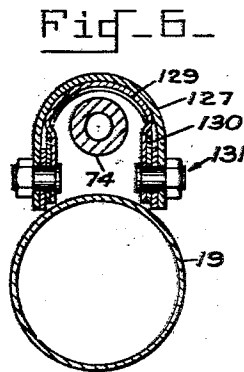
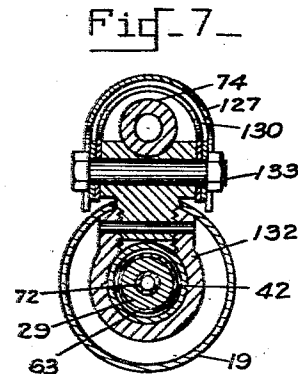
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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

2,299,073

GUN

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Application October 26, 1939, Serial No. 301,440

13 Claims. (Cl. 124—11)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to an air gun that may be physically embodied in the form of either a rifle or pistol.

It is an object of the invention to materially increase the unit working pressure of the compressed air utilized as the propelling force for the projectiles as compared with the unit working pressures heretofore employed in the art for this purpose.

It is a further object of the invention to greatly increase the mean effective unit pressure of the compressed air utilized as the propelling force for propelling a projectile from the gun by employing an increased maximum unit working pressure.

It is still a further object of the invention to provide a compound stage compressor for developing the high unit pressures used in the air gun of this invention adapted to be manually actuated with minimum effort and through a minimum number of cycles to develop the desired pressure.

It is a still further object of the invention to employ a compound compressor wherein the final stage of the compressor also serves as an air reservoir for holding the compressed air propelling charge until released to propel a chambered projectile through the bore of the barrel.

A still further object of the invention is to generally improve the elements and organization of the same in an air gun to provide a ballistic performance approaching that of powder type firearms; to provide for economy of fabrication; and, facilitate the balance of the weapon.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings in which:

Fig. 1 is a fragmentary sectional view partially in elevation showing a preferred embodiment of the present invention with all parts in full line positions in readiness for firing. The chain line position of the toggle shows it in its forward position in the compressor actuating cycle;

Fig. 1A shows an enlarged detail of the main operating valve;

Fig. 2 is a fragmentary view partially in elevation and partially in section showing a modification which employs the barrel as one link of the toggle used for actuating the compressor. The full line position of the barrel shows it in its forward position of the compressor actuating cycle while the chain line position of the barrel shows it in its normal firing position;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2 looking in the direction of the arrows;

Fig. 4 is a fragmentary view partially in elevation and partially in section showing a further modification in which the compressor toggle is disposed on the top side of the barrel. The toggle is shown in normal position of firing in full lines and in its forward position in the compressor actuating cycle in chain lines;

Figs. 5, 6 and 7 are sectional views taken on the lines 5—5, 6—6, and 7—7 of Fig. 4, respectively, looking in the direction of the arrows;

Figs. 8 and 9 are modifications of valves suitable for use with the compressor.

Referring now to the drawings by characters of reference, and more particularly to Fig. 1, there is shown the stock portion 10 of an air gun embodying this invention provided with a suitably recessed or bed portion 11 adapted to seat the gun receiver frame or casting 12 and low pressure cylinder of a compound or other multiple stage compressor generally indicated at 13. The stock 10 may be formed of any material desirable for the purpose, such as wood of walnut, and may be designed to form a support for the weapon in either the embodiment of a pistol or rifle.

The receiver frame 12 may be comprised of a plurality of separate components secured together in cooperating relation to form the frame, but as herein shown is preferably formed as a casting provided with an inclined lower face 14 adapted to engage and be seated on the corresponding inclined portion of the bed 11 of the stock. Conveniently the frame 12 may be removably secured to the stock 10 in any conventional manner, as by the interiorly threaded boss 15 formed on the rear face of the frame and rod 16 interthreaded with the boss and secured to

the stock. Intermediate its upper and lower faces the casting 12 is suitably formed to provide a longitudinal cylindrical passage 17 interiorly threaded adjacent its forward end as indicated at 18 for a purpose hereinafter more specifically referred to.

The compressor 13 shown is of the two stage type, although it will be obvious that any desirable multi-stage compressor may be adapted to the purpose. As shown the compressor comprises a low pressure cylinder 19 of any suitable substance capable of taking a high polish and resisting oxidation or other corrosion and is seated in the bed 11 of the stock 10 and demountably secured to the frame 12 at its rear end through interthreaded engagement with the threads 18. At its forward or muzzle end the low pressure cylinder 19 is closed by an end closure cap 20 secured to the cylinder in any convenient fluid sealed relation and the cap is provided with an air intake port 21 communicating with atmosphere through the intake passage 22 controlled by a conventional spring actuated or similar one-way valve 23 preferably of the type having a "Duprene" or like plastic seat for the valve element. In the form of the invention shown in Fig. 1 valve 23 is a spring actuated valve having a spring 24 assembled in the seated position of the valve member 25 to have an initial compression substantially equal to the weight of the member whereupon the member 25 may be displaced from its normal seat against the action of spring 24 by atmospheric pressure.

The low pressure cylinder 19 is rectilinearly slotted through its lower surface from its rear or breech end to a point intermediate its forward or muzzle end and medial portion as indicated at 26 for a purpose made clear hereinafter and is closed at its breech end by a somewhat elongated plug 27 of generally circular section throughout its length. The plug 27 is formed to have a body portion 28 of an outside diameter of such dimension as to snugly fit within the breech end of cylinder 19 in circumferential engaging relation and has an integral exteriorly threaded nipple 29 of reduced diameter protruding from its muzzle end axially of the cylinder 19. Rearwardly of the body portion 28 the plug 27 is formed to have an annular portion 29' of increased diameter and in which seats for the "Neoprene" or similar gaskets 30 and 31 are provided. The body portion 28 of the plug 27 is longitudinally bored from its breech end as indicated at 32 to form a housing for the main valve 33 hereinafter more specifically referred to, and is interiorly threaded inwardly from its breech end on a slightly increased diameter to provide a seat for a gasket 34 of material similar to the gaskets 30 and 31 which is interposed between its seat and a valve stem bushing 35 secured within the bore in interthreaded relation and having a rearwardly extending protrusion 36. The nipple 29 is axially bored as indicated at 37 to communicate with the valve housing portion 32 and the plug 27 is removably retained in frame 12 in operable relation with cylinder 19 by a lock nut or similar removable fastening means 38 centrally apertured to receive the protrusion 36 and exteriorly threaded for interthreaded engagement with cooperating interior threads in passage 17 in abutting engagement with the rear or breech faces of the plug 27 and body of the valve stem bushing 35. For expedient insertion and removal of the fastening means 38 the stock 39 surrounding the aperture for protrusion 36 may be

formed to receive any suitable wrench or tool. To insure fluid tight joints between atmosphere and the valve housing 32 by way of the valve stem bushing 35 the gaskets 30 and 31 are interposed between their respective seats in the plug 27 and the end of cylinder 19 and inner face of means 38, respectively, likewise the gasket 34 is interposed between valve stem bushing 35 and the portion of bore 32 of reduced diameter for a similar purpose. In practice, in order to obviate the non-uniform deformation of gasket 30, which would be effected by directly abutting the gasket against the end of cylinder 19 due to the slot 26, it is preferable to insert an annulus 40 of slightly less outside diameter than the diameter of cylinder 19 between the end of the cylinder and gasket 30.

Disposed within the cylinder 19 for reciprocal movement is a piston 41 and tubular piston rod 42 having its axis coincident with the axis of cylinder 19 while any piston suitable for the purpose may be used, for convenience of illustration the piston 41 is shown as comprising a cylindrical insert 43 inserted within the muzzle end of the piston rod 42 in any fluid sealed manner and as having a passage 44, controlled by a spring or other suitably actuated one-way valve 45, intercommunicating between the low pressure chamber 46 of low pressure cylinder 19 and the interior of the piston rod 42 which is utilized as a high pressure cylinder. To establish a fluid seal between the skirt of the piston and cooperating walls of the chamber 46 the piston is provided with a cup leather 47 treated with tallow, tanalin or a suitable lubricating oil and retained in position on the piston skirt by opposed retaining elements 48 and 49. In lieu of the cup leather 47 the substitution of washers of synthetic composition as is presently used commercially in oil seals and such for example as shown in U. S. Patent No. 2,099,241 to the Garlock Packing Co., is contemplated. Valve 45 is designed to admit passage of air compressed in chamber 46 into the interior of the piston rod 42 but will not permit passage of air in the reverse direction. At the breech or rear end of the piston rod 42 is secured a cross-head 50, as by the interthreaded or equivalent engagement 51. The cross-head 50 is formed with an interiorly threaded boss 52 for remotely receiving a lug 53 adapted to slide in the slot 26 of cylinder 19, and has sleeved thereover a fibrous or other suitable relatively soft tubular member 54 which engages the interior surface of cylinder 19 for guiding the cross-head in movement axially of the cylinder.

For actuating the piston 41, piston rod 42 and cross-head 50, a toggle linkage is employed which comprises a link 55 of U-shape in cross-section pin connected at one end, as by the pin 56, to a point adjacent the muzzle end of cylinder 19 which may conveniently be a bifurcated depending ear 57 made integral with the end closure cap 20. Adjacent its end remote from the pin 56 the link 55 is provided with a hand grasp 58 preferably of the same material as the stock 10 and formed so as in its normal position, as shown in full lines in Fig. 1, to constitute a pleasing continuation of the contour of stock 10 and proper balance of the weapon. A second link 59 of generally rectangular or other suitable section shape in cross-section is connected by the pin 60 at one end to link 55 intermediate the ends of the latter and in such manner as to jack-knife between the sides of link 55 in the normal position of the links, shown in full lines in

Fig. 1. The end of link 59 remote from pin fastening 60 is pin connected to the lug 53 as at 61 for which purpose the lug 53 may conveniently be formed to have a bifurcated depending integral ear 62.

Within the tubular piston rod 42 and disposed axially of cylinder 19 is a stationary tubular member 63 secured at its breech or rear end to the nipple 29 in interthreaded relation and provided at its forward or muzzle end with piston 64 secured within the tubular member in fluid sealed relation and having a passage 65 leading from the interior of piston rod 42 to the interior of member 63 controlled by the spring actuated one-way valve 66. The piston 64 is sealed with respect to the cooperating interior surface of piston rod 42 by means of washers 67 of a material similar to the washer 47 secured to the piston in fluid sealed engagement with the interior of piston rod 42 and retained in position thereon between the fixed annular abutment 68, which also serves to position the piston within tubular member 63, and removable retaining fastener 69. Valve 66 is similar to valves 23 and 45 and has a valve core 70 threaded in the passage 65 and a spring loaded seat 71 formed of "Duprene" or similar plastic material normally engaging the exit of the passage in the core. As will be obvious from inspection the valve will permit passage of air or similar compressed fluid from the interior of the piston rod 42 thereby but will prevent passage of air in the reverse direction.

In order to keep the air compressed within the piston rod 42 from expanding after passage through valve 66 and to provide a storage reservoir in cooperation with the main valve housing 32 a tubular conduit 72 of relatively small diameter is extended between the bore 37 of nipple 29 and passage 65 axially of cylinder 19 and in fluid sealed relation with the bore and passage, respectively.

Adjacent its upper face the frame 12 is formed with a second longitudinal cylindrical passage 73 in parallel relation with passage 17 and in the forward portion of this passage the rear end of the barrel 74 is inserted and secured by the removable fastening device 75. The barrel is disposed in parallel relation with the cylinder 19 and is conveniently supported at its muzzle end by a perforated supporting lug 76 made integral with the end closure cap 20. As will be understood by those skilled in the art the barrel 74 may be rifled at a predetermined twist to impart sufficient rotation to a pellet or projectile forced therethrough for insuring stability of flight of the pellet through its trajectory.

As shown in Fig. 1 the lower wall defining the chamber 77 of the barrel, the portion of frame 12 intermediate the passages 17 and 73 below chamber 77, the plug 27 and the valve stem bushing 35 are formed with registering apertures which define a substantially vertical air conduit 78 leading from the chamber 77 of the barrel to the valve housing 32 through the horizontal passage 79 in valve stem bushing 35. Preferably the barrel fastener 75 lies directly over conduit 78 and the barrel is pierced through and receives the fastener in fluid sealed engagement in order that the fastener may be removed and the cooperating pierce in the barrel used for inspection of the chamber 77 and conduit 78.

The main valve 33 which serves as an outlet valve for the high compression storage reservoir formed by the conduit 72 and valve housing 32 comprises a valve stem 80 reciprocally disposed in

substantially fluid sealed relation within the passage 79 located in the valve stem bushing 35 and protrusion 35 thereof. The valve stem 80 is formed with an axially arranged portion 81 of reduced diameter and is so proportioned that the reduced portion 81 will underlie the passage 78 in all operable positions and project into the valve housing 32. A cylindrical valve cage 82 counter-bored at one end to receive a plastic valve element 83 of desirable characteristics of deformation under high unit pressures, such as "Neoprene" of relatively high durometer test is axially bored and mounted through its bore on the reduced portion 81 of the valve stem 80 with the element 83 confronting the mouth of passage 79. Any conventional means may be employed to secure the valve cage on the stem portion 81. An annular valve seat 84 integral with bushing 35 is formed about the mouth of passage 79 for engaging the valve element 83 and has a wall of such radial face thickness as to cause the necessary deformation of valve element 83 under predetermined pressure as will insure a substantially perfect seal. A spring 85 is interposed between the valve cage 82 and nipple 29 under assembled initial compression sufficient to normally retain the valve element 83 in effective sealed relation with the face of annular valve seat 84. The reduced valve stem 81 does not completely protrude through the valve cage 82 whereby leakage of air around the stem is obviated. As will be noted in the enlarged detail of the main valve 33 the end of the valve cage 82 adjacent the end of bushing 35 is arranged to have a predetermined clearance coordinated with the deformation of valve element 83 by valve seat 84. By this arrangement when valve seat 84 has deformed valve element 83 sufficient to assure a perfect seal the confronting ends of valve cage 82 and bushing 35 will engage to prevent further deformation of valve element 83 and thereby prevent destructive deformation of the valve element 83.

The breech closure comprises a rotatable and slidable bolt 86 manipulative by the bolt handle 87 operable in the cam slot 88. In the present form of the invention, although it is not intended that such embodiment be limitative, it has been found convenient to mount the hollow plunger or striker 89 of the firing mechanism within the rear portion of passage 73 for sliding movement and to then mount the bolt with its rear portion within the plunger and provide a collar 90 on the rear end of the bolt in engaging relation with the interior of the plunger for the purpose of guiding the bolt in its rotary and sliding movement. To further steady and guide the bolt the forward end of the plunger may be provided with the perforated closure 91 disposed as shown. A bolt head having a cylindrical body 92 and conical seat 93 of such included angle as to form a seal with the breech of the barrel chamber in the locked position of the bolt is formed on the forward end thereof and terminates in an axial finger 94 which functions to properly chamber a projectile or pellet 95. The receiver frame portion through which the passage 73 is formed is cut away adjacent the breech of the barrel to facilitate access to the barrel chamber for insertion of projectiles 95 and to form a locking shoulder 96 at the forward end of the cam slot 88 for engagement by the bolt handle 87 to hold the bolt in locking position with the conical surface 93 in sealed relation with the chamber against the pressure of compressed air or other fluid admitted to the chamber. A spiral spring or other

resilient element 97 is interposed between the collar 90 on the bolt and closure 91 on the plunger and is designed to be sufficiently compressed in the retracted position of the plunger as to drive the plunger forwardly when released from the retracted position, with such velocity as to impart a sharp blow to any obstruction lying in its path of movement a relatively short distance away.

A removable cylindrical insert 97' having its rear end 98 formed on a contour mating with the contour of stock 10 and formed intermediate its ends with a transverse through opening 99 is axially apertured from the forward end to the transverse opening and inserted within the rear portion of passage 17 with the axial aperture receiving the protrusion 36 of valve stem bushing 35 and its forward face abutting the rear face of stock portion 39 of fastening means 38. The insert 97' is retained in position with its contoured rear end 98 forming a continuation of the contour of stock 10 by any desirable fastening expedient such as means 100. An angular sear spring 101 having one of its legs secured to the insert 97' rearwardly of opening 99 and its other leg depending in the opening 99 carries a sear 102 adapted to engage and retain the plunger 89 in the retracted position shown in Fig. 1 against the influence of spring 97. The insert 97' is formed with a clearance space 103 adjacent the leg of the sear spring secured thereto to provide for displacement of the spring to disengage the sear from the plunger. A firing lever 104 is pivoted at its lower end in the passage 99 between the protruding end of valve stem 80 and depending leg of the sear spring in such manner that the valve stem 80 will normally urge the firing lever into its normal rearward position adjacent the sear spring. The upper end of the firing lever is extended through a slot in the web of frame 12 separating passages 17 and 73 and lies in the path of movement of plunger 89 so as to receive a sharp impact from the plunger upon release of the latter from its retracted position. A transverse opening 105 is extended from the lower face 14 of frame 12 into passage 17 in communicating relation with the opening 99 in insert 97' and a similar opening is formed in stock 10 communicating with the frame opening to provide for the mounting of the trigger 106 in the frame, which in the form shown is of the bell crank type having one arm engaged with the depending leg of sear spring 101 and the other arm extending without stock 10.

In the disclosure of Fig. 1 sights for the weapon have not been shown, however, the use of any conventional sighting system properly calibrated to the weapon is contemplated and as such system forms no part of the present invention it is not thought essential to disclose the system.

In operation of the weapon the bolt handle 87 is rotated and retracted through the cam slot 88. This motion will cause the rear face of the head portion 92 on the bolt to engage and retract the plunger 89 and spring 97 as a unit. When the plunger 89 is displaced to a position in rear of the sear 102 the sear under the influence of the sear spring 101 will be projected into the path of forward movement of the plunger. When the bolt is closed the sear will retain the plunger in retracted position and forward relative movement of the bolt with respect to the plunger will compress the spring 97 between the collar on the bolt and forward end cap on the plunger to drive the plunger forwardly when released from its

retracted position by the sear. Optionally, a pellet 95 may be chambered, after the bolt is opened, and the bolt closed to properly seat the pellet through the action of finger 94 and to seal the breech end of the chamber through interengagement of the conical seat 93 with the breech end of the chamber or this phase of the bolt operation may be performed subsequent to operation of the compressor. In either sequence of operation of the bolt it is locked with handle 87 engaging shoulder 96.

Assuming that a pellet has been chambered and the bolt locked the operator next grasps the hand grasp 58 and swings it from its full line position shown in Fig. 1 through the chain line position thereof which pivots the link 55 about its pin connection 56 and displaces the link 59 forwardly through its position also shown in chain lines. Forward movement of link 59 slides the cross-head 50, attached piston rod 42, and piston 41 forwardly to end closure cap 20 and the piston 41 compresses the air initially confined in chamber 46 by one-way valve 23 at atmospheric pressure. The air so compressed in chamber 46 is forced through the one-way valve 45 in piston 41 into the space or chamber within piston rod 42 between the piston 41 and stationary piston 64 of predetermined smaller volume than the full volumetric capacity of chamber 46. After completion of the forward phase of the operating cycle of the compressor the hand grasp 58 is returned to its normal position shown in full lines in Fig. 1. Return of the hand grasp 58 to its normal position likewise restores the toggle linkage to its initial position which returns the cross-head 50, piston rod 42 and piston 41 to the position shown in Fig. 1, in which position the pistons contact as shown to completely displace the volume therebetween. Movement of the piston 41 from its forward operating position to its normal position will compress the air compressed by the first stage of compression and confined in the piston rod 42 between pistons 41 and 64 and force it past one-way valve 66 in piston 64 into the high compression storage reservoir formed by the conduit 72 and valve housing 32 where it is retained under high compression by valve 66 and main valve 33 in readiness for release to act upon the pellet 95 as a propelling agent. It will be understood that the initial loading on the springs of valves 45 and 66 will be coordinated with the pressures developed to function as above referred to and that the compressor may be actuated through several cycles if desired, although ordinarily one cycle operation of the compressor will develop sufficient pressure. With air or other gas now stored in the high compression storage reservoir formed by valve 66, conduit 72, and valve housing 32 and the plunger 89 retained in the retracted position by sear 102 the weapon is in readiness for firing. Release of the sear 102 from engagement with the retracted plunger 89 through the trigger 106 will permit the plunger to move forward and impart a sharp blow to the firing lever 104 which will effect rotation of the firing lever and forward movement of the valve stem 80 and attached valve 33. Opening of the valve 33 releases the compressed air in the high compression storage chamber under high unit pressure to expand through conduits 79 and 78 against the chambered pellet 95 which is driven through the rifled barrel under the accelerating force of the expanding gases.

rear end portion of the low pressure member, a piston having a passage controlled by a one-way valve mounted within the low pressure member for reciprocal movement toward and from its forward end closure, a tubular piston rod connected to the piston with its interior in communication with said passage, means on the piston rod protruding through said slot for reciprocating the piston rod and piston, a second piston stationarily mounted within the tubular piston rod having a passage controlled by a one-way valve, means forming a conduit connecting said last named passage with the interior of the valve housing, a barrel mounted in parallel relation to said low pressure member, means forming a conduit between the interior of the valve housing and the chamber of the barrel, a main valve in said valve housing for controlling the last named conduit, firing mechanism for controlling said main valve, and means for admitting air from atmosphere into the chamber defined by the low pressure member between its forward end closure and said reciprocally mounted piston.

2. In a pneumatic gun comprising in combination, a low pressure tubular member closed at its forward end and slotted from a point intermediate its ends rearwardly, a valve housing member secured to the rear end portion of the low pressure member, means for admitting air from atmosphere into the low pressure member at a point forwardly of said slot, a piston having a passage controlled by a one-way valve mounted within the low pressure member for reciprocal movement toward and from its forward end closure, a tubular piston rod connected to the piston with its interior in communication with said passage, means on the piston rod protruding through said slot for reciprocating the piston rod and piston, a second piston stationarily mounted within the tubular piston rod having a passage controlled by a one-way valve, means forming a conduit connecting said last named passage with the interior of the valve housing and a main valve mounted within the valve housing for controlling the outlet from said conduit.

3. In a pneumatic gun comprising in combination, a receiver frame formed to have a longitudinal passage, a low pressure tubular member closed at its forward end slotted from a point intermediate its ends rearwardly secured with its rear end in the forward portion of said passage, means for admitting air into the low pressure member at a point forwardly of said slot, a valve housing member having a forwardly protruding nipple secured to the rear portion of the low pressure member, means within said passage securing the valve housing member in position, a piston having a passage controlled by a one-way valve mounted in said low pressure member for reciprocation between the slot and forward end closure, a tubular piston rod connected to the piston with its interior in communication with said passage, means on the piston rod protruding through said slot for reciprocating the piston rod and piston, a tubular member disposed within the piston rod and secured to said nipple, a second piston having a passage controlled by a one-way valve mounted at the forward end of the last named tubular member, means forming a conduit establishing communication between said last named passage and the interior of the valve housing through said nipple and a main valve within the valve housing for controlling the outlet of said conduit.

4. The structure of claim 3 wherein said valve

housing is formed with an air passage through its side wall and gaskets are interposed on either side of the air passage between the housing member and adjacent wall of the passage in the receiver frame in fluid sealed relation.

5. The structure of claim 3 wherein said valve housing is formed with an air passage through its side wall and gasket seats are provided on either side of the air passage, said low pressure member being slotted to its rear end, an annulus being disposed between the rear end of the low pressure member and adjacent gasket seat and gaskets are interposed between the passage in said receiver frame and gasket seats in fluid sealed relation, said gasket in the seat adjacent the annulus engaging the latter throughout its extent.

6. The structure of claim 2 wherein a valve stem bushing is secured to the rear end of the valve housing member in fluid sealed relation, the main valve is provided with a valve stem slidably mounted in and protruding from said bushing, and the bushing and side wall of the housing member are provided with registering openings controllable by said main valve.

7. The structure of claim 2 wherein the means on the piston rod protruding through the slot comprises a cross-head secured to the piston rod having a lug projecting through the slot, and a fiber guide sleeve is interposed between the cross-head and interior of said low pressure member.

8. The structure of claim 2 wherein the forward end of the low pressure cylinder has a projecting lug and a toggle linkage is interconnected between the projecting lug and means on the piston rod protruding through the slot for manually actuating said reciprocal piston and piston rod.

9. The structure of claim 2 wherein the forward end of the low pressure cylinder has a projecting lug, a barrel having a radial opening leading to its chamber is pivotally mounted adjacent its forward end on the lug, a link is connected at one end to said means on the piston rod protruding through the slot and at its other end to the barrel rearwardly of the latter's pivotal mounting whereby the barrel may be used to actuate said reciprocal piston and piston rod, a conduit extended from said valve housing to the chamber of the barrel in the normal position of the barrel and a perforated sealing element of plastic material is interposed in said conduit adapted to engage the barrel around said radial opening in fluid sealed relation.

10. In a gun of the type described in combination, a receiver frame having a longitudinal guideway cutaway on one side to form a retaining shoulder, a plunger slidably mounted in the guideway, a bolt having its rear portion rotatably and slidably mounted in the plunger and provided with a bolt head having a conical sealing surface and projectile engaging finger, a bolt handle adapted to engage the retaining shoulder secured to the bolt head, and resilient means interposed between the bolt and plunger adapted to be compressed for effecting relative movement of the plunger and bolt when released.

11. In a gun of the type described in combination, a receiver frame having a longitudinal passage and a transverse opening intersecting the passage, a plug adapted to be inserted within the passage and formed with a transverse opening overlying said first named transverse opening when the plug is in position in the passage, an angular sear spring having one leg secured to the plug and the other leg depending within the plug opening, a sear secured to one of the legs and a

In one embodiment of the invention in a pilot model the following controlling dimensions were adopted which are set forth merely by way of illustration and not of limitation:

|                                                                                                |                           |
|------------------------------------------------------------------------------------------------|---------------------------|
| Inside diameter of cylinder.....                                                               | 1.277 in.                 |
| Stroke of piston 41.....                                                                       | 8.5 in.                   |
| Volume of chamber 46.....                                                                      | 10.88 cu. in.             |
| Initial loading on spring of valve 23.....                                                     | Wt. of valve element 25   |
| Initial loading on spring of valve 45.....                                                     | 2.0 oz.                   |
| Initial loading on spring of valve 66.....                                                     | 3.5 oz.                   |
| Volume of compression chamber between pistons 41 and 64.....                                   | 1.853 cu. in.             |
| Volume of high compression storage reservoir comprised of conduit 72 and valve housing 32..... | 0.110 cu. in.             |
| Compression ratio between chambers 46 and high compression chamber or reservoir.....           | 99:1.                     |
| Computed pressure in high compression chamber.....                                             | 1485 lbs./sq. in. approx. |
| Face width of annular valve seat 84.....                                                       | 0.015 in.                 |
| Unit loading on valve elements 111 and 113 approx.....                                         | 15,000 lbs./sq. in.       |
| Length of link 55.....                                                                         | Approx. 20 ins.           |
| Pin connection 60 spaced from pin 56.....                                                      | 4.5 ins.                  |
| Effort required to actuate compressor through link 55.....                                     | 20 lbs.                   |

In the pilot model referred to above chronograph measured muzzle velocities of about 500 ft. sec. were obtained with air compressed with one stroke of the link 55, using a .22 caliber pellet 95 of 16½ grains. Two strokes of the link 55 generated, consistently, pressures that developed in excess of 700 ft. sec. muzzle velocities with the same caliber and weight of pellets and the grouping of a series of pellets fired at a range of 50 feet were within a ring of ¾ inch in diameter. While extensive tests have not been performed to determine the shock power of the pilot model it will clearly penetrate 1½ inch soft wood from a range of 35 feet.

Figs. 8 and 9 show modified forms of main valves that may be substituted for the main valve 33.

In Fig. 8 the forward end of the valve stem bushing 35 is terminated in a plane annular face 110 disposed in a plane normal to the axis of passage 79 so as to form the angular edge 111 which is ground to an included angle substantially equal to the included angle of the valve element 112. Valve element 112 is mounted on the reduced portion 81 of the valve stem 80 and retained in place by the cap fastener 113 which is formed exteriorly to serve as a seat for one end of the valve spring 85. The valve element is formed of laminated "Bakelite" or similar material and is of conical shape having an included angle coinciding with the included angle of the valve seat 111.

The valve of Fig. 9 is similar to the one shown in Fig. 8 but in this form the conical valve ele-

ment is made of a suitable metallic substance and the seat for the valve element is formed in a laminated Bakelite insert 114 snugly fitted within a corresponding bore within the valve stem bushing 35.

The modified compressor actuating means shown in Fig. 2 discloses a form of the invention wherein the barrel is employed as a substitute for the link 55 shown in Fig. 1. In this case the barrel is pivoted as at 115 to a bifurcated lug 116 carried by the front end closure cap for cylinder 19. The cross-head 117 attached to piston rod 42 has a lug 118 extending through the slot 119 in the upper side of cylinder 19 and a link 119 is interconnected with the lug 118 and barrel at a point spaced rearwardly of pivot pin 115 as at 120. If desired, to simplify the construction the pivot pin for pivot 120 may be carried by a member 121 extending along the barrel and secured by the pin 115. In as much as the barrel of this form of the invention is necessarily of the break type it is essential that a seal such as 122 shown in Fig. 3 be inserted between the barrel and conduit 78 leading to the barrel to prevent escape of air through the conduit past the barrel. The seal 122 may be "neoprene" and has a conical sealing surface engageable with a conical seat in the barrel in the normal position of the barrel shown in chain lines in Fig. 2. The seal 122 is retained in a recess in frame 12 by the retaining plate 123. Spring detents 124 engage notches 125 in the barrel to retain the barrel in normal position. The barrel is actuated about its pivot 115 in much the same manner as link 55 is actuated to compress the air and in all other respects the operation of the weapon of this modification is essentially the same as that shown in Fig. 1. If desired, however, the valve 23 of Fig. 1 may be replaced by a valve port 126 which is uncovered in the rearward position of the low pressure piston 41 to admit air to chamber 46 and closed upon initial forward displacement of the piston to prevent escape of air from chamber 46 by any passage other than valve 45.

In Figs. 4, 5, 6 and 7 a toggle linkage for actuating the compressor is shown located on top of the barrel. The link 127 is of arcuate cross section and is pin connected at its forward end to a lug carried by the front end closure cap for cylinder 19 as at 128. An arcuate clip 129 is secured to the interior of link 127 in rearwardly spaced relation of pin connection 128 and the forward end of another link 130 of arcuate section is connected to the clip as indicated at 131. The rear end of the link 130 is secured to the cross-head 132 on piston rod 42 by a pin connection 133. The arcuate shape of link 127 is designed to give the gun a neat and finished appearance in its normal position and overlies and receives the link 130 in such position. In operation the link 127 is oscillated about the pivot 128 between its full line or normal position and chain line position shown in Fig. 4 to actuate the compressor. In other respects the weapon may be in all essentials similar to the embodiment shown in Fig. 1.

Having now specifically described this invention in its present preferred embodiment what I claim and desire to cover by U. S. Letters Patent is:

1. An air gun comprising in combination, a supporting stock, a low pressure tubular member closed at its forward end and slotted from a point intermediate its ends rearwardly secured to the stock, a valve housing member secured to the

trigger mounted in the transverse opening of the frame and having a finger engaged with said depending leg of the sear spring.

12. In a gun of the type described in combination, a valve housing member, a valve stem bushing secured to one end of the valve housing member in fluid sealed relation and provided with an annular projecting valve seat disposed within the valve housing, a valve cage having a recess at one end disposed in the valve housing with the end of the wall forming the recess and confronting the valve stem bushing adapted to abut the valve stem bushing in surrounding relation of said annular valve seat, a valve stem secured to the valve cage and slidably mounted in the valve stem bushing, a plastic valve element mounted in the recess of the valve cage of lesser depth than said recess and adapted to deformably engage said annular valve seat when the end of the wall forming the recess abuts the confronting portion of the valve stem bushing and resilient means normally urging the valve cage into abutment with the valve stem bushing.

13. An air gun comprising in combination, a low pressure tubular member closed at one end portion, a main valve housing member secured to

the low pressure member, a piston provided with a passage mounted in the low pressure member for movement toward and from the closed end portion thereof, said tubular member being provided with means to admit a fluid into the chamber formed between the piston and closed end portion of the tubular member, a hollow piston rod connected to the piston in communicating relation to the passage therein, means restricting the passage to one way flow of fluid from said chamber through the passage, means for actuating the piston, a second piston provided with a passage mounted in the hollow piston rod, conduit means connecting the passage in the second cylinder with the interior of the main valve housing, means restricting the passage in the second piston to one way flow of fluid from the conduit means to the interior of the main valve housing, a barrel, conduit means connecting the interior of the valve housing and chamber portion of said barrel, a main valve in said main valve housing normally closing said last recited conduit means, and firing mechanism for controlling said main valve.

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