Oct. 31, 1950 W. S. WELLS 2,528,462

SELF-LOADING AIR GUN

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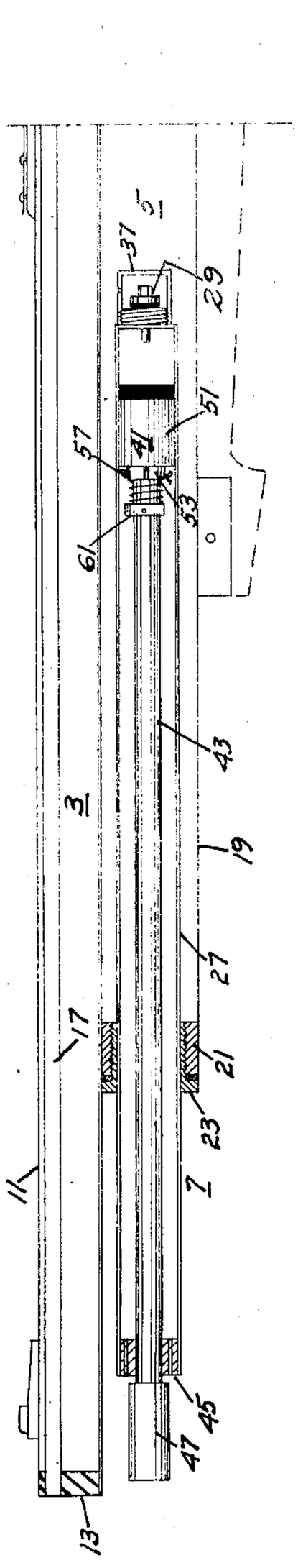

FIG. 1.

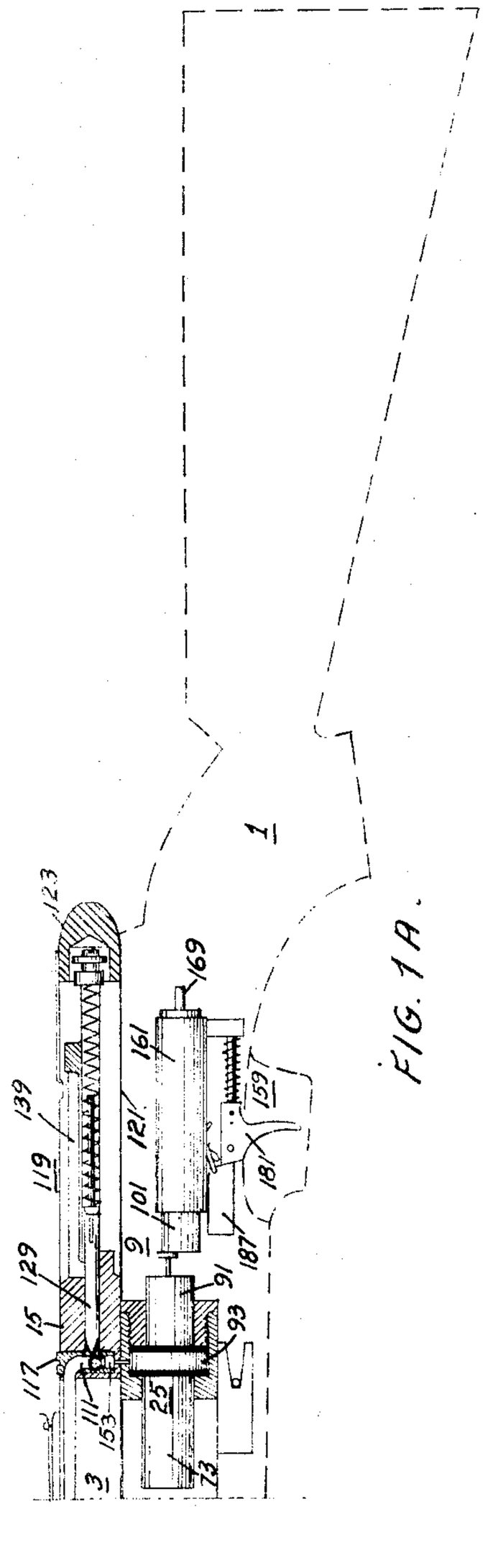

FIG. 1A.

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FIG. 2.

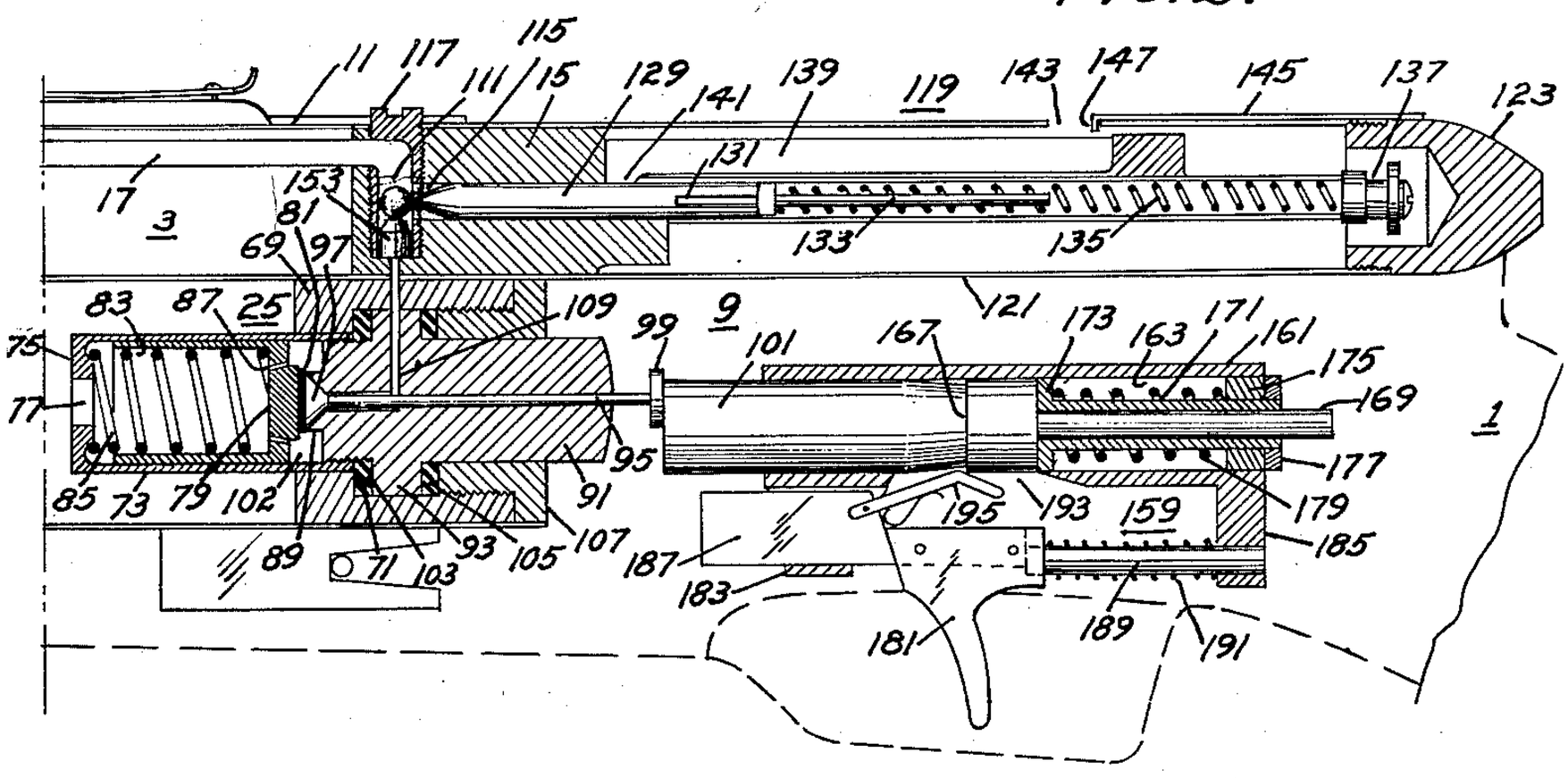

FIG. 3.

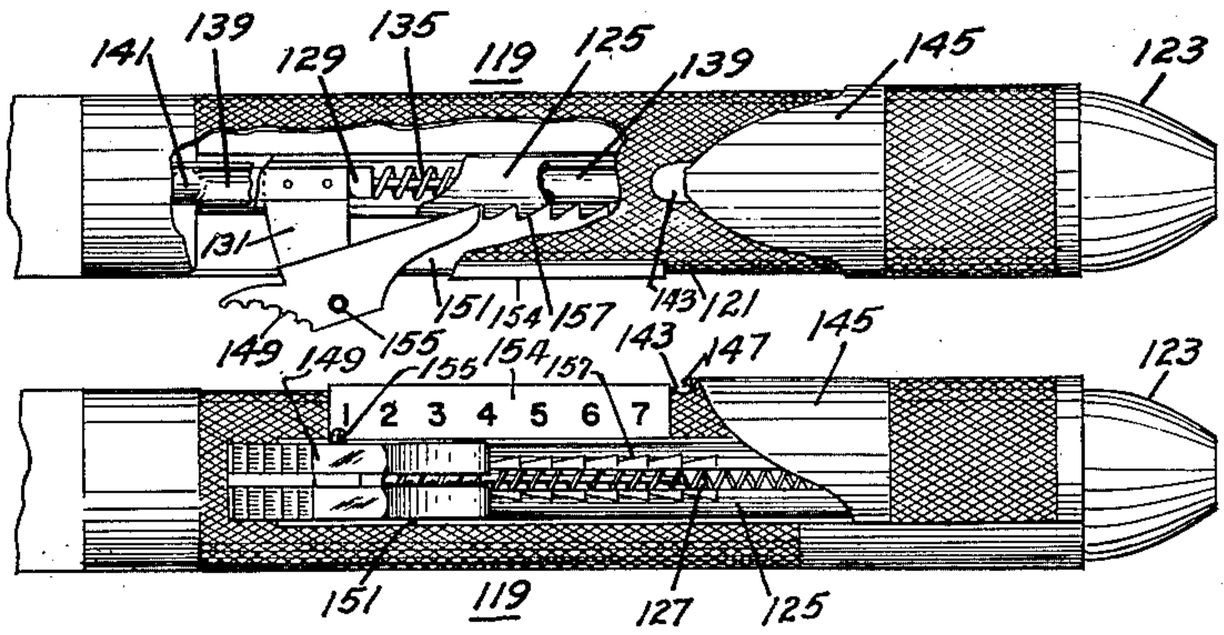

FIG. 3A.

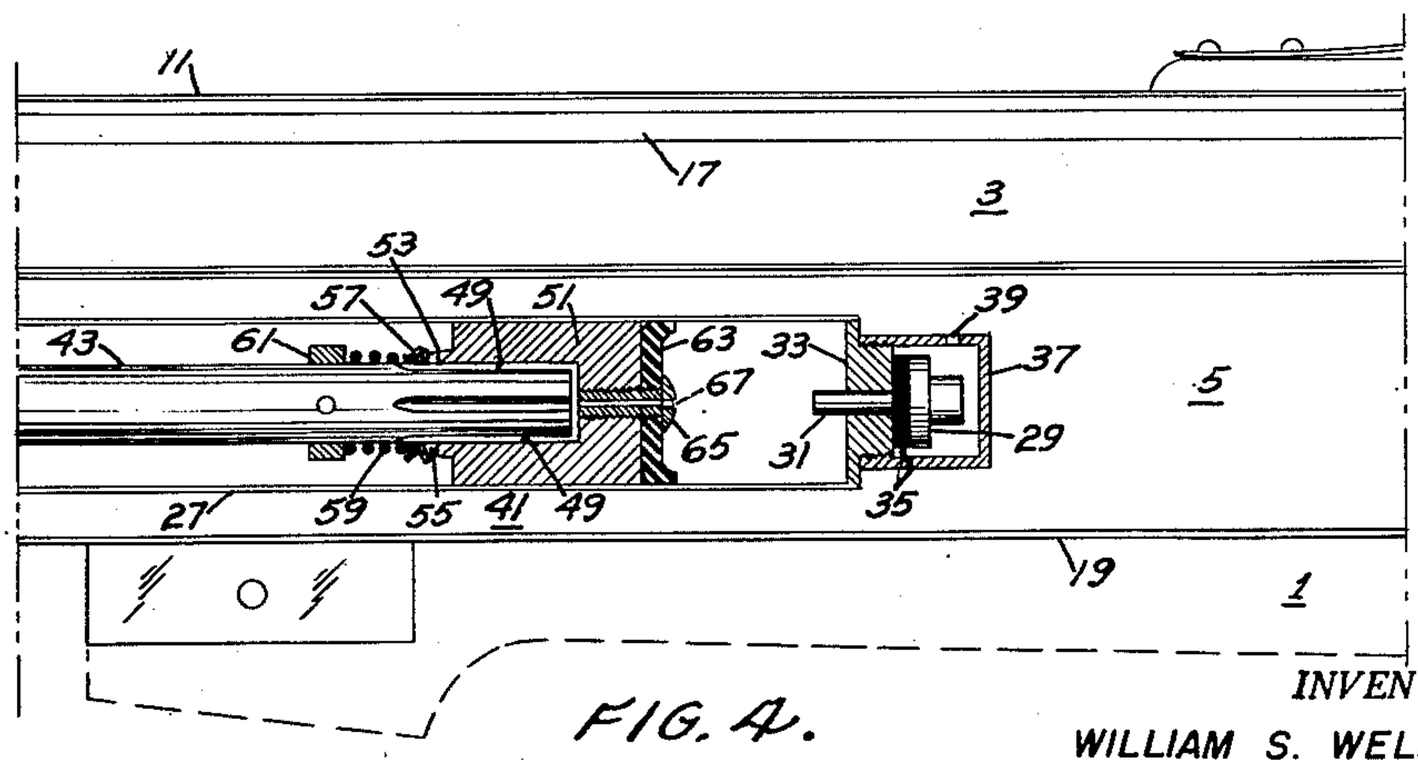

FIG. 4.

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UNITED STATES PATENT OFFICE

2,528,462

SELF-LOADING AIR GUN

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Application August 21, 1944, Serial No. 550,440

7 Claims. (Cl. 124—13)

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My invention relates to guns, and more particularly to guns powered by air under compression.

Among the objects of my invention are:

(1) To provide a novel and improved compressed air gun of the automatic type;

(2) To provide a novel and improved automatic feed in an air gun;

(3) To provide a novel and improved air gun having an automatically resetting firing mechanism;

(4) To provide a novel and improved air gun holding a plurality of shot and embodying feeding or loading means assuring placement of one shot at a time at the firing position;

(5) To provide an air gun for ball shot, having a novel and improved means for holding a shot at firing position;

(6) To provide a gun of the compressed air type, having a novel and improved compression pump as a part thereof;

(7) To provide a novel and improved air gun of the repeater type, having means for indicating the number of shot available in the gun for firing, before reloading becomes necessary;

(8) To provide a novel and improved air gun capable of exceedingly fast resetting action between successive firings of the gun.

Additional objects of my invention will be brought out in the following description of a preferred embodiment of the same, taken in conjunction with the accompanying drawings wherein—

Figure 1 is a view, partly in section, of the barrel portion of the gun assembly;

Figure 1A is a view, partly in section, of the breech portion of the gun assembly;

Figure 2 is an enlarged view, for the most part in section, of the operating mechanism at the breech portion of the gun;

Figures 3 and 3A are top and side views respectively of the magazine and feed assembly of my improved gun;

Figure 4 is an enlarged view, for the most part in section, of a novel and improved pump assembly comprising a feature of my gun.

Referring to the drawings, my gun comprises a stock 1 in which is mounted an assembly including a gun barrel 3, a compressed air storage chamber 5 along the underside of said barrel and closed at its forward end by a pump 7, and breech mechanism 9 interconnecting the air storage chamber and the gun barrel.

The barrel is comprised of an outer tube 11, closed at the muzzle end of the gun by a plug 13

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and at the breech end, by a breech block 15, the plug and breech block supporting a tube 17 through which the shot passes when fired.

The compressed air storage chamber located along the underside of the barrel includes a tube 19 of substantial diameter terminating at the forward end in an internally threaded bushing 21 for receiving and mounting the pump 7, the pump being frictionally fixed in position by a cylindrical sealing nut 23 surrounding the pump and threaded into the bushing. At the breech end, the compressed air storage chamber is closed by a valve assembly 25 forming part of the breech mechanism.

A feature of my improved gun resides in the aforementioned pump 7, the barrel 27 of which terminates, within the compressed air storage chamber 5, in a discharge valve arrangement including a flat seating pump discharge valve 29 having a stem 31 slidably fitting through an opening in an end plug 33 which provides the seat for the valve. A suitable sealing gasket 35 about the valve stem serves to increase the sealing effect of the valve in its closed position. The plug 33 extends beyond the end of the pump barrel 27, and is externally threaded to receive a valve cage 37 over the valve to restrict its operational movement, such cage having one or more perforations 39 to effect communication with the compressed air storage space in the storage chamber.

The pump includes a piston assembly 41 facing the discharge valve 29, and a piston rod 43 extending from the piston assembly through a perforated air intake plug 45 at the nozzle end and terminating in an externally mounted operating handle 47, for reciprocating the piston assembly.

The piston end of the rod is fluted by forming therein a plurality of longitudinal grooves 49, and this end of the rod is loosely enclosed by the piston assembly which includes a piston 51 having a piston rod receiving recess, and a split skirt 53 extending along the piston rod. The skirt is provided with diametrically positioned slots 55 to receive a cotter pin 57 or the like through the rod to permit limited movement of the piston on the rod sufficient to include abutment of the piston against the extreme end of the rod.

The piston is normally held at one extreme end of its limited permissible movement, out of abutting contact with the end of the rod, by a biasing spring 59 disposed about the rod between the piston head skirt 53 and an abutment ring 61

fixed about the rod by a pin passing through the rod and ring.

The piston head assembly is completed by a piston seal 63 of leather or the like, though preferably of an artificial rubber known to the trade as "Koroseal," held in place by a machine screw 65 extending through the piston and having a longitudinal bore 67 therethrough establishing communication between opposite sides of the piston assembly.

The accumulation of air under compression in the storage chamber is realized through repeated reciprocation of the piston assembly. On the intake strokes, the piston 51 being normally slightly spaced from the end of the rod 43 by the biasing spring 59, air entering the pump barrel through the perforated plug 45, can find passage to the work side of the piston by way of the grooves 49 and the longitudinal bore 67 through the machine screw 65. During compression strokes, the push on the piston rod is in opposition to the force of the biasing spring and of a magnitude sufficient to effect abutment of the piston 51 against the end of the piston rod 43 to block off the passage through the piston assembly.

The resulting compression of air on the work side of the piston unseats the pump discharge valve 29 and permits discharge of air into the compression chamber. Seating of the discharge valve between compression strokes, precludes loss of air from the compressed air storage chamber during these intervals.

Upon completion of the pumping operation, residual compressed air existing in the end of the pump cylinder or barrel between the piston assembly 41 and the discharge valve 29, would have a normal tendency to force the piston assembly back and drive the piston rod to an extended position beyond the muzzle end of the gun.

Such undesirable action, however, is precluded by the design of the piston assembly and its cooperation with the piston rod, in that such residual compressed air, by way of the bore 67 of the screw 65, forces separation of the piston 51 from the end of the piston rod 43, thus unblocking the passage through the assembly to permit equalization of pressure on both sides of the piston. Under such condition of equilibrium, the piston rod and piston assembly will remain in position at the end of a compression stroke when placed in such position by the operator.

As previously stated, the compressed air storage chamber is closed off at the breech end, by a valve assembly 25 which controls the air discharge of the gun. This valve assembly includes a plug 69 having a passage therethrough, one portion of which, located at the storage chamber end, being of a smaller diameter than the other portion, to provide a shoulder 71. The smaller diameter portion is adapted to receive an open end of a valve cage 73 to support the same, while the other end of the cage is provided with a base 75 having an opening 77 therethrough to establish communication between the storage chamber and the interior of the valve cage. This valve cage houses a valve 79 having a flat surface preferably covered with a disk 81 of sealing material such as leather, rubber or the like, and is further possessed of an integral skirt 83 slidably engaging the inner wall of the cage and adapted to enclose a valve biasing spring 85 inserted between the valve 79 and the cage bottom 75.

A plurality of perforations 87 through the valve at points distributed about the valve disk 81, provides for substantially free flow of compressed

air from behind the valve, as well as facilitating movement of the valve substantially unopposed except for the biasing spring 85.

The valve seat associated with the aforementioned valve is formed by a conical recess in the end of an extension 89 on a block 91 receivable in the passage of the plug 69. This valve block is of cylindrical shape and its diameter is approximately that of the smaller diameter portion of the passage. This block is provided with a circumferential rib 93 of outside diameter sufficient to snugly fit the portion of the passage of larger diameter.

A longitudinal bore through the block 91 in alignment with the conical recess provides, in cooperation with such conical recess, a passage for the reception of an independent valve stem 95 having a conical head 97 adjacent the valve disk 81, the stem being of such a length as to extend beyond the confines of the block to the rear thereof. The exposed end the stem is provided with an abutment 99 for receiving the impact of a hammer 101, forming part of a trigger controlled hammer assembly to be described, whereby to effect momentary opening of the firing valve 79.

Between the valve 79 and block 91 there is formed an annular chamber 102 surrounding the valve seat. This chamber places a measured amount of air under compression at the valve seat ready for instant discharge upon opening of the valve, and is adapted to be recharged at a rate dependent upon the size and number of perforations 87 through the valve.

Prior to assembling the block 91, suitable gaskets 103 and 105 are disposed thereabout on each side of the rib, and following the insertion of the block, the same is fixed in place with the gaskets under compression, by a hollow cylindrical nut 107 surrounding the block 91 and threadedly receivable in the end of the plug 69.

The stem passage is enlarged adjacent the conical recess to form in cooperation with a radial bore 109 through the rib 93 and plug 69, a passageway for the release of a charge of compressed air, upon opening of the firing valve 79.

In the breech block 15, I form a well 111 at the termination of the tube 17 and substantially normal thereto, and through the bottom of this well I provide a bore connecting with the radial bore 109, said well and bore forming a continuation of the air discharge passage from the firing valve 79 to the gun barrel. Intersecting the well at an intermediate level above its bottom, is a lateral feeding or loading passage 115 extending rearwardly of the well. The well is preferably formed by threading into a recess in the breech block, a machine screw 117 which has been hollowed out to a height capable of permitting communication with the tube 17 through a side opening. The diameter of the feed or loading passage, and the internal diameter of the well should correspond with the diameter of the shot to be handled by the gun.

Mounted on and extending to the rear of the breech block 15 is a magazine and feed assembly 119. This assembly includes an outer tube or housing 121 closed by a removable end plug 123. Within the housing, there is provided a tube 125 extending from the rear of the breech block and constituting a continuation of the lateral feed passage 115. This tube is formed with a slit 127 from its rear edge, whereby such tube is adapted to receive a breech pin 129 having a fin 131 extending through the slit.

The breech pin is formed with a rearwardly extending tail pin 133 on which may be mounted a coil spring 135 of a diameter adapted for insertion in the tube 125 with the breech pin. When placed under compression by the application of an adjusting nut 137 threaded into the end of the tube, this spring acts as a biasing means normally urging the breech pin through the loading passage 115 toward the well 111.

Supported on the upper surface of the breech pin tube is a magazine in the form of a channel 139 having closed ends but communicating with the loading passage 115 through a connecting opening 141 in the floor of the channel adjacent the breech block 15.

Filling of the magazine may be effected through a filling opening 143 provided in the housing above the rear end of the magazine channel, such opening being adapted to be closed by a sliding cover 145 encircling or partially encircling the housing 121 and having a depending lip 147 in the filling opening for limiting movement of the cover.

In effecting transfer of the shot from the magazine channel 139 to the feed or loading passage 115, the breech pin 129 is retracted against the action of the biasing spring 135, sufficiently to expose the connecting opening 141. Provision is made for such retraction of the breech pin by pivotally mounting a spring biased thumb control 149 on the fin 131, access to which is had through a side opening 151 in the housing provided for this purpose.

An important feature in connection with the feeding mechanism of my gun is the disposition in the well 111 of an elevator plug 153 of a height sufficient to bring its upper surface to the lower edge of the loading passage 115. This elevator plug is of slightly less diameter than the internal diameter of the well and has its upper edge beveled.

The function of this plug in the gun is manifold. When resting on the bottom of the well, it normally covers up the end of the compressed air discharge passage and is adapted to receive and support one shot from the loading passage, as placed thereon by the action of the breech pin. In this position, the shot has little opportunity to leave the well by way of the gun barrel in any position in which the gun may normally be carried. Upon opening of the firing valve 79, the full effect of the discharge of compressed air will be initially directed against the bottom of the plug and cause the same to rise and elevate the shot to the level of the tube 17, the compressed air blast in the meantime escaping around the plug and bringing its full force to bear against the shot to discharge the same with considerable velocity from the gun.

The metered amount of air which has been permitted to discharge into the well, has by this time, escaped around the plug to follow the shot through the gun barrel. What, if any, residual air remained would be insufficient to even support the plug, still less carry it up to a higher elevation in the well.

In thus elevating the shot, the plug serves the added purpose of automatically blocking off the loading passage 115, thereby precluding the entrance of a second shot while the first one is being discharged. Thus the possibility of erratic operation of the gun whereby the same may fire two or more shots simultaneously, is positively precluded, and not until the elevator plug again drops to the bottom of the well can the breech

pin function to urge an additional shot into firing position in the well. The return of the elevator plug to the bottom of the well and the placing of a shot thereon is facilitated by the beveled edge on the plug which enables the breech pin to aid in the return of the plug and at the same time more quickly position the next shot. Thus rapid loading of the gun with one shot at a time, is effectively assured.

A feature of my gun for use in connection with the loading or feeding mechanism is the provision of indicating means for informing a gunner as to the number of shots present in the loading passage 115 at any time. For this purpose I provide an indicia strip 154 above the thumb control, this strip to contain numbers indicating the number of shots in the loading passage for the various positions of the thumb control, as the shots are discharged from the gun. Thus if the loading passage normally holds seven shots when filled, the numbers on the indicia strip will run from one to seven, and the location of some indicating or identifying mark on the thumb control such as the pin 155 which holds the same to the fin, will indicate with reference to this strip, the number of shots remaining in the gun for firing, before refilling of the loading passage becomes necessary.

Unintentional retraction of the thumb control, or recoil of the breech pin in response to the discharge blast when firing the gun, is precluded by providing a series of ratchet teeth 157 in the side of the breech pin tube 125 into which the tail end of the thumb control may ride.

The velocity with which a shot leaves the gun is a function of the suddenness with which the air under compression may be released behind such shot. The efficiency of operation of a gun is a function of the economy with which the air under compression is metered out in the firing of the shots from the gun. Both a high velocity of discharge and a high efficiency of operation are realized in my gun through the cooperation between the previously described firing valve assembly 25 and a novel and improved trigger mechanism 159 which I will now describe.

Such trigger mechanism involves a supporting frame 161 mounted in the stock at the trigger position, and includes a cylindrical bore 163 behind and in substantial alignment with the firing valve pin 95, for slidably receiving the hammer 101 having a circumferential groove 167 and provided with a tail pin 169. The tail pin is inserted through a sleeve 171 having a flange 173 abutting against the rear end of the hammer, such sleeve protruding through a closure plug 175 at the rear of the cylindrical bore and provided with a nut 177 to limit forward movement of the sleeve in the bore.

A compression spring 179 about the sleeve between the flange 173 and the closure plug 175 normally urges the hammer to a forward position in the bore, in contact with the valve stem abutment 99. Such contact, however, is designed to be wholly ineffective to overcome the compressive force of the firing valve spring 85, and thus the abutment 99 fixes the normal position of the hammer.

The trigger 181 is disposed below the hammer and is slidably supported between depending end portions 183 and 185 of the frame, the forward end portion 183 being slotted to slidably receive a strip 187 to which the trigger is affixed, while the rear end portion is drilled to slidably receive a rod 189 extending from the trigger. A

compression spring 191 about the rod 189, normally positions the trigger at the forward end of its permissible travel.

Pivotally mounted on the strip and spring biased into engagement with the peripheral groove 167 in the hammer through a slot 193 in the lower portion of the bore wall, is an angularly bent finger 195 whose engagement in the groove is such as to enable retraction of the hammer in response to a pull on the trigger.

At some intermediate point in the travel of the trigger, this finger comes into engagement with the edge of the slot which is preferably beveled, and is thereby disengaged from the groove in the hammer, thus releasing the hammer. Under the action of its compression spring, the hammer is driven forward against the valve stem abutment 99 with sufficient impact to momentarily overcome the normally predominant compression force of the valve spring 85 and cause a sudden and momentary opening of the firing valve 79. The presence of a charge of compressed air in the chamber 102, between the valve 79 and the valve seat block, permits of instantaneous release of such charge with minimum loss during such momentary opening of the valve.

Upon completion of the impact by the hammer, immediate restoration thereof to its normal position is assured by the valve spring 85, so that by the time the trigger is permitted to return to its rest position, the hammer will be in position to again be engaged by the trigger and prepared for another operation. The perforations 87 are sufficient in number and size to recharge the chamber 102 in such brief interval of time. Thus the gun is adapted for rapid successive firing, limited only by the rapidity with which the gunner can pull the trigger.

Of importance also in this connection is the fact that the movement of the trigger is linear instead of pivotal. This is conducive to more accurate aiming and firing of the gun, since finger pressure is along a line parallel to the line of sight and thus not apt to upset one's aim in firing the gun.

From the foregoing description of a preferred embodiment of my invention, it will become apparent that my novel and improved gun embodies many features of importance, all contributing to fulfill the objects as set forth previously. While I have described my invention in considerable detail, the same is subject to alteration and modification, without departing from the underlying principles embodied therein, and I accordingly do not desire to be limited in my protection to the specific details disclosed and described, except as may be necessitated by the appended claims.

I claim:

1. In a gun for the discharge of shot by compressed air, a gun barrel, a well disposed below and connecting with said barrel at a substantial angle thereto, a freely slidable plug loosely disposed in said well for longitudinal movement therein, means for placing a shot on said plug, and means for releasing air under pressure against said plug to elevate said plug toward said barrel and discharge a shot therefrom through said barrel in one operation.

2. In a gun for the discharge of shot by compressed air, a gun barrel, a well adjacent to and connecting with said barrel from below at the breech end thereof, a freely slidable plug loosely disposed in said well for longitudinal movement therein and adapted to support a shot

to be fired, and means for discharging a blast of air under pressure against said plug to elevate said plug toward said barrel and discharge the shot therefrom through said barrel in one operation.

3. In a gun for the discharge of shot by compressed air, a gun barrel, a chamber for holding air under compression, an air discharge passage interconnecting said chamber with said barrel, and having at least the portion thereof adjacent said barrel of a diameter permitting sliding movement therein of the shot to be fired, a loading passage connecting with said portion and adapted to hold a plurality of shot, means urging said shot in the direction of said portion of the air discharge passage, a freely slidable plug in said portion of the air discharge passage and adapted to move toward said barrel and at least partially block said loading passage in response to pressure of air against an end of said plug, and means enabling said air to discharge a shot disposed at the other end of said plug.

4. In a gun for the discharge of shot by compressed air, a gun barrel, a chamber for holding air under compression, an air discharge passage interconnecting said chamber with said barrel and including a well adjacent said barrel and substantially normal thereto, a valve normally blocking said air discharge passage to the flow of air from said chamber to said barrel, a passage for shot connecting with said well, a freely slidable plug in said well below the connection of said shot passage, and adapted to move toward said barrel and at least partially block said shot passage in response to pressure of air against an end of said plug upon opening of said valve, and means enabling said air to by-pass said plug to discharge a shot disposed at the other end thereof.

5. In a gun for the discharge of shot by compressed air, a gun barrel, a chamber for holding air under compression, an air discharge passage interconnecting said chamber with said barrel at the breech end of said barrel, means for arbitrarily controlling the discharge of air under pressure from said chamber to said barrel via said air discharge passage, a passage for shot connecting with said air discharge passage at a point intermediate said barrel and said discharging means, a freely slidably plug in said air discharge passage between said discharging means and said shot passage and adapted to move toward said barrel and at least partially block said shot passage in response to pressure of air against an end of said plug during discharge of air under pressure, and means enabling said air to by-pass said plug to discharge a shot disposed at the other end thereof.

6. In a gun for the discharge of shot by compressed air, a gun barrel, a chamber for holding air under compression, an air discharge passage interconnecting said chamber with said barrel at the breech end of said barrel, a valve normally blocking said air discharge passage to the flow of air from said chamber to said barrel, a passage for shot connecting with said air discharge passage at a point intermediate said barrel and said valve, a freely slidable plug in said air discharge passage on the discharge side of said valve and adapted to move toward said barrel and at least partially block said shot passage in response to pressure of air against an end of said plug upon opening of said valve, and means enabling said air to by-pass said plug

to discharge a shot disposed at the other end thereof.

7. In a gun for the discharge of shot by compressed air, a gun barrel, a chamber for holding air under compression, an air discharge passage interconnecting said chamber with said barrel at the breech end of said barrel, valve means normally blocking said air discharge passage to the flow of air from said chamber to said barrel, a passage for shot connecting with said air discharge passage at a point intermediate said barrel and said valve means, a spring biased breech pin in said passage for urging shot toward said air discharge passage, a freely slidable plug in said air discharge passage on the discharge side of said valve and adapted to move toward said barrel and at least partially block said shot passage in response to pressure of air against an end of said plug upon opening of said valve, and means enabling said air to by-pass said plug to discharge a shot disposed at the other end thereof.

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