Sept. 28, 1948. W. S. WELLS 2,450,029

COMPRESSED AIR GUN

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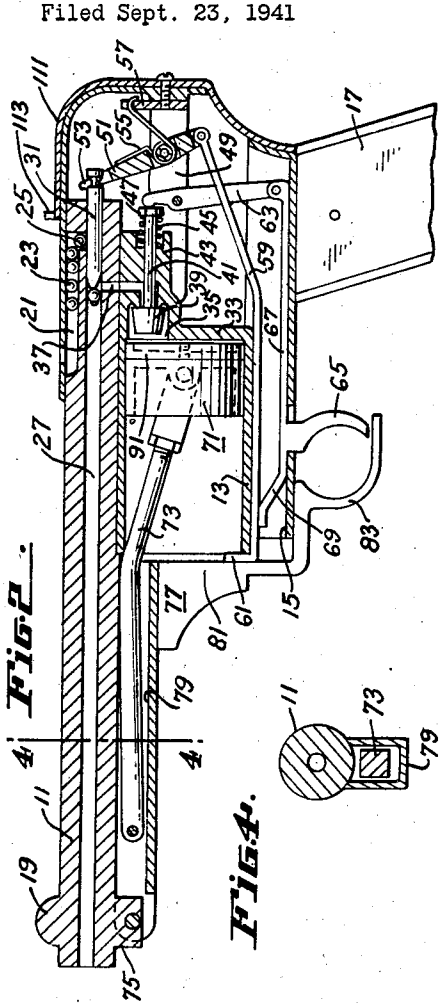


Fig. 2.

Fig. 4.

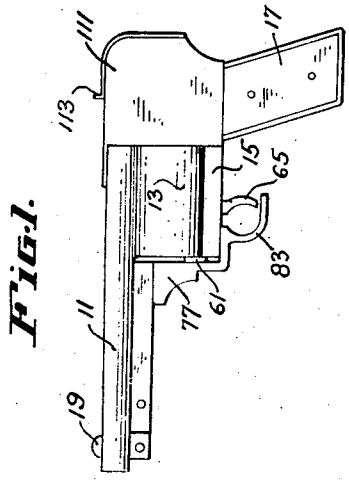


Fig. 1.

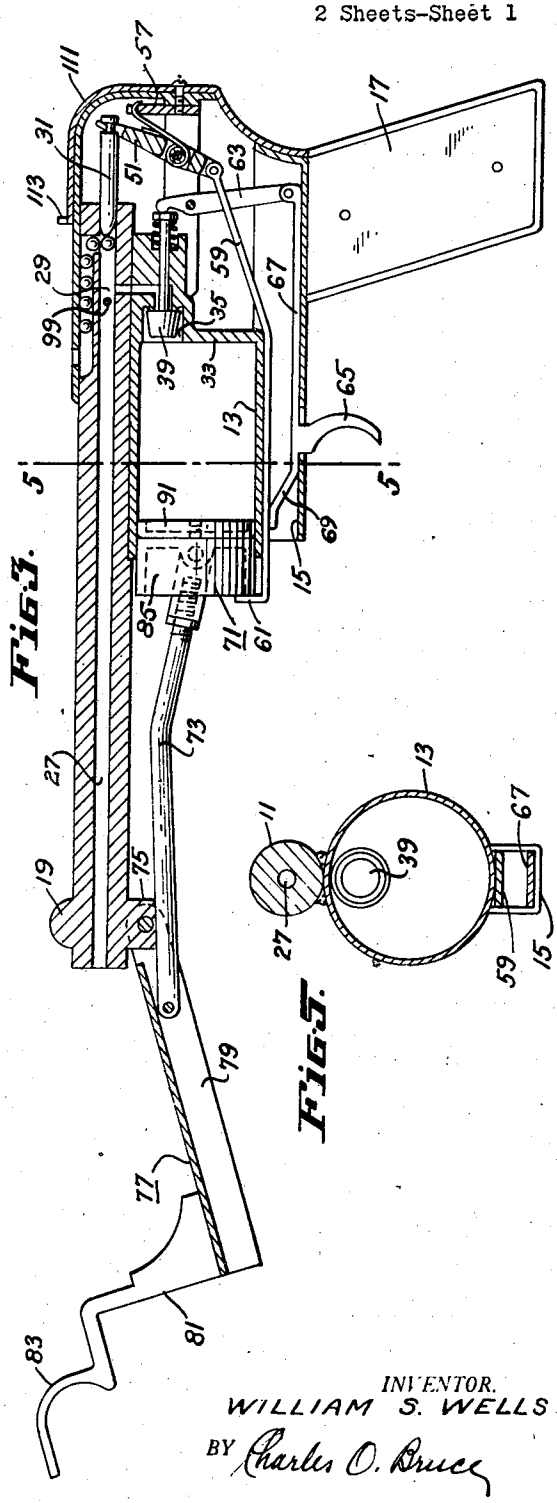


Fig. 3.

Fig. 5.

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Fig. 6.

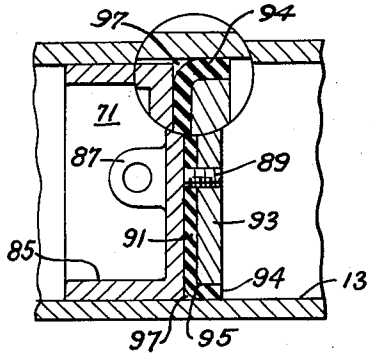


Fig. 6a.

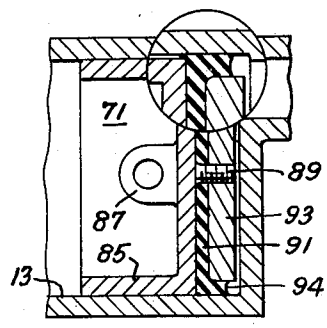


Fig. 7.

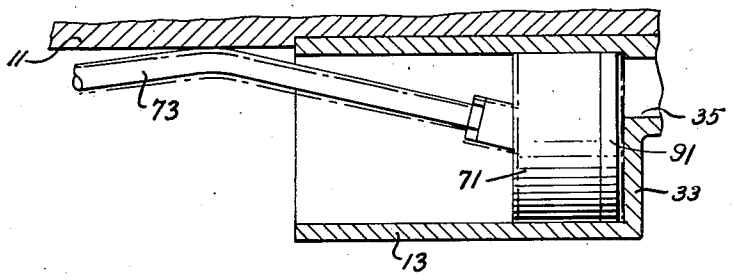
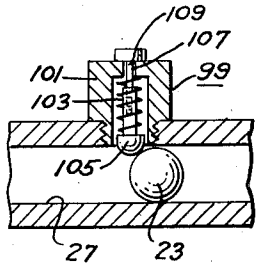


Fig. 8.



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COMPRESSED AIR GUN

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Application September 23, 1941, Serial No. 411,989

5 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 to provide a novel and improved air gun which is self-loading.

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

Figure 1 is a side elevational view of a pistol embodying my invention,

Figure 2 is a longitudinal section through the pistol of Figure 1, in condition for firing,

Figure 3 is a view similar to Figure 2, illustrating the mode of operation of the gun mechanism in preparing the same for firing,

Figure 4 is a section in the plane 4—4 of Figure 2,

Figure 5 is a section in the plane 5—5 of Figure 3,

Figures 6 and 6a are comparative views, magnified in part and depicting the features and manner of functioning of my improved piston,

Figure 7 is a fragmentary view of the pump mechanism, depicting an important feature thereof in the operation of such pump,

Figure 8 is a fragmentary view in section through the barrel of the gun, illustrating an improved restraining device for holding the shot to firing position.

My invention, for purposes of description, is shown embodied in an air gun of the pistol type, for which it is particularly adaptable, though it is to be understood that the features thereof are just as applicable to air guns of the rifle type, while certain of the features involved in the pump are of general utility and, accordingly, are not necessarily limited in their application to air guns.

Referring to the drawings for a complete description of my invention, the pistol illustrated comprises a gun barrel 11, to the underside of which is affixed the cylinder 13 of a pump for compressing the air employed as the source of power in the gun. This cylinder carries a trough or channel member 15 to the underside thereof, this channel member extending a substantial distance to the rear of the cylinder, and to this extended portion, the handle 17 of the pistol is attached.

The gun barrel is provided with a sight 19 at the muzzle end thereof, while the rear or breech end of the barrel is provided with a groove 21 for the reception of a plurality of shot 23. The

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rear end of the groove is connected by a well 25, to the bore 27 of the barrel at a point to the rear of the firing position 29 of a shot in said barrel. The bore of the barrel extends throughout the entire barrel and is adapted to slidably receive a breech pin 31 through the breech end thereof.

The pump cylinder 13 is of substantial diameter and provided with an end wall 33 at the breech end thereof, while at the other end, it is open. The cylinder opens through its end wall 33, into a small valve chamber 35 which is connected by a discharge channel 37 to the firing position of a shot in the barrel. A valve 39 is disposed in this valve chamber and is possessed of a valve stem 41 which extends to the rear, through a rear wall extension 43 of the valve chamber. On its exposed end, it carries a spring 45 which is maintained under compression by a nut 47 threaded to the end of the valve stem. This arrangement normally holds the valve to its valve seat in the valve chamber.

The rear wall extension 43 of the valve chamber carries a U-shaped yoke 49 which extends to the rear of the breech of the gun, and between the legs of this yoke, are pivotally supported a pair of levers.

One of these levers 51 is provided with a forked end 53 which straddles a section of reduced diameter in the protruding end of the breech pin 31, and is spring biased in the direction of urging the pin into the gun barrel, with the front end of the pin terminating approximately at the firing position of a shot in the barrel. The spring 55 for biasing this lever is preferably of the coil spring type, encircling the pivot shaft of the lever, with one end of the spring bearing against the lever, while the other end is hooked over an upright or bracket 57 affixed to the crotch of the yoke. To the lower end of the lever, there is pivotally connected a control arm or link 59 which extends in slidable relationship along the undersurface of the pump cylinder, and at the open end of the cylinder, the free end 61 of this control arm is turned upwardly.

The other lever 63 enables control of the valve 39 from a trigger 65. To realize such control, one end of the lever bears against the exposed end of the valve stem, while the other end is connected to a link 67 connected to or forming a part of the trigger and slidably supported in the channel 15. A front extension 69 of this connecting arm is turned upwardly to provide a slidable support for the arm or link 59 connected to the breech pin lever.

The pump, in addition to the cylinder 13 already described, includes a piston 71 reciprocally mounted in the cylinder, and a piston rod 73 connected to the piston. The piston is disposed with its work-surface facing the cylinder and wall 33, while the piston rod which is pivotally connected to the piston, extends a substantial distance beyond the open end of the cylinder.

At the muzzle end of the gun barrel, I provide a depending lug 75, to which is pivotally connected one end of a pump lever 77 to be employed in the operation of the pump. This lever, as shown in Figure 2, is shaped to provide a portion 79 extending along the gun barrel to the pump cylinder, and another portion 81 at substantially right angles thereto, extending across the open end of the cylinder and terminating in a trigger guard 83 which serves the added purpose of a hand grip to facilitate manipulation of the lever.

The protruding end of the piston rod is pivotally secured to that portion 79 of the lever running along the gun barrel, and at a point close to the fulcrum of the lever. This portion of the lever is of channel construction to receive the piston rod and enable the lever to fit snugly up against the gun barrel when in its closed position as indicated in Figure 2.

In the pump assembly, thus far described, the line of dead center connects the pivot end of the piston rod and the fulcrum point of the pump lever. When the piston is of substantial diameter, the line of dead center lies at a sufficient angle to the gun barrel, so that the point of connection of the rod to the lever will travel just slightly beyond dead center when the piston reaches the end of its compression stroke. Under the effect of the air, then under compression, the piston is automatically locked under compression.

The length of the piston rod is preferably such that on the compression stroke, the piston will be urged to within a very small fraction of an inch of the end wall of the cylinder, while on the intake stroke of the pump, that is when the pump handle is swung outwardly to its maximum extent, as is determined by the piston rod striking against the lower edge of the lug 75 (Figure 3), the piston will be partially withdrawn from the open end of the cylinder. By such withdrawal, the piston, it will be noted, is caused to engage the turned up end 61 of the arm 59 and carry the same along with it. This has the effect of withdrawing the breech pin a distance sufficient to expose the bore 27 of the barrel, to the well 25 and permit of the entrance of a shot from the groove 21. Upon restoration of the pump lever to its closed position, the air confined in the cylinder will be compressed, while at the same time, the firing pin will be permitted to move forward to its normal position and thus place the shot at the proper position in the barrel for firing. The lever 77 locks the pin in this position.

The pump of my improved air gun embodies additional features of considerable importance, and in the further discussion of my invention, these features will be stressed.

The particular pump described is of a type known as a single stroke pump. In a pump of this type, compression is realized by one compression stroke of the piston, at the end of which stroke, the piston is locked in position and is relied upon to function as a valve in precluding loss of air from the cylinder. While such pumps are not common, wherever they have been used, it has

been the practice to so design them as to provide a pump with a piston of small diameter and long stroke. The reasons for this are, firstly, that the sealing of a piston of small diameter is more easily realized, and, secondly, the friction offered by pistons of the prior art, which invariably employ expansible cups of rubber or leather, is so great that a piston of substantial diameter would require considerable expenditure of power to reciprocate the same, even on the intake stroke. Such piston, to be effective, must exert considerable lateral pressure against the cylinder wall when assembled therein, and the friction increases considerably above that in response to the lateral spreading force of the air as it is compressed. Therefore, in order to realize high compression with a pump of this kind, it has been practically necessary, as previously indicated, to design such pumps with small pistons and with long strokes.

I have developed a piston having such superior sealing qualities and such a low coefficient of friction that the factors which previously had to be considered in the design of pumps of this character, are no longer a limitation on their design.

By constructing a pump of substantial diameter, it is possible to compress a large volume of air into an exceedingly small space, with but a very short stroke of the piston. Therefore, the pump cylinder may be designed to have a relatively short longitudinal dimension, and this has the very material advantage of enabling the application of a pump of the single stroke type to a pistol, which by its very nature is of a relatively short longitudinal dimension, whereas a pump having a long stroke could not very well be adapted thereto.

My improved piston 71, which enables me to accomplish such a radical design in this type of pump, comprises a cup-shaped element 85 of metal or the like, having a cylindrical surface closely but not tightly fitting the interior of the pump cylinder, and a central perforated lug 87 to which the piston rod 73 may be pivotally connected. The outer circular face of this element has a short threaded stud 89 extending centrally therefrom.

Mounted on this stud, is a disk 91 of rubber-like material held in compression against the face of the cup-shaped element 85 by a metal compression disk 93 threaded to the stud. The rubber-like material is preferably of artificial rubber, one form of such material being known under the trade name of "Koroseal" which is basically formed from an acetylene derivative known as a polymer of one of the vinyl halides. This material has an exceedingly low coefficient of friction and is essentially unaffected by oils or lubricants. The radius of the disk 91 of this material is greater than that of the compression disk 93 by an amount substantially equal to the thickness of the compression disk, to form a rim 94, so that when the piston is assembled in the cylinder, the rim will be forced over between the peripheral rim of the compression disk 93 and the cylinder wall where it will fit snugly but not tightly. Under the circumstances, the edge of the rubber-like disk will lie substantially flush with the work face of the piston. The piston is thus capable of practically free movement in the cylinder in the absence of air under confinement therein.

Such freedom of movement is enhanced by preferably beveling along that circumferential edge 95 of the disk 93, bearing against the disk 91, so that when the disk 91 is placed under compression by the compression disk, the overhang-

ing portion or rim 94 will be forced to bend in the direction of the compression disk and away from the cup-shaped element 85.

When assembled in the cylinder, an annular space 97 is thereby caused to exist between the turned over rim 94 and the cup-shaped element 85 in the region of the cylinder wall. This space permits substantially free sliding movement of the rim 94 to the rear and into the annular space 97 under slight compression of air in the cylinder. This is of considerable importance in the functioning of my improved piston, for it will be apparent that during the initial portion of a compression stroke, such sliding of the rim 94 results in the exposed edge of the turned over rim being withdrawn from adjacent the work surface of the piston, thereby precluding the air under compression from exerting any lateral pressure against this rim in the direction of the cylinder wall.

The pressure of the compressed air, under the above circumstances, must, therefore, be directed exclusively in a longitudinal direction causing the rim 94 to swell and tightly pack the space between the compression disk 93 and cylinder wall, and wedge itself under increasing compression, into such clearance space as may exist between the cup-shaped element 85 and the cylinder wall, whereby to effectively seal the piston against leakage of air thereby. This manner of sealing is clearly illustrated in comparative Figures 6 and 6a of the drawings.

With a construction of this character and operating in the manner described, it will be apparent that the piston may be designed so as to normally move in the cylinder with considerable freedom, for any play which may normally be present will be effectively overcome by the compression of the air in the pump, working against the exposed edge of rim 94 of the sealing disk. Upon release of compression, as when the gun is fired, the rim 94 is free to resume its original condition, whereby the piston is again freely movable for subsequent pump operation.

In conjunction with this improved piston, I employ a piston rod so designed as to function in perfect cooperation with the rest of the pump in realizing additional advantages of considerable importance in the operation of such pump, and more particularly in its effect upon the firing characteristics of the gun.

As was previously pointed out, the construction of a cylinder of large diameter permits of the compression of a large volume of air into a space having an exceedingly small longitudinal dimension, with but a short stroke of the piston. In my improved gun, the distance between the piston and the end wall of the cylinder upon the completion of the compression stroke, may be of the order of a hundredth of an inch. If upon release of the air from the cylinder, which release occurs at the moment of firing the gun, the piston could be suddenly thrust forward to the end of the cylinder at a rate commensurate with the rate of discharge of the air, it will be apparent that the pressure of the air during discharge may be maintained above a practical minimum value, or in other words, the pressure may be precluded from decaying to any substantial extent during which split second period when the air is performing its function in the discharging of the shot.

I am enabled to accomplish such a sudden thrust of the piston, by bowing the piston rod 73 somewhat, thereby effectively turning it into a very stiff and powerful spring. It is preferably so designed that at the end of the compression stroke of the piston 71, the piston rod, under the pressure of which it has been exposed, will have been shortened by an amount comparable to the narrow spacing remaining between the piston and the end of the cylinder. Under these conditions, upon release of the air, the sudden restoration of the piston rod to its normal length will produce a sudden forward thrust of the piston as indicated in Figure 7, to accomplish the result desired.

To derive the most beneficial advantage from this feature, the valve chamber 35 is made only large enough to comfortably accommodate the valve 39 and permit of its being lifted from its valve seat. In other words, the air space in the valve chamber should be reduced to a minimum consistent with the ability to permit proper functioning of the valve.

As a further means of developing maximum pressure behind the shot at the instant of firing, I have developed a novel and improved restrainer 99 whose function it is to restrain the shot from any movement in the barrel until the pressure behind the same has built up to a substantial value, whereupon the release of the shot will be sudden and at considerably increased velocity. It thereby also effectively increases the beneficial results attributable to the follow-up feature of the bowed piston rod. This restrainer may take the form of a hollow plug 101 having a reduced open end threaded through the wall of the gun barrel, at approximately the firing position of a shot in the barrel. In the hollow of the plug, I provide a spring pressed pin 103 having a rounded end 105 extending but slightly into the bore of the barrel, but sufficiently to preclude free discharge of a shot placed at the firing position. The rounded end presents a sloping surface to the shot, thus enabling the pin to be depressed laterally in response to pressure applied normal to the pin axis, and such pressure will be developed upon opening of the valve to release the air in the cylinder.

I prefer to make this restraining device adjustable, whereby a certain amount of control may be exercised as to the velocity to be obtained. To this end, I provide a hole 107 in the end wall of the plug, through which an adjusting screw 109 may be passed and threaded into the stem of the pin 103. The adjusting screw will thereby enable one to adjust the extent to which the pin protrudes into the bore of the barrel and thereby effectively alter the resistance which must be overcome by the shot before being released.

In completing the pistol, the breech end thereof is enclosed in a casing 111. This casing extends over the grooved portion 21 of the gun barrel, cooperating therewith to form a magazine for holding the pellets in the groove provided therein, and to the rear of the magazine, the casing carries a rear sight 113.

From the description of my improved gun, it will be apparent that the same is capable of fulfilling all the objects of my invention as previously set forth, and while I have disclosed the same in detail in a preferred embodiment thereof, my invention is susceptible to change and modification, without departing from the scope of the same, and I accordingly do not desire to be limited in my protection to the details of my disclosure, except as may be necessitated by the appended claims.

I claim:

1. A compressed air gun comprising a barrel, a pump associated therewith including a cylinder having an open end and supported adjacent said barrel with its closed end toward the breech end of the gun, a lever pivoted adjacent the muzzle end of said barrel, said lever in one extreme position of swing having a portion disposed substantially parallel to said barrel and an angularly disposed portion extending across the open end of said cylinder, a piston in said cylinder having its working surface facing the closed end of said cylinder, a piston rod connected at one end to said piston and at its other end to an intermediate point on said lever lying just slightly beyond a line joining the pivot axis of said lever and the piston rod connection to said piston, in the direction of said barrel, when said piston is at the end of its compression stroke, a slidable breech pin normally held at the firing position of a shot in said barrel, and adapted to be withdrawn sufficiently to expose the interior of said barrel to a feed opening, and means connected to said breech pin and extending between the open end of said cylinder and said lever, in the path of movement of said piston on its intake stroke for effecting such withdrawal of the breech pin to automatically load said gun during the operation of said pump.

2. In an air gun, a gun barrel having a feed opening therein for the entrance of a shot into said barrel for subsequent placement at the firing position in said barrel ahead of said feed opening, a breech pin slidable in said barrel, means normally urging said breech pin to said firing position, a pump associated with said gun, and including a pump cylinder and a piston therein, and means acted upon by said pump piston for temporarily retracting said breech pin sufficiently to expose said barrel to said feed opening.

3. In an air gun, a gun barrel having a feed opening therein for the entrance of a shot into said barrel for subsequent placement at the firing position in said barrel ahead of said feed opening, a breech pin slidable in said barrel and normally blocking said feed opening with one end of said pin at said firing position, a pump associated with said gun, and including a pump cylinder and a piston therein, and means acted upon by said pump piston at the end of an intake stroke of said pump for withdrawing said breech pin sufficiently to expose said feed opening and admit a shot into said barrel.

4. In an air gun, a gun barrel having a feed opening therein for the entrance of a shot into said barrel for subsequent placement at the firing position in said barrel ahead of said feed opening, a breech pin slidable in said barrel, means normally urging said breech pin to said firing position and simultaneously causing the same to block said feed opening, a pump associated with said gun, and means acted upon by said pump at the termination of an intake stroke of said pump for withdrawing said breech pin sufficiently to expose said feed opening and admit a shot into said barrel.

5. In an air gun, a gun barrel having a feed opening therein for the entrance of a shot into said barrel for subsequent placement at the firing position in said barrel ahead of said feed opening, a breech pin slidable in said barrel and having an end protruding therefrom, a spring pressed lever engaging said protruding end and normally urging said breech pin to said firing position, a single stroke pump associated with said gun, and including an open end pump cylinder and a piston therein, said piston being adapted to be partially withdrawn from the open end of said cylinder at the end of the intake stroke thereof, and a slidable link connected at one end to said lever and having its other end turned up in front of the open end of said cylinder in the path of movement of said piston.

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