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PNEUMATIC GUN FOR SUBAQUATIC HUNTING

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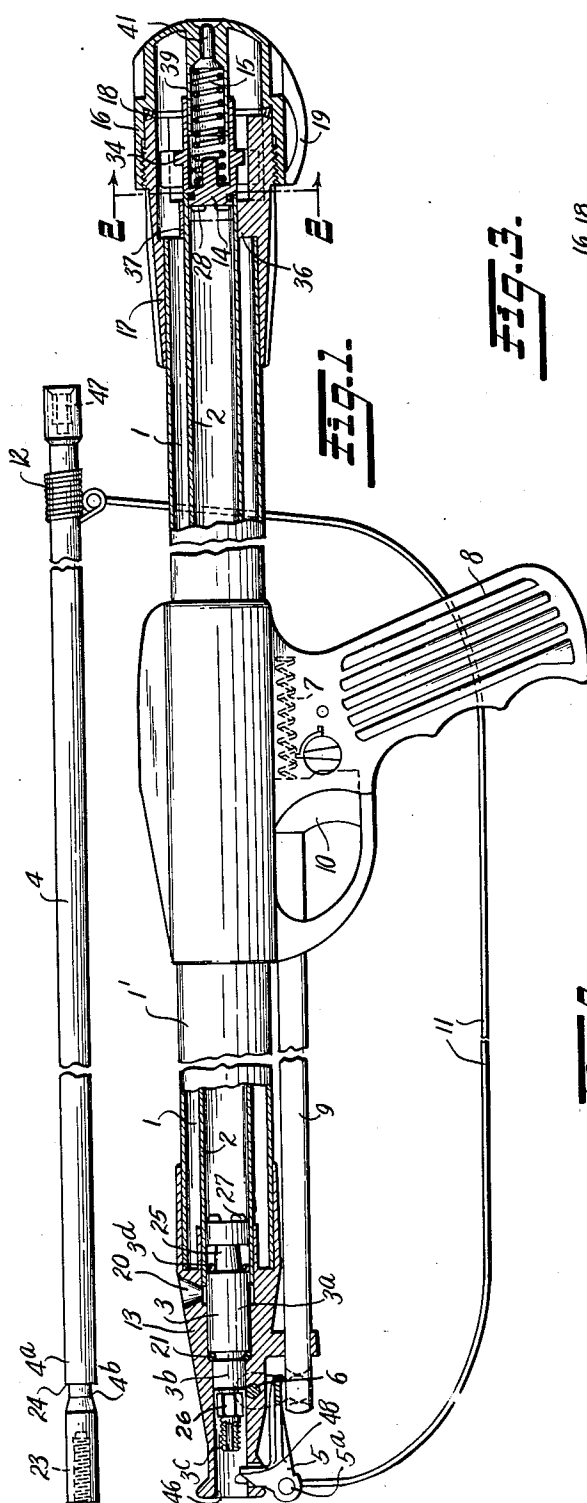


Fig. 1.

Fig. 3.

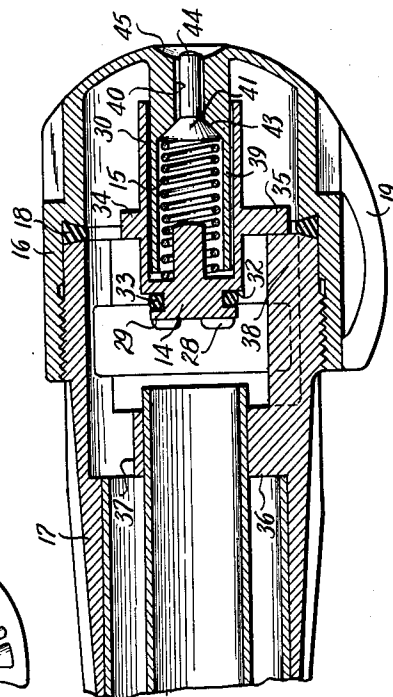
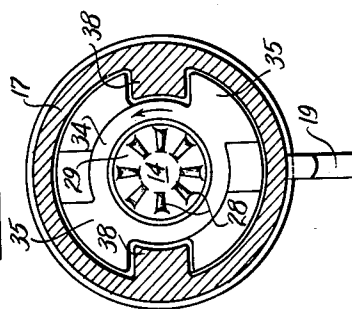


Fig. 2.



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PNEUMATIC GUN FOR SUBAQUATIC HUNTING

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6 Claims. (Cl. 124—13)

The present invention relates to a gun for subaquatic hunting of the pneumatic type in which the force for shooting the projectile, provided with a harpoon, is supplied by the discharge of compressed air contained in a reservoir, which air, after having effected the shooting of the projectile, remains entrapped within the barrel and reservoir, for utilization in succeeding loadings and shots.

Different types of subaqueous guns or weapons are known, operating with a spring, cartridge or hydropneumatic pressure.

The characteristics of spring and cartridge guns being generally known, the hydropneumatic type alone will be discussed, in order to point out that, in spite of the fact that a certain shooting power has been achieved with it, the fact remains that water accumulated under great pressure is used for compressing the air, already under pressure within a rubber bag, which air is thus employed as the propelling means.

This type of gun shows some non-negligible defects, the greatest of them resulting from the use of the rubber bag in the air chamber, entailing heavy losses of energy due to the inertia of the water having to flow through the container, as well as from the necessary travel of the grip and the running of the water through the whole barrel length.

Further, this type of gun, on account of its construction and operative characteristics, is handled with difficulty in water, also taking into account the readiness with which the projectile slips out from the barrel.

It is an object of this invention, therefore, to provide a novel pneumatic gun which utilizes air alone for the propulsion of the projectile.

It is a further object of this invention to provide a novel pneumatic gun which may be easily charged by reciprocating action of the piston, which functions in the nature of a pump to charge atmospheric air into the compressed air reservoir of the gun.

It is a further object of the invention to provide a novel pneumatic gun in which the projectile is provided on one end with means for positively engaging the piston to reciprocate the latter, and is provided on the other hand with means for loosely engaging the piston to rotate the latter.

It is a further object of the invention to provide a novel pneumatic gun including a check valve which retains the compressed air within the reservoir, and which valve can be unseated by means of the piston and projectile to place the gun in its "armed" condition.

It is a further object of the invention to provide a novel pneumatic gun which, having once been armed, can be loaded and discharged an indeterminate number of times without loss of the compressed air.

It is a still further object of the invention to provide a novel pneumatic gun in which the piston is braked by dashpot action toward the end of its outward stroke.

According to the present invention, a mass of compressed air is used for shooting the projectile, which mass of air is contained in a reservoir attached to the

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barrel and is susceptible of communicating with the said barrel wherein slides the piston used as a means for transmitting the propelling force in such a manner that the said mass of air, after having shot the arrow, does not escape through the bore of the barrel, but remains entrapped within the barrel to be, during the return of the piston, effected with the aid of a projectile, reutilized for an indeterminate number of successive gun loadings and re-shootings of the projectile.

To this end, there is provided a barrel within which slides a piston; a compressed air reservoir, annexed to and external of the said barrel and capable of being put into communication therewith, a valve which, during the loading (air compression) keeps the rear end of the said barrel closed, whereas, when open, puts it into communication with the said reservoir, a release device constantly kept inside the barrel and operated by means of a conventional trigger carried by the hand grip by means of a tube; a screw threaded end cap for closing the extremity of the weapon with a perfect compressed airtight seal and a spring arranged in the said end piece for closing a second valve provided at the rear end of the barrel.

These and additional characteristics and advantages will better be shown by a perusal of the following specification with reference to the appended drawings given by way of example and in no way limitative of the practical possibilities of realization of the gun according to the present invention, in which Fig. 1 is an elevational view of the gun, illustrating parts in section; Fig. 2 is a sectional view through the gun on the line 2—2 of Fig. 1, drawn to a larger scale; and Fig. 3 is a fragmentary view of the right hand end of Fig. 1, drawn to a larger scale, showing the valve in its open position.

As shown in Fig. 1, the gun includes a reservoir 1 for the compressed air which may be tubular in shape. The compressed air reservoir may have an annular cross section, formed by an outer tube 1' and by an annular inner tube 2 concentric with the outer tube 1', having a rear threaded sleeve 17, and closed at the front end by a muzzle piece 13, constituting the gun barrel, in which slides a piston 3; by rod or projectile 4, carrying at the front end thereof a means for receiving the harpoon (not shown); by a detent device formed by a catch 5, fulcrumed at 6 on the muzzle piece 13, in such a manner as to be constantly maintained inside the barrel, and by a compression spring 7 housed within the hand grip 8, and controlled by a trigger 10, through a tube 9 integral with said trigger 10. Movement of the trigger is manually controlled within the hand grip 8.

The outer end of the catch 5 is hooked and presents a hole 5a for tying to it a line 11, the other end of which is fastened to the line carrier 12 provided upon the corresponding end of the rod or projectile 4. The latter is provided with an internally threaded bore 23 at its forward end 4a for screwing into it a harpoon, and includes a neck 4b, having a shoulder 24 adapted for engagement with the catch 5. The rear end has a hexagonal bore 47 for controlling, through the piston, the movement of a valve 14, as will be described more fully hereinafter. The piston 3 presents a fairly loose fit within the barrel, and adjacent its inner end has a truncal groove 25 for a resilient sealing ring 3d, a cylindrical fore portion 3b, having a smaller diameter fitting within a reduced diameter outlet end 46 of the muzzle 13, and a threaded end 3c for screwing into the threaded bore 23 in the fore end 4a of the projectile 4 when the weapon is to be loaded, that is, charged with compressed air. To the rear of said threaded end 3c is provided a hexagonal shaped head 26, which is adapted to be introduced into the hexagonal bore 47 in the rear end of the projectile 4 and rotated therewith for transmitting

rotary movement to the valve 14 as will be described more fully hereinafter. Said movement is rendered possible because the two facing surfaces of the piston and valve carry a plurality of axially extending fingers 27 and 28, respectively, which mutually interdigitate to make the operation possible.

The rear end of the gun is closed by a closure cap 16. The valve 14, loaded by a compression spring 15 arranged in the cap 16, is provided for closing the rear end of the gun barrel, which closure is essential for effecting the charging of compressed air into the reservoir 1, after which the valve is unseated from its seat on the end of the gun barrel to permit communication of the compressed air charge in the reservoir with the gun barrel, to have a direct communication with the inner end of the piston 3. The valve 14 (Fig. 3) is formed by a disc 29 on the end of an elongated sleeve 30, the outer diameter of the sleeve being slightly larger than the diameter of the disc 29. An annular groove 32, carrying a sealing O-ring 33, is provided between the disc 29 and the sleeve 30. As shown in Fig. 1, the disc 29 and the sealing ring 33 enter the open inner end of the gun barrel, while the end of the sleeve adjacent the disc provides a shoulder engaging the end of the barrel to limit the closing movement of the valve. An external flange 34 is provided, spaced from the ends of sleeve 30, which flange carries a pair of opposite, radial, extensions or wings 35. Rear sleeve 17 is provided with one or more radially, inwardly projecting members 36, carrying a ring 37 adapted to engage and center the inner end of the gun barrel, as seen in Figs. 1 and 3. The rear sleeve 17 is also provided with a pair of opposed, inwardly directed, projections 38, providing shoulders cooperating with the wings 35 to retain the valve 14 in its open position, as will appear hereinafter. Closure cap 16 carries an inwardly extending sleeve 39, which loosely slides within the sleeve 30 to form a guide for the valve 14. The interior of sleeve 39 communicates with the atmosphere by means of an aperture 40, which is controlled by a check valve 41, engaging a valve seat 43, having a valve stem 44 extending into the bottom of a recess 45 of closure cap 16. The compression spring 15 within sleeve 39 engages the valves 14 and 41, urging them toward their respective seats. In the illustrated embodiment, the closure cap 16 insures, by means of a gasket 18, a perfectly tight joint to the compressed air and permits quickly demounting the gun assembly, even without tools.

The closure cap 16 is provided with a line holder 19.

In order to prevent a useless compression of the water that, during the use of the gun and before firing, may enter and collect in the forward end of the barrel ahead of the piston 3, a ring of holes 20 has been provided, of which only one is shown, through which the water is expelled as the piston 3 is driven forwardly by the compressed air. The forward end of the muzzle piece 13 is provided with an outlet 46 of reduced diameter, in which is received the reduced diameter forward extension 3b of the piston 3, as described above. A groove is provided between the central cylindrical portion 3a and the reduced diameter extension 3b of the piston 3 to receive a sealing ring 21. During its firing stroke, the piston 3 forces the water in front of it through the holes 20 until the cylindrical portion 3a shuts the passage of the said holes 20, while the extension 3b thereof enters the outlet 46 in the front part of the muzzle piece of the gun. The water, entrapped in this annular chamber between the holes 20 and the reduced diameter outlet 46, serves as a hydraulic absorber or brake to the piston 3, which is pushed at high speed toward the front end of the weapon. For reducing the consequences of the final blow and avoiding a direct contact between the front end of the gun and the piston 3, the sealing ring 21 on said piston becomes effective.

For charging the reservoir 1 with compressed air, the valve 14 should be on its valve seat. The threaded end

23 of projectile 4 is screwed on the threaded end 3c of the piston 3. The charging of the reservoir is effected by reciprocating the piston within the gun barrel 2 in the ambient atmosphere, which introduces the compressed air into the reservoir by a pumping effect. It is understood that the air is at all times retained within the reservoir 1 by the valve 14.

In the successive movement of the piston 3 away from the valve 14 during the pumping action, due to the fact that the check valve is closed at that time, a vacuum is created between the piston 3 and the valve 14 which, together with the movement of the piston, helps displace the seal 3d from its sealing position to the position of least diameter of the trunco-conical groove 25 of the piston, allowing atmospheric air to enter by way of the holes 20 and around the loosely fitting piston 3 into the barrel between the piston and the check valve 14.

On the other hand, during the return or inward movement, the sealing ring 3d is forced into its sealing position in the narrowest portion of the annular groove 25 on account of the pressure produced between the piston 3 and the check valve 14. As the piston 3 is forced by projectile 4 toward the check valve 14, the air is compressed, unseats the check valve and enters the reservoir 1. As piston 3 is drawn outwardly, the check valve is seated by the spring 15 and by the compressed air in the reservoir, while the ring or seal 3d is forced from its seat, as explained above, to permit atmospheric air to enter into the gun barrel between the piston 3 and the check valve 14. The projectile 4 and piston 3 are reciprocated until the desired pressure is attained in the reservoir 1. The projectile 4 may then be unscrewed from the piston 3, whereupon the check valve will prevent the escape of the compressed air.

When it is desired to arm the gun, the right hand end of the projectile 4 is inserted into the outlet 46, permitting the hexagonal bore 47 to engage the hexagonal head 26 on the piston extension 3b. By means of the projectile, the piston can be forced to the right, compressing the air between the piston and valve, until the axially extending fingers 27 on the piston interdigitate with the axially extending fingers 28 on the valve 14. Further movement toward the right unseats the valve. Loss of compressed air from the reservoir 1 is prevented by the sealing ring 3d being forced against its seat by the air pressure. Piston 14 is moved to the right against the compressed air on piston 3 and the pressure of spring 15 on the valve 14 until the wings 35 have passed beyond the shoulders on the inwardly extending projections 38, at which time the projectile 4 is given a one-quarter turn, which aligns the wings 35 with said shoulders. Pressure is released on the projectile 4 until the wings 35 contact the shoulders on the projections 38, which will limit the closing movement of the valve 14. As pressure is still further released on the projectile 4, the pressure of the air on piston 3 will move the projectile outwardly until the catch 5 enters the neck 4b and engages the shoulder 24 on the projectile, thereby stopping further outward movement. The spring 7 urges the pivoted catch 5 to rotate in a clockwise direction about its fulcrum 6, and thereby forces the end of the catch 5 through an opening 48, in the muzzle piece 13 and into the neck 4b. It is preferred that the above arming operation be performed in the open atmosphere, to prevent the pumping of water into the reservoir which might occur if performed below the water surface. A harpoon may then be screwed into the threaded bore 23 of the projectile.

The hand grip device 8 is provided to facilitate aiming and firing. By pulling the trigger 10, the catch 5 is rotated in a counterclockwise direction about its fulcrum 6, while compressing spring 7, thus releasing the projectile, which is projected with considerable force by the compressed air acting on the rear of piston 3. The water ahead of the piston is forced out of the holes 20, and when the piston covers the holes, the water ahead of the

piston will be trapped, as explained above, to cushion the forward stroke.

Having once been armed, as described above, the gun may be repeatedly loaded and fired under the surface of the water without loss of air and without admitting water into the reservoir 1. Air pressure acting on the sealing ring 3d retains it in its seating position, preventing the escape of air around the loosely fitting piston 3 or the entry of water into the space between the piston and the unseated valve 14. The end of the projectile 4 having the hexagonal bore 47 may be fitted over the hexagonal head 26 of the piston extension 3b, as described above, and the projectile and piston 3 forced toward the right until the catch 5, under the urging of compression spring 7, engages the neck 4b.

To disarm the gun, the projectile 4 is inserted, as in loading, until the fingers 27 on the piston 3 interdigitate with the fingers 28 on the valve. The projectile and piston are then given a one-quarter turn, which moves the wings 35 from alignment with the shoulders on the extensions 38. Release of the projectile permits the spring 15 to return the valve 14 to its seat.

To the end of reducing the pressure in the reservoir as well as of entirely emptying it of air, the valve 41 at the rear end of the gun may be opened by manually pressing the outer end of the extension of the valve stem 44 in the recess 45.

In consequence of the above described structure, in which a large portion of the reservoir 1 surrounds the gun barrel, the gun, according to the invention, is ordinarily floatable without the rod 4, this being an advantage particularly felt in the operations for recovering hit fish, allowing, especially in shallow waters, of abandoning the weapon after the shot. The construction also permits a large volume reservoir, increasing the efficacy of the weapon.

It is understood that by suitable modifications to the structure and dimensions of the various parts, it is possible to obtain different characteristics relative to the effort to be applied at the start and the end of the piston stroke, as it is possible, by the effect of the said variations to obtain the buoyancy of the loaded gun complete with harpoon, or else the loss of buoyancy, for instance, in order to have a weapon with an easy loading at the beginning, and with a hard loading at the end of the stroke.

I claim:

1. A subaquatic gun, comprising: a barrel; a piston positioned for sliding movement within said barrel; a projectile having means to engage said piston for sliding and rotatable movement therewith; a compressed-air reservoir communicating with the rear end of said barrel; a check valve interposed between said reservoir and said barrel to permit said reservoir to be charged with air through said barrel; and means for holding said check valve in open position, said piston including means to

engage said check valve, when the piston is actuated by said projectile, to unseat the check valve and to rotate it into engagement with said holding means, whereby charged air in said reservoir is applied against said piston tending to force said piston toward the forward end of said barrel.

2. The device of claim 1 wherein said reservoir entirely surrounds said barrel in substantially coaxial relation thereto for a major portion of its length.

3. The device of claim 1 wherein said piston includes valve means whereby reciprocation of said piston effects a pumping of air from said barrel through said check valve into said reservoir.

4. The device of claim 3 wherein said projectile has a second means thereon for removably attaching it to said piston for reciprocation thereof.

5. A subaquatic gun comprising: a barrel; a piston positioned for sliding movement within said barrel; means tending to move said piston toward the forward end of said barrel for movement of a projectile engaged by the forward end of said piston, said barrel having lateral unobstructed port means adjacent the forward end thereof to facilitate discharge of fluid in advance of said piston as said piston moves toward the forward end of said barrel; means associated with said piston for closing said port means as said piston reaches a point adjacent the forward end of said barrel to restrict said discharge and means to brake the momentum of said piston comprising a reduced diameter outlet from said barrel, a forward extension of reduced diameter on said piston adapted to enter said reduced diameter outlet toward the end of the piston stroke, said piston, barrel, reduced diameter outlet and extension on said piston forming a dashpot which becomes effective after the said means associated with the piston closes said port means to brake the piston movement.

6. The device of claim 3 in which said means to engage said piston for sliding and rotatable movement therewith is provided on one end of said projectile to loosely engage said piston whereby the piston may project the projectile from the gun, and the projectile is provided, on its other end, with a second means for securely connecting the projectile to the piston to permit pumping action of the piston.

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