P. A. McCULLOUGH.

FLUID PRESSURE GUN.

APPLICATION FILED DEC. 16, 1915.

1,204,803.

Patented Nov. 14, 1916.

2 SHEETS—SHEET 1.

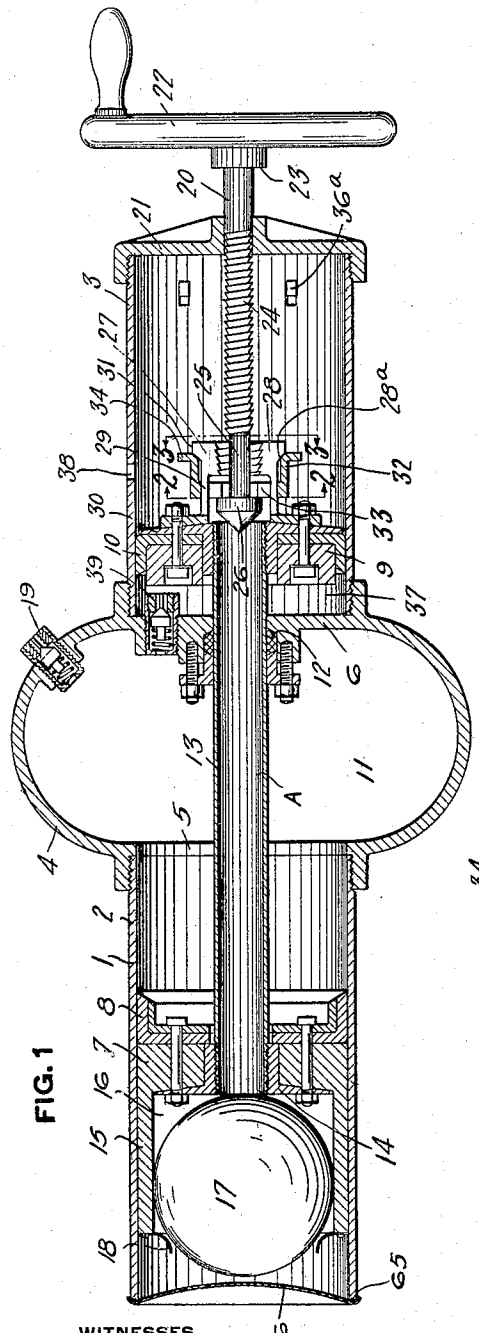


FIG. 1

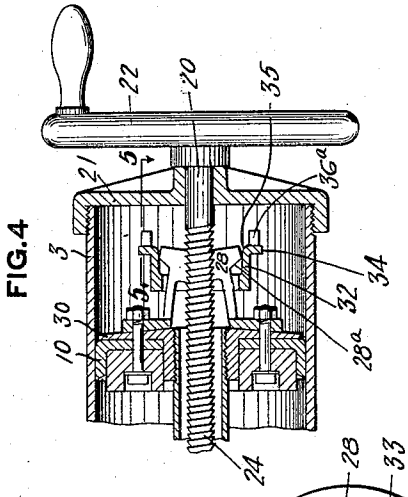


FIG. 4

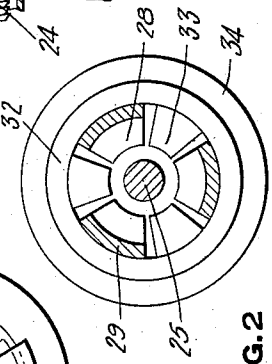


FIG. 2

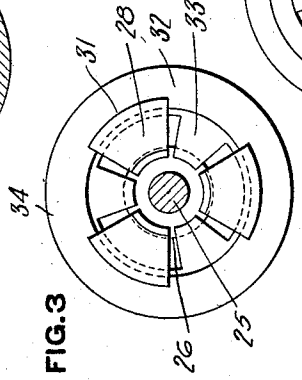


FIG. 3

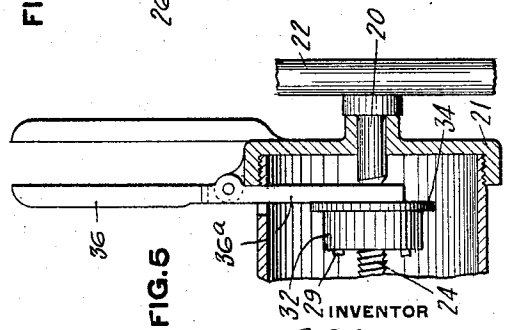


FIG. 5

WITNESSES

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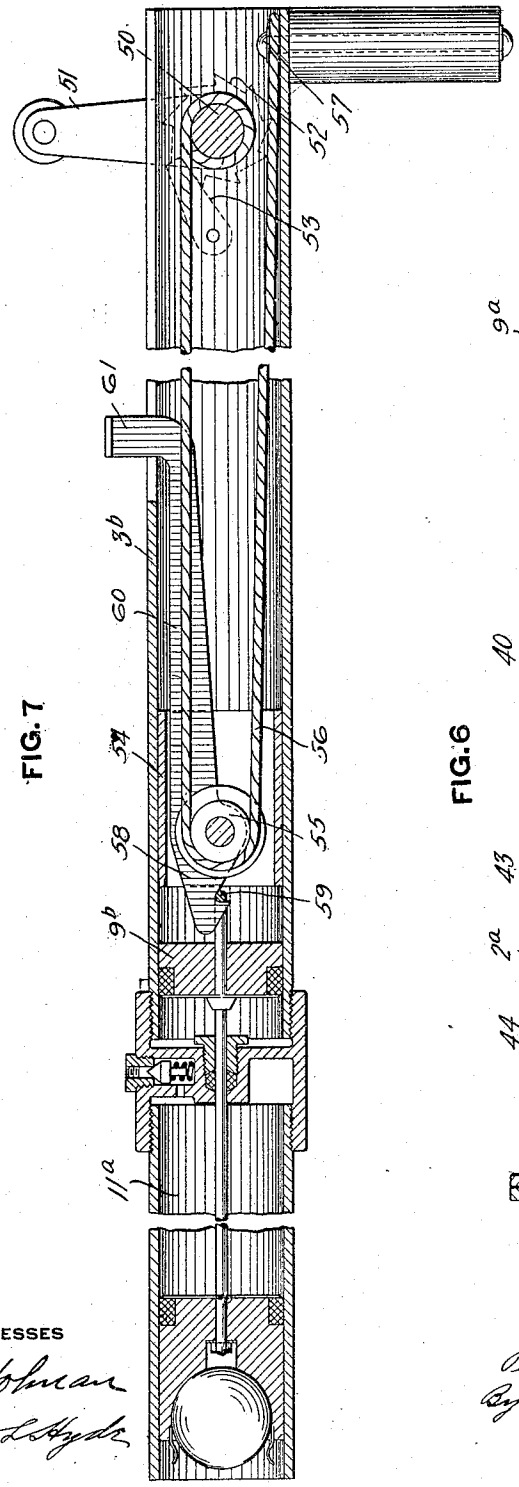


FIG. 7

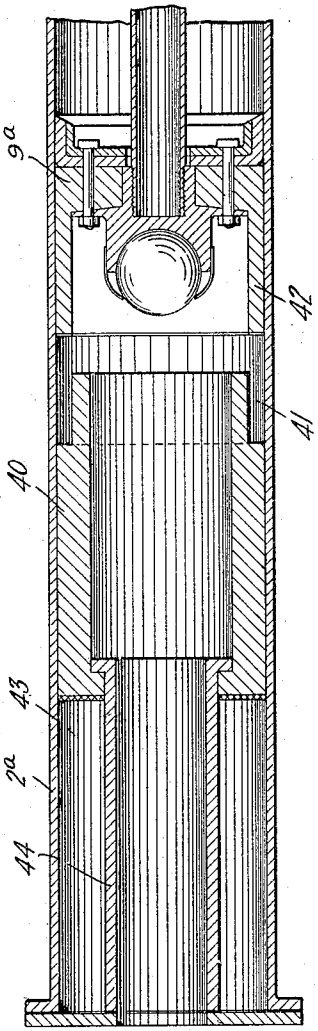


FIG. 6

WITNESSES

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UNITED STATES PATENT OFFICE.

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FLUID-PRESSURE GUN.

1,204,803. Specification of Letters Patent. Patented Nov. 14, 1916.

Application filed December 16, 1915. Serial No. 67,268.

To all whom it may concern:

Be it known that I, PETER A. McCULLOUGH, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Fluid-Pressure Guns, of which the following is a specification.

This invention relates to fluid pressure guns for impelling projectiles.

The object of the invention is to provide a simple form of gun requiring no explosive for impelling the projectile, but nevertheless enabling it to be safely thrown to a distant point with accuracy and a minimum expenditure of energy; and one which can be readily operated by unskilled persons and can be regulated to impel the projectile to any distance.

A further object of the invention is to provide a gun of this kind which has maximum strength for its weight and which is provided with cushioning devices for absorbing the surplus energy of the impelling member, thereby avoiding injury to the gun; and also one which is of simple construction so that it can be readily repaired or its parts replaced in the field from ordinary material likely to be at hand.

Further objects of the invention are in part obvious and in part will appear more in detail hereinafter.

In the drawings, Figure 1 represents a longitudinal sectional view through one form of gun embodying the invention; Fig. 2 is a cross sectional view on the line 2—2, Fig. 1, looking in the direction of the arrows; Fig. 3 is a cross sectional view on the line 3—3, Fig. 1, looking in the direction of the arrows; Fig. 4 is a detail view of the plunger retracting mechanism, the plunger being shown in retracted position ready to be released; Fig. 5 is a detail sectional view on the line 5—5, Fig. 4; Fig. 6 is a longitudinal sectional view, of another gun, showing a modification; and Fig. 7 is a similar view, showing still another form of gun.

Referring to the drawings, the gun shown embodies a hollow casing 1, which may be of any suitable form, and is shown as embodying two tubular members 2 and 3 threaded into opposite ends of a large intermediate member 4 having a large opening 5 at one end leading into the tube 2 and at its opposite end provided with a cross wall 6. The two tubes 2 and 3 form supports and guides for a movable plunger A, shown as provided with a stem 13, a head 7 having a suitable packing 8 closely fitting the walls of the tube 2 and a head 9 having a similar packing 10 fitting the walls of the tube 3. Both of said packings 8 and 10 are shown as cupped members whose rims extend toward the hollow member 4. The chamber 11 within said member and behind the head 7 is filled with a body of fluid, such as air or other gas, which forms the power medium for operating the plunger and impelling the projectile. Said fluid is confined at one end of said chamber by the packing 8, and at the opposite end by a packing 12 in the cross wall 6 through which slides the hollow tubular stem 13 of the operating plunger.

Head 7 of the plunger is shown as comprising a fitting 14 screwed upon the pipe 13 and to which is bolted or otherwise secured a cup-shaped holder 15 whose cavity 16 forms a seat for the projectile 17. Said projectile is preferably held loosely in said seat and is prevented from accidentally escaping therefrom by light springs, such as the leaf springs 18, attached to the outer end of the holder 15.

In operation of this gun the plunger is retracted in the casing to increase the pressure of the fluid in chamber 11, so that the pressure of said fluid forms the impelling force for throwing the plunger forward and impelling the projectile from the gun. The pressure in chamber 11 is usually maintained at some point above atmospheric pressure. In other words, the pressure in said chamber is raised above normal from some outside source. For this purpose the gun is provided with an outwardly seating valve 19, shown as located in the wall of the hollow member 4, which retains the pressure in the chamber 11, and also enables pressure to be supplied to said chamber from an outside source, such as a hand pump or other device which may be attached to the outer end of the casing of valve 19.

Any suitable means may be provided for retracting the impelling plunger. In the form shown in Fig. 1, the plunger is retracted by a rotatable rod 20 which passes through a central opening in a head 21 on the outer end of pipe 3 and is provided on its outer end with an operating member, such as the hand wheel 22, although, of course,

a power motor may be employed if desired. Said rod is also provided with a collar forming a shoulder 23 which abuts against the outer face of the head 21 in retracting the piston, and the outer portion of said rod, where it passes through said head, is a smooth cylinder, so that said rod can be rotated freely in the head without moving longitudinally therein. The central portion of said rod is provided with threads 24, and its inner end has the threads cut away to form a reduced smooth cylindrical portion 25 beyond which is a head 26 of larger diameter than the reduced portion 25. Attached to the operating plunger is a sectional nut 27, shown as comprising a plurality, say three, of internally threaded members 28 which are movable radially relatively to each other. Said threaded members are shown as carried by longitudinally extending arms 29 which may be formed on or attached to the fitting 30 of the head 9, and which arms have sufficient flexibility and resiliency to enable the nut sections to expand and retract. The outer surfaces of said nut sections are provided with inclined shoulders 28^a and longitudinally extending abutment surfaces 31 to coöperate with an operating sleeve 32 surrounding said nut. Said sleeve embraces the arms 29 and is provided with inwardly extending abutments 33 lying behind the head 26 of the operating rod 20, and its outer end is provided with an annular flange 34 having a curved inner surface 35 for cooperation with the inclined surfaces 28^a of the nut sections.

In Fig. 1 the parts are shown in the position when the plunger has been released and has moved forwardly, the projectile being just about to begin its forward travel. To retract the piston the operating rod 20 is first pulled outwardly by its handle to cause the head 26 to engage the shoulders 33 of the sleeve 32 and force said shoulder outwardly, whereby its rounded surfaces 35 ride over the inclined surfaces 30 and upon the cylindrical abutment surfaces 31 of said sections. Rod 20 is then pushed inwardly until its threads 24 engage the threads of the nut and is turned by its handle to cause the nut to travel outwardly along the screw threads and thereby retract the plunger. Suitable mechanism is also provided for releasing the plunger from the retracting rod to impel the projectile. In the form shown said means comprises a handle 36 pivotally mounted upon the outside of the casing, for example, upon the periphery of the head or cap 21, and having one or more arms 36^a extending through openings into said casing and lying opposite the flange 34 of sleeve 32 when in retracted position. By pressing upon the handle 36 sleeve 32 is pushed back off the nut sections, which thereupon expand and release the plunger from the operating rod 20. The plunger thereupon is thrown forwardly by the pressure in chamber 11 and impels the projectile to its destination. The plunger may be released in several different positions with varying pressures behind it, and the normal pressure in chamber 11 may be increased or diminished by way of valve 19, whereby the range of the gun may be adjusted as desired. The arms 36^a may, if desired, be rigidly mounted upon the casing walls in the position shown in Fig. 1, and so arranged as to push the sleeve 32 off from the nut sections by the rearward movement of the plunger 13, so that said plunger is automatically released when fully retracted. The gun is also arranged to cushion the blow of the plunger at the end of its stroke and thereby avoid transmitting a powerful shock to the casing or frame and possibly injuring the gun. Several cushioning devices are shown for this purpose. In the form shown in Fig. 1 the cushioning effect is obtained by the air in the chamber 37 between the head 9 and cross wall 6. Pipe 3, in which the head 9 travels, is provided at one point with a port or opening 38 located outwardly beyond the limit of travel of the head 9. Consequently said head passes and closes the port 38 when the plunger moves forwardly, and compresses the air in the chamber 37. By locating the port 38 longitudinally at different points on the tube 3 any desired cushioning effect can be obtained. Furthermore, the cross wall 6 is preferably provided with a check valve 39, seating toward the chamber 37, and governing the passage of fluid from said chamber to the chamber 11. The operating plunger travels forward with considerable momentum, and always moves slightly beyond the point at which the pressures in chambers 11 and 37 equalize. Consequently at each forward movement of the plunger a small amount of air passes through the valve 39 from chamber 37 to chamber 11, thereby automatically maintaining the pressure in chamber 11 and compensating for losses therefrom by leakage. Usually the pressure in chamber 11 builds up to and does not exceed a definite maximum, so that the air passing through the valve 39 is merely sufficient to supply leakage losses.

Fig. 6 shows another cushioning arrangement. This form of gun is provided with an auxiliary piston 40, located in advance of the head 9^a of the main operating plunger and provided on its outer face with an annular cavity 41 to receive the rim or wall 42 of the head 9^a. Consequently, when the head 9^a encounters the auxiliary piston in its forward travel the rim or wall 42 enters the cavity 41 and compresses the air therein to cushion the blow. Auxiliary piston 40 also travels in a closed chamber 43, formed by the main casing 2^a and a supplemental inner cas-

ing 44, as the result of which the main plunger compresses the air in chamber 43 in addition to moving the auxiliary piston forwardly.

Fig. 7 shows another embodiment of the invention including slight modifications in the form of the main plunger and the casing in which it travels and also shows a different form of mechanism for retracting said piston. Said mechanism comprises a winding drum 50 journaled in the outer end of the casing tube 3^b and operated by a handle 51. Connected to said drum is a ratchet 52 coöperating with a pawl 53 mounted on the casing and adapted to prevent backward rotation of the drum when wound. Behind the rear piston head 9^b is a sliding hollow sleeve 54 in which is journaled a pulley 55 over which passes a cord or cable 56. One end of said cable is secured at 57 to a fixed part of the casing, and the other end of said cable is fastened to the drum 50. By winding up the drum the sleeve 54 is retracted in the casing. Said sleeve is connected to the main plunger, for retracting the same, by a hook 58 arranged to engage a loop or eye 59 carried by the plunger, and which hook is located on one end of a long arm 60 pivoted on the axis of the pulley 55. Said arm has a portion 61 extending out through a longitudinal slot in the casing tube 3^b. With this form of the invention the main piston is retracted by winding up the drum 50 so as to compress the air in the chamber 11^a. The more the plunger is retracted the greater is the pressure in said chamber and the impelling force applied to the projectile. Consequently, with this arrangement the projectile can be impelled to any distance by retracting the plunger to the proper degree. When retracted the plunger is released by pressing down upon the outwardly extending portion of lever 60, thereby releasing the hook 58 from the loop 59.

With all forms of the invention the effect may be increased by closing the outer or muzzle end of the gun by a substantial non-collapsible diaphragm, so as to prevent the entrance of air thereto. When the main plunger is retracted a vacuum is produced in the muzzle end of the gun to assist in moving the plunger forwardly when released. For example, in Fig. 1 the muzzle end of the gun is provided with a seat for a gasket 65, and after the projectile is put in place a thin sheet metal diaphragm 66, preferably convex toward the projectile, is placed over said gasket. This diaphragm is strong enough to resist collapse by the vacuum, but is so light that when the plunger moves forwardly the projectile merely pushes it out of the way and it offers no substantial resistance to the forward movement of the projectile.

In use of the gun it will of course be mounted upon a suitable support or frame designed to absorb the recoil and also embodying suitable means for aiming the gun in any desired direction. These features, however, may be of any suitable form and are not essential to the invention and are therefore not illustrated. This form of gun is very simple and does away entirely with the use of explosive charges for firing projectiles. It is therefore particularly valuable for impelling explosive projectiles, such as grenades which are ordinarily thrown by hand. It can be made in any size to suit the particular grenade which it is desired to discharge and can be proportioned or adjusted to impel said projectile to any desired distance.

What I claim is:—

1. A fluid pressure gun, comprising a casing having a pressure chamber therein, and a projectile impelling member movable in said casing and adapted when retracted therein to increase the pressure in said chamber.

2. A fluid pressure gun, comprising a casing having a pressure chamber therein, a projectile impelling member movable in said casing and adapted when retracted therein to increase the pressure in said chamber, and means for retracting said member.

3. A fluid pressure gun, comprising a casing having a pressure chamber therein, a projectile impelling member movable in said casing and adapted when retracted therein to increase the pressure in said chamber, means for retracting said member, and means for releasing said member from said retracting means.

4. A fluid pressure gun, comprising a casing having a pressure chamber therein, a projectile impelling member movable in said casing and adapted when retracted therein to increase the pressure in said chamber, and means for cushioning said member on its forward stroke.

5. A fluid pressure gun, comprising a casing having a pressure chamber therein, and a projectile impelling member movable in said casing and having a portion forming one wall of said chamber, said member being adapted when retracted in said casing to increase the pressure in said chamber.

6. A fluid pressure gun, comprising a casing having a pressure chamber therein, a projectile impelling member movable in said casing and having a portion forming one wall of said chamber, said member being adapted when retracted in said casing to increase the pressure in said chamber, and means for retracting said member.

7. A fluid pressure gun, comprising a casing having a pressure chamber therein, a projectile impelling member movable in said casing and having a portion forming one

wall of said chamber, said member being adapted when retracted in said casing to increase the pressure in said chamber, means for retracting said member, and means for releasing said member from said retracting means.

8. A fluid pressure gun, comprising a casing having a pressure chamber therein, a projectile impelling member movable in said casing and having a portion forming one wall of said chamber, said member being adapted when retracted in said casing to increase the pressure in said chamber, and means for cushioning said member on its forward stroke.

9. A fluid pressure gun, comprising a casing having a pressure chamber therein, a projectile impelling member movable in said casing and adapted when retracted therein to increase the pressure in said chamber, and means for automatically supplying pressure to said chamber.

10. A fluid pressure gun, comprising a casing having a pressure chamber therein, a projectile impelling member movable in said casing and adapted when retracted therein to increase the pressure in said chamber, and means controlled by said piston for supplying fluid to said chamber.

11. A fluid pressure gun, comprising a casing having a pressure chamber therein, a projectile impelling member movable in said casing and adapted when retracted therein to increase the pressure in said chamber, and means whereby said piston on its forward stroke supplies fluid to said chamber.

12. A fluid pressure gun, comprising a tubular casing having a pressure chamber therein, and a plunger slidable in said casing and having a seat for a projectile, said plunger when retracted being adapted to increase the pressure in said chamber.

13. A fluid pressure gun, comprising a tubular casing having a pressure chamber therein, and a plunger slidable in said casing and having a seat for a projectile, said plunger having a portion forming one wall of said chamber and adapted when retracted to increase the pressure therein.

14. A fluid pressure gun, comprising a tubular casing having a pressure chamber therein, a plunger slidable in said casing and having a seat for a projectile, said plunger when retracted being adapted to increase the pressure in said chamber, and means for retracting said plunger.

15. A fluid pressure gun, comprising a tubular casing having a pressure chamber therein, a plunger slidable in said casing and having a seat for a projectile, said plunger having a portion forming one wall of said chamber and adapted when retracted to increase the pressure therein, and means for retracting said plunger.

16. A fluid pressure gun, comprising a tubular casing having a pressure chamber therein, a plunger slidable in said casing and having a seat for a projectile, said plunger when retracted being adapted to increase the pressure in said chamber, means for retracting said plunger, and means for releasing said plunger when retracted.

17. A fluid pressure gun, comprising a tubular casing having a pressure chamber therein, a plunger slidable in said casing and having a seat for a projectile, said plunger having a portion forming one wall of said chamber and adapted when retracted to increase the pressure therein, means for retracting said plunger, and means for releasing said plunger when retracted.

18. A fluid pressure gun, comprising a tubular casing having a pressure chamber therein, a plunger slidabe in said casing and having a seat for a projectile, said plunger when retracted being adapted to increase the pressure in said chamber, and means for cushioning said plunger on its forward stroke.

19. A fluid pressure gun, comprising a tubular casing having a pressure chamber therein, a plunger slidable in said casing and having a seat for a projectile, said plunger having a portion forming one wall of said chamber and adapted when retracted to increase the pressure therein, and means for cushioning said plunger on its forward stroke.

20. A fluid pressure gun, comprising a tubular casing having a pressure chamber therein, a plunger slidable in said casing and having a seat for a projectile, said plunger when retracted being adapted to increase the pressure in said chamber, and means operable from the breech end of said casing for retracting said plunger and thereby compressing the fluid in said chamber.

21. A fluid pressure gun, comprising a tubular casing having a pressure chamber therein, a plunger slidable in said casing and having a seat for a projectile, said plunger having a portion forming one wall of said chamber and adapted when retracted to increase the pressure therein, and means operable from the breech end of said casing for retracting said plunger and thereby compressing the fluid in said chamber.

22. A fluid pressure gun, comprising a tubular casing having a cross wall therein, a plunger extending through said wall and provided with heads on opposite sides thereof working in the tubular casing, and means for retracting said plunger in said casing to compress the fluid in said casing between one of said plunger heads and said cross wall.

23. A fluid pressure gun, comprising a tubular casing having a cross wall therein, a plunger extending through said wall and

provided with heads on opposite sides thereof working in the tubular casing, means for retracting said plunger in said casing to compress the fluid in said casing between one of said plunger heads and said cross wall, and a valve located in said cross wall for controlling the flow of fluid therethrough.

24. A fluid pressure gun, comprising a casing having a pressure chamber therein, a projectile impelling member movable in said casing and adapted when retracted therein to increase the pressure in said chamber, and means for sealing the muzzle end of said casing for producing a vacuum in advance of the projectile.

In testimony whereof, I have hereunto set my hand.

PETER A. McCULLOUGH.

Witnesses:
ELBERT L. HYDE,
GLENN H. LERESCHE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D C."