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Gordon

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[54] **HIGH PRESSURE VALVE**

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[52] **U.S. Cl.**.....**251/214,** 251/318

[51] **Int. Cl.**.....**F16k 5/00**

[58] **Field of Search**.....251/120, 122, 213, 251/214, 318, 319, DIG. 4; 137/495, 509, 522, 625.68

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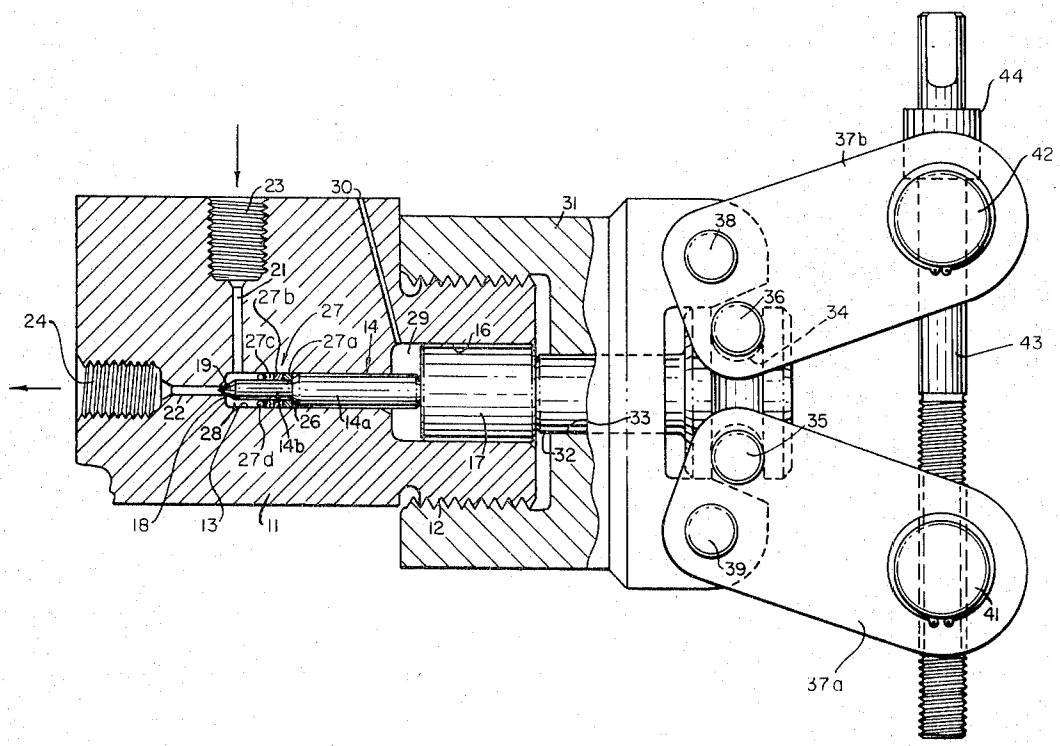
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[57] **ABSTRACT**

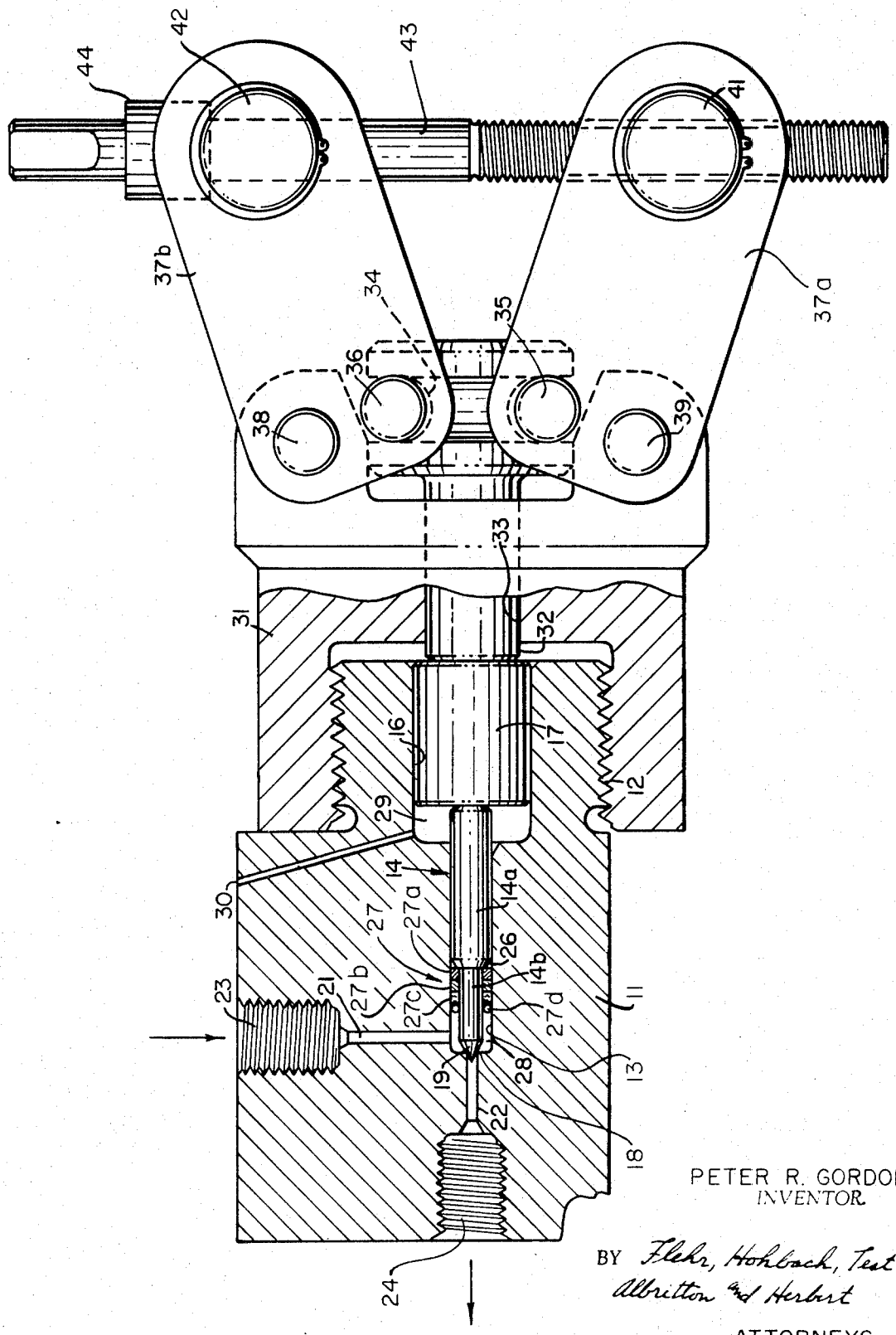
A high pressure valve in which the valve needle is guided in a well formed in the valve body so that it can be moved to seat one end in a valve seat formed at the bottom of said well. Outlet and inlet passages communicate with the opposite sides of the seat whereby the flow of fluid between said passages can be controlled by axial movement of the valve needle. The valve needle is arranged and formed whereby the pressure of the fluid being controlled applies a retracting force to retract the valve needle. The valve needle drive means cooperates with said valve needle to overcome the retracting force and advance the needle into seating engagement in the valve seat.

5 Claims, 1 Drawing Figure



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HIGH PRESSURE VALVE

BACKGROUND OF THE INVENTION

The invention described herein was made in the course of or under a grant from the National Science Foundation, an agency of the Government.

This invention relates generally to valves and more particularly to a self-retracting needle high pressure valve.

In the prior art, the valve needle is advanced and retracted by positive drive means. Because of backlash in the drive means, the valve cannot be smoothly retracted. The instant the valve is unseated, the high fluid pressures drive the needle outwardly until the backlash in the drive is taken up. In many high pressure applications, it is desirable to accurately and smoothly control the needle position. Prior art high pressure valves have been unsatisfactory in this regard

OBJECTS AND SUMMARY OF THE INVENTION

It is an object of the present invention to provide a high pressure valve in which the valve needle position can be accurately controlled.

It is another object of the present invention to provide a high pressure valve having a self-retracting valve needle.

The foregoing and other objects of the invention are achieved by a valve in which a valve body is bored to form a well with the bottom of the well defining a valve seat. Inlet and outlet passages communicate with the bottom of said well from the opposite side of said seat. A valve needle is accommodated in said well and is movable between an advanced position where it is seated in the seat and a retracted position. The needle has one end formed of reduced diameter to provide a shoulder and thereby a space between the needle and the well at the bottom where by the passages can be placed in communication with one another. Packing means are carried at the end of said valve needle in abutting relationship with the shoulder whereby fluid under pressure in said space provides an axial retracting force to said needle to retract the needle. Drive means are adapted to abut the other end of the valve needle to overcome the axial retracting force to advance the needle towards its seated position.

BRIEF DESCRIPTION OF THE DRAWING

The single FIGURE of Drawing is a cross-sectional view of a valve in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The valve includes a valve body **11** including a threaded end **12.** The valve body includes a well **13** adapted to receive the valve needle **14.** Communicating with the well **13** is an enlarged bore **16** adapted to receive a thrust block **17.** The bottom of the well **13** is provided with a valve seat **18** which cooperates with end **19** of valve needle **14** to control the flow of fluids from the inlet port **21** to the outlet port **22.** The inlet and outlet ports communicate with the well **13** on opposite sides of the valve seat **18.** The ends of the ports **21** and **22** are threaded as shown at **23** and **24** to receive associated fluid conduits.

The valve needle **14** includes a portion **14*a*** and portion **14*b*** of reduced diameter with its end conically

shaped **19** to seat in seat **18.** The transition between the portions **14*a*** and **14*b*** includes an inclined surface **26.** Packing means **27** are carried on the portion **14*b*** and are adapted to abut the inclined surface **26.** The packing means **27** may comprise brass ring **27*a***, lead ring **27*b***, leather ring **27*c*** and an O-ring **27*d***. The rings serve to form a seal between the needle and the walls of the well **13** whereby fluid pressures in the space **28** act on the packing **27** to generate axial retracting forces to retract the valve needle from its seated position. Thus, there is a force urging the needle towards its retracted position. Any fluid which escapes past the packing means flows into the space **29** which is vented to the atmosphere by passage **30.**

The outer end of the valve needle abuts the thrust block **17.** The threaded portion of the valve body **12** threadably receives fulcrum body **31.** The fulcrum body **31** accommodates a thrust piston **32** which extends through the opening **33** formed in the fulcrum body. The end of the piston includes a groove **34** which receives dowel pins **35** and **36** carried by bell crank levers **37.** The bell crank levers are pivoted on pins **38** and **39** carried by the fulcrum body **31.** The ends of bell crank lever **37*a*** receive a threaded clevis **41** and the lever **37*b***, and unthreaded clevis **42,** both of which cooperate with the screw **43** which carries stop **44.** By rotating the screw **43,** the bell crank levers are caused to pivot about pins **38** and **39** in opposite directions to move the thrust piston **32** inwardly forcing the thrust block and valve needle inwardly into a seated position or outwardly to allow the needle valve to move outwardly under the pressure created by the fluid within the chamber **28** to unseat the needle. It is to be observed that at all times forces are generated which urge the valve needle outwardly and maintain all parts under pressure whereby movement or rotation of the screw **43** will either allow the needle to move further outwardly or will force the same inwardly without backlash.

It is to be understood that the drive means for the piston **32** can include other drive means. The means illustrated and described were found to be preferably under the high pressure conditions to which one valve was subjected, namely, fluids under pressure between 30,000 and 150,000 psi. Furthermore, by the use of the lever arrangement shown, it is possible to obtain very small amounts of movement with each turn of the screw **43.** It is further to be observed that the bore **16** is of larger diameter than the opening **33** and likewise that the thrust block, when it moves outwardly a predetermined distance, will abut the fulcrum body **31.** Under extremely high pressures to which the valve is subjected, this is a safety measure preventing any injury to personnel in the event that the thrust piston is removed or the drive fails. At most, the valve needle will retract a distance corresponding to the distance between the back of the thrust block **17** and the fulcrum body **31.**

Thus, it is seen that there has been provided a high pressure valve in which the effects of backlash are overcome by employing a self-retracting valve needle.

I claim:

1. A valve comprising a valve body, a well formed in said body with a valve seat formed at the bottom of said well, inlet and outlet pressure passages communicating with said well from opposite sides of said valve seat, a valve needle accommodated in said well and movable

between an advanced seated position and a retracted position, said valve needle having one end of reduced diameter to form a shoulder along the needle and provide a space between the needle and well at said one end whereby the pressure passages can be placed in communication with one another, packing means carried by said end of said needle in abutting relationship with said shoulder whereby fluids under pressure in said space provide a continuous axial force on said packing and needle to retract the valve needle, and unyielding drive means adapted to abut the other end of said needle to overcome the axial retracting forces to advance the needle towards its seated position.

2. A valve as in claim 1 wherein said shoulder is inclined to urge the packing outwardly against the walls of the well.

3. A valve as in claim 1 wherein said packing is retained by means of an O-ring.

4. A valve as in claim 1 wherein said drive means includes a thrust block carried in said body for transmitting forces between the needle and associated drive.

5. A valve as in claim 4 including means limiting movement of said thrust block under retracting forces from said needle.

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