May 15, 1956 R. K. SHELLMAN 2,745,631

OIL WELL MUD PUMP VALVE

Filed Oct. 23, 1952

Fig. 1.

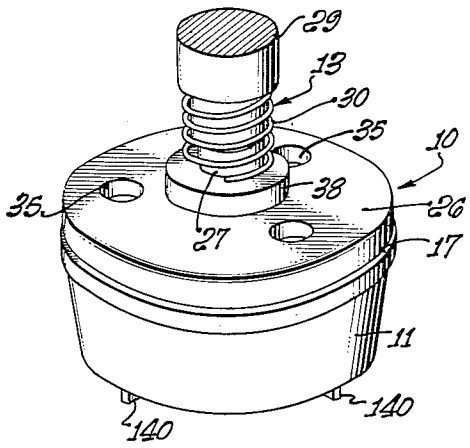


Fig. 2.

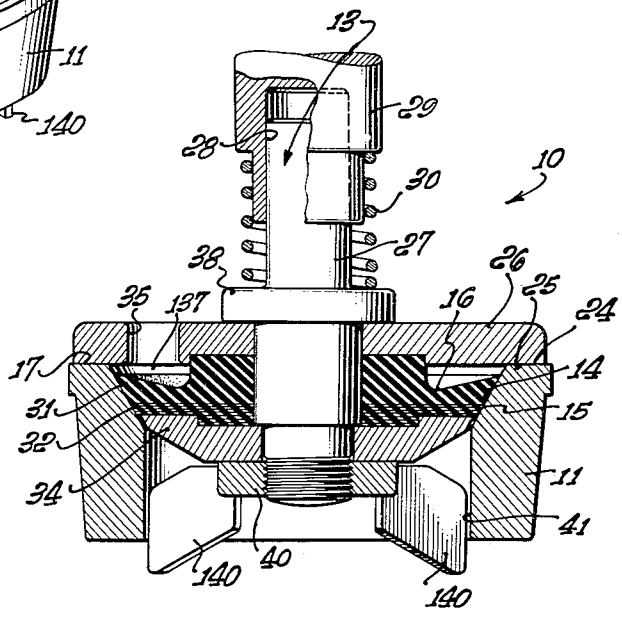
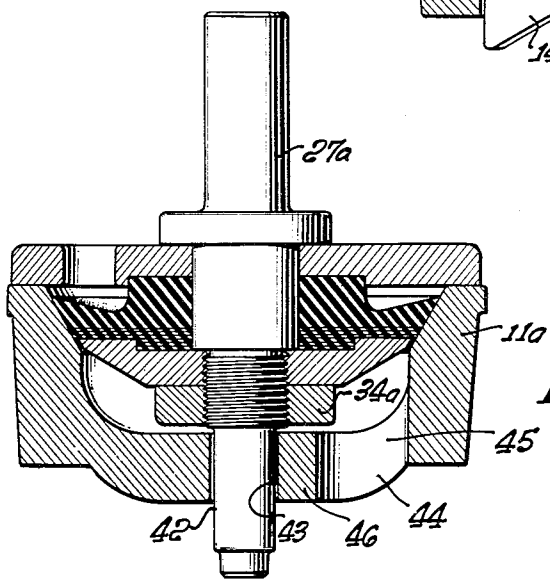


Fig. 3.



ROY K. SHELLMAN,
INVENTOR.

BY Hitchcock & Wolfe

ATTORNEY.

United States Patent Office 2,745,631 Patented May 15, 1956

2,745,631

OIL WELL MUD PUMP VALVE

Roy K. Shellman, Compton, Calif., assignor to MacClatchie Manufacturing Co., Compton, Calif., a corporation of California

Application October 23, 1952, Serial No. 316,347

1 Claim. (Cl. 251—175)

This invention relates to improved valve structures particularly adapted in certain respects for use as fluid inlet and outlet check valves in high pressure pumps, as for instance in oil well mud pumps.

The operating pressures of an oil well mud pump are usually extremely high, with the result that the inlet and outlet valves of the pump are opened and closed rapidly and with very great force. Consequently, unless the valves are of a special wear resistant construction, their repeated closures tend to quickly damage the engaging surfaces of the valve and its seat, and soon render the valve ineffective to close off fluid flow. For this reason, it has heretofore been proposed to provide the movable valve element and its seat with interengageable stop shoulders (in addition to the main valve surfaces), which act to limit closure of the valve element and thus prevent damage to the sealing surfaces. These stop shoulders have heretofore been formed at an inner side of the valve element inwardly beyond the seat surface in the direction of valve closing movement. In order that the valve seat may be of a construction to prevent a stop shoulder at that location, the seat has generally been formed as a forging, usually having a valve guide portion as well as the stop shoulder at the inner side of the valve structure.

The general object of the present invention is to provide an improved valve of the above discussed type which is so constructed as to overcome certain disadvantages or limitations of prior such valves. For one thing, the present valves are so designed that their stop shoulders may have a considerably greater striking area than has been possible in prior devices, so that the shoulders may resist damage for an increased period of use. Further, the valve shoulders are so positioned relative to the valve seat surface as to permit formation of the main seat structure from ordinary tubular stock, instead of requiring its special construction as a forging.

The present valve units preferably differ from prior similar valves in that the closure limiting stop shoulders are positioned at the outer rather than inner side of the valve, that is, they are offset in the direction of valve opening movement from the main valve seat surface. As will be appreciated, there is considerably more space at the outer side of the valve than at its inner side for accommodating stop shoulders of an increased striking area, and to do so without unduly obstructing the path of fluid flow through the device. Also, when the stop shoulders are positioned at the outer side of the valve, the shoulder on the seat structure may be formed as merely an end surface on a piece of tubular stock, without requiring that the seat be a forging to carry a stop shoulder inwardly beyond the main seat surface.

Preferably, the stop shoulder on the valve seat structure is located farther from the valve axis than is the valve seat surface. This feature, like the positioning of the stop shoulders at the outer side of the valve, considerably increases the possible striking area of the stop shoulder.

The above and other features and objects of the present invention will be better understood from the following detailed description of the typical embodiments illustrated in the accompanying drawing, in which:

Fig. 1 is a perspective view of a first form of oil well mud pump valve embodying the invention;

Fig. 2 is an axial section through the Fig. 1 valve; and

Fig. 3 is an axial section through a variational form of the valve embodying the invention.

The oil well mud pump check valve **10** shown in Figs. 1 and 2 includes a seat section **11** and a movable valve unit **13**. The seat section **11** is annular and typically formed of a short length of metal tubing. At its inner side, seat **11** has an annular inclined upwardly facing seat surface **14** against which an annular inclined downwardly facing surface **15** of deformable element **16** of the valve unit **13** seats in closed condition of the valve. At its upper end, seat **11** has an annular surface or shoulder **17**, which preferably extends directly transversely of the valve axis, and is engageable by transverse shoulder **25** at the underside of flange **26** of valve unit **13** to limit its downward or closing movement. The vertically movable valve unit **13** includes a vertically extending stem **27**, which carries the above mentioned transverse stop flange **26**. The upper end of stem **27** may be guided for the desired vertical movement by reception within bore **28** in a guide member **29**, with the valve unit being yieldingly urged downwardly to closed condition by spring **30**.

Beneath flange **26**, valve stem **27** carries a resiliently deformable annular seat engaging element **16**, which may include a main rubber portion **31** and fabric or plastic reinforcing **32**. The inclined seat engaging surface **15** of deformable element **16** is preferably disposed at a slightly greater angle to the valve axis than is the seat surface **14**, to assure the formation of a most effective fluid seal between the parts. Element **16** may be backed at its upper side against the central portion of flange **26**, which is in turn backed against an integral flange **38** on stem **27**. The outer portion of valve element **16** is axially spaced from flange **26** at **137**, to provide an annular space into which fluid may flow through circularly spaced openings **35** in the flange to urge element **16** downwardly against its seat. As will be understood, the force of such fluid acts in the closed condition of the valve to urge the valve element tightly against its seat **14**.

A rigid retaining member **34** is provided about stem **27** beneath valve element **16**, with a bottom nut **40** being screwed onto the stem therebeneath, to tighten elements **34**, **16** and **26** upwardly against the stem flange **38**. Nut **40** preferably carries a number of circularly spaced outwardly projecting guide fins **140**, slidably engaging bore **41** in seat section **11**, to cooperate with upper guide member **29** in guiding the valve for its vertical opening and closing movement.

In use, the valve of Figs. 1 and 2 is normally urged by spring **30** to its closed position of Fig. 2, in which surfaces **14** and **15** form a tight fluid seal. The downward closing movement of movable unit **13** is limited in the Fig. 1 position by engagement of stop shoulders **24** and **25** on seat section **11** and flange **26**. When the fluid pressure beneath the movable valve unit **13** reaches a predetermined value, unit **13** moves upwardly, to pass fluid upwardly past seat surface **14** and flange **26**. When the pressure at the underside of the valve subsequently decreases, spring **30** and the fluid pressure at the upper side of the valve return unit **13** downwardly to closed position. By virtue of the interengagement of stop shoulders **24** and **25**, the closing movement of the valve is limited, regardless of how great the closing force may be, without damage to seat surface **14** or deformable element **16**. It also will be seen that the inward axial spacing of the sealing surface **15** of the element **16** from the stop surface **25** on the flange **26** precludes any

pinching off of the element **16** as the surface **25** slams against the stop surface **17**. Furthermore, because of such spacing, the radially inwardly directed fan-shaped jet squeezed from between the surfaces **25** and **17** as the valve closes, does not detrimentally impinge on the sealing surface **15**. In order that the limitation of valve movement may be as effective as possible, and to assure a minimum wear on the parts, seat section **11** and flange **26** are preferably formed of a suitable very tough and hard steel or other metal.

The Fig. 3 valve is substantially identical with that of Figs. 1 and 2, except as to the manner in which the lower end of the movable valve unit is guided for vertical movement. Specifically, in Fig. 3, nut **34***a* does not carry guide fins corresponding to those shown at **40** in Fig. 2, but instead has a lower cylindrical guide portion **42**, which is slidably received within and engages cylindrical bore **43** formed in a spider **44** carried by the lower portion of seat section **11***a*. As will be understood, spider **44** is formed integrally with seat section **11***a*, and includes at least one, and preferably several, circularly spaced radial webs **45**, carrying an inner annular portion **46** within which guide bore **43** is formed.

I claim:

A reciprocating valve comprising: a rigid valve seat having an annular concavo-conoidal sealing surface and an annular substantially flat stop surface offset both radially and axially outwardly of said sealing surface; and a reciprocable valve unit seatable on said seat, said

unit comprising a stem member, means defining a rigid circumferential flange fixed on said stem member against outward movement relative thereto and having an annular stop surface opposed and complementary to said seat stop surface for abutment thereagainst in the closed position of the valve, and a yielding pressure-deformable sealing ring coaxially mounted on said stem member inwardly of said flange and having an inner peripheral portion fixed against axial movement relative to said stem member and an outer peripheral sealing surface opposed and substantially complementary to said seat sealing surface for sealing engagement thereagainst in the closed position of the valve, the outer peripheral portion of said ring being spaced from said flange with the axially and radially outer edge of said ring sealing surface being axially spaced from said flange stop surface, to thereby define an annular space between said ring and flange, the latter having at least one aperture therethrough to communicate fluid to said space in the closed position of the valve.

References Cited in the file of this patent

UNITED STATES PATENTS

758,012	Marsh	Apr. 19, 1904
1,654,772	Akerson	Jan. 3, 1928
2,255,404	White	Sept. 9, 1941
2,402,713	Volpin	June 25, 1946
2,495,880	Volpin	Jan. 31, 1950