Feb. 25, 1941. D. C. SHARP ET AL 2,232,739

PUMP VALVE

Filed March 1, 1932 2 Sheets-Sheet 1

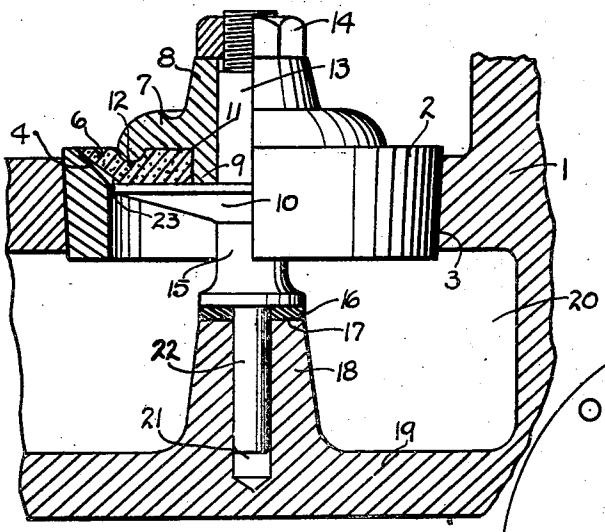



Fig. 1.

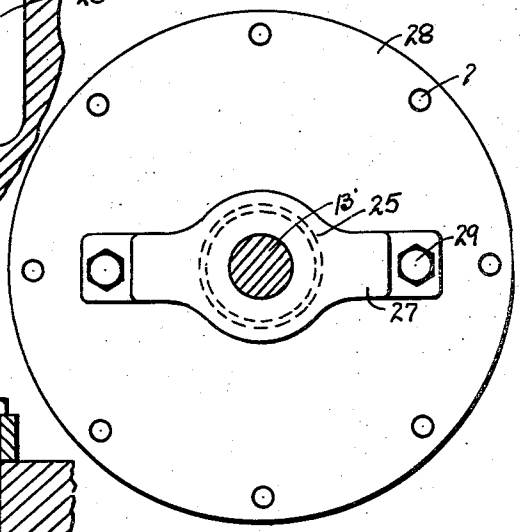



Fig. 3.

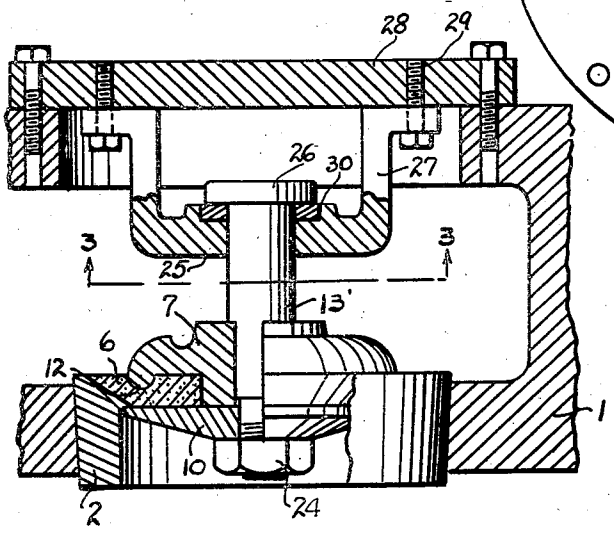



Fig. 2.

Dudley C. Sharp
T. W. Adair Inventors

By Jesse P. Stone
Lester B. Clark
Attorneys

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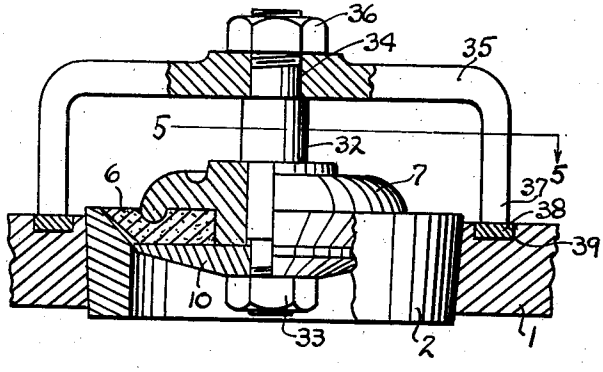



Fig. 4.

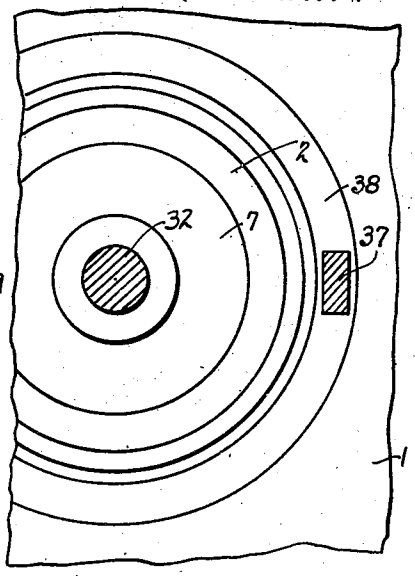



Fig. 5

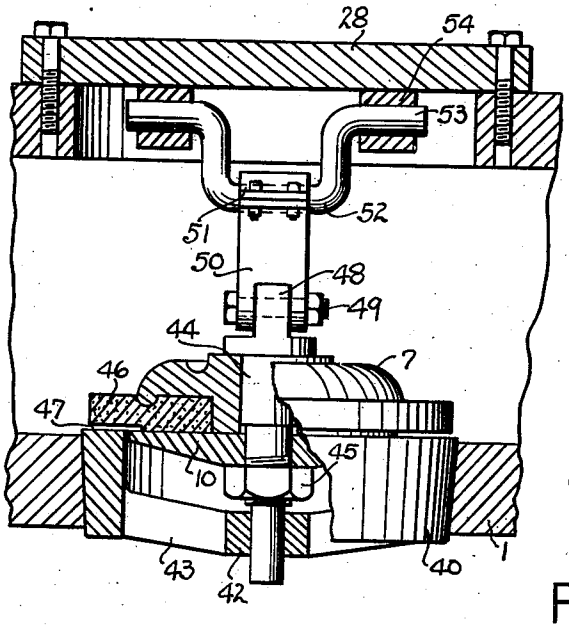



Fig. 6.

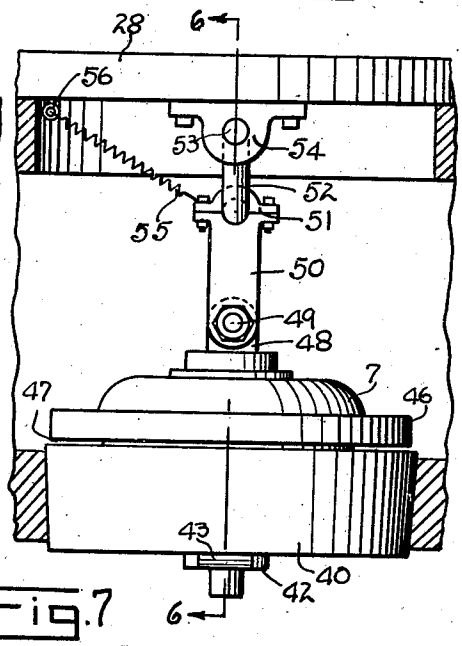



Fig. 7

& Dudley C. Sharp
T. W Adair Inventors

By Jesse R. Stone
& Lester B. Clark

Attorneys

Patented Feb. 25, 1941 2,232,739

# UNITED STATES PATENT OFFICE

2,232,739

## PUMP VALVE

Dudley C. Sharp and Thomas W. Adair, Houston, Tex.

Application March 1, 1932, Serial No. 596,022

11 Claims. (Cl. 251—127)

Our invention relates to pump valves and more particularly to the type of valve employed in high pressure pumps for handling slush and the like in well drilling. The valve is, however adapted for general application.

In slush pumps employed in well drilling and particularly in the deep wells which are being drilled today it has become necessary to handle fluids under excessively high pressures and in so doing it becomes necessary to make provision to avoid wear and deterioration due to the pressure of the fluid being handled and so that the valves will endure for long periods of time.

It is an object of our invention to provide a valve structure in which the shock of closing of the valve is delivered upon a stop member before the sealing gasket employed upon the valve comes to its seat.

We desire to take the shock of closing upon a removable member which may be made of different material and of high wear-resisting qualities to take up the force of the closing of the valve so as to prevent wear upon the packing member employed with the valve.

Our invention consists particularly in the provision of a removable wear-resisting stop member for the valve which may be placed in various positions relative to the valve to prevent the valve from completely seating, but which allows the pressure of the fluid being handled to assist in forming the seal between the gasket and the valve seat.

In the drawings herewith wherein various embodiments of the invention are disclosed, Fig. 1 is a broken side view partly in central vertical section through a valve embodying our invention.

Fig. 2 is a similar broken side view partly in central vertical section illustrating a slightly different embodiment from that shown in Fig. 1.

Fig. 3 is a transverse section taken on the plane 3—3 of Fig. 2.

Fig. 4 is a broken side view partly in elevation and partly in vertical section illustrating a still different embodiment of the stop member.

Fig. 5 is a broken detail taken in section on the plane 5—5 of Fig. 4.

Fig. 6 is a broken side view partly in section illustrating a still further modification of the inventive idea and taken approximately on the plane 6—6 of Fig. 7.

Fig. 7 is a side view showing a valve mechanism in elevation and taken at right angles to the view shown in Fig. 6.

The present invention is in the nature of an improvement over the combination structure which is broadly claimed in the prior copending application of the inventor, Dudley C. Sharp, Serial No. 473,087, filed August 4, 1930 for Valves for pumps.

In the embodiment of our invention shown in Fig. 1, the frame of the pump indicated at 1 is intended to show the most common type of structure of the pump body and it is to be understood that our type of valve may be employed in any of the ordinary types and mud pumps now in use. The seat ring 2 of the valve forms a driving fit with the opening 3 in the pump body. This valve ring has a downwardly and inwardly tapered seat 4 at its upper end to receive the gasket 6 upon the valve. The valve comprises an upper plate 7, which has a hub 8 thereon extending both above and below the plate, the lower end 9 of the hub forming a spacing member adapted to contact with the lower plate 10 forming a space, indicated at 11, between said upper and lower plate to receive the gasket 6. The upper plate is formed with a downwardly extending bead 12 at its outer margin to wedge within a recess in the upper face of the compressible gasket 6. Both the upper and lower plates are formed with openings to receive the valve stem 13 which is threaded at its upper end to receive the nut 14.

Below the lower plate 10 is a stop bushing 15 mounted upon the valve stem 13 and having its lower face somewhat enlarged at 16 to contact with a stop washer 17 on the upper end of the post 18. Said post 18 is preferably formed integral with the lower wall 19 of the chamber 20 of the pump. Its upper end forms a seat upon which the removable stop washer 17 may be mounted. There is a longitudinal guide bore 21 in said post to receive the reduced extension 22 on the valve stem 13. It will be obvious that the stop bushing 15 upon the valve stem may be formed integral therewith if desired, the upper end thereof forming a shoulder upon which the lower plate 10 of the valve may be seated.

It is to be noted that the valve gasket 6 is tapered on its lower surface at a different angle from that of the valve seat 4, thus leaving a clearance space at 23 between the lower end of the gasket and the upper end of the valve seat which may contact, first, with the upper edge of the seat. The outer margin of the lower plate 10 of the valve is slightly smaller than the interior of the valve ring 2 so that it may pass within the interior of the ring. Thus when the valve seats it will strike, first, upon the removable stop ring 17 which will take up the shock of the closing of the valve. When the valve is thus stopped the

outer margin of the gasket 6 will strike the upper edge of the seat, as shown in Fig. 1. If a seal is not quickly formed, the pressure of the liquid above the gasket will force it upon the seat in such manner as to form a complete seal.

The use of a removable stop member, such as that shown at 16, enables us to make the said washer of hard wear-resisting material different from that employed in the construction of the valve. The wear tending to destroy the valve under ordinary conditions will be largely taken up by the removable washer which may be replaced when wear occurs. Our valve is thus adapted to operate for long periods without the removal of parts.

In Figs. 2 and 3 we have disclosed a separate embodiment of the stop member. The valve ring 2 and the upper and lower valve plates 7 and 10 are the same in construction as in the previous embodiment, the valve gasket 6 being also identical. The valve stem 13', however, is a cylindrical pin, the lower end of which is threaded to receive the nut 24. The upper end of the stem is extended through a guide member 25 and is formed with a head 26 to limit its downward movement in said bushing.

The member 25 is formed upon a yoke 27 having opposite arms extended upwardly and flanged to engage against the upper wall or plate 28 on the pump body. Cap screws 29 extending through said flanges secure the yoke in position on said plate. The member 25 forms a guide for the stem 13' and on its upper side adjacent the head 26 it is recessed to receive a stop washer 30. Said washer is similar in construction to the washer 16 previously noted and will resist wear due to the shock of the closing of the said valve for long periods without replacement.

The action of this valve in its operation is practically identical with that of the Fig. 1 embodiment. The valve is stopped by the head 26 on the valve stem at the time when the outer margin of the gasket 6 contacts with its seat and there will therefore be no pounding of the valve upon the gasket tending to cause excessive wear thereof.

Fig. 4 discloses a still further embodiment in which the valve seat 2, the upper and lower plates 7 and 10, with the gasket 6 between them, are the same as in the previous embodiments. The valve stem 32 comprises a pin extending downwardly through the valve plates which are held thereon by a nut 33. The upper end of the valve stem is reduced in outer diameter and extended through an opening 34 in the yoke 35 and said yoke is held rigidly in position on the stem by the nut 36.

The yoke 35 has two or more opposite arms extending from the bushing and bent downwardly at 37 to contact with a wear ring 38 countersunk within a groove 39 in the wall of the pump body 1. In this particular embodiment the arms 37 of the yoke contact with the hardened stop ring 38 and limit the downward movement of the valve at the moment when the outer margin of the gasket strikes the seat. In this way the shock of closing is taken upon the body of the valve adjacent the seat and the stop ring performs the same function as has been previously noted relative to the other embodiments.

In Figs. 6 and 7 a further form of stop member is disclosed. The valve ring 40 is set within the opening in the valve body 1 as before and a guide 42 is formed upon the spider 43 connected with the interior of the valve ring. This guide is extended downwardly partly below the margin of the ring so as to allow a larger space for the passage of fluid through the ring and between the same and the bushing. The upper end of the valve seat is formed at right angles to the axis of the ring, thus producing a flat seat along the upper face thereof.

The valve is formed with an upper plate 7, and a lower plate 10, as in the previous embodiments, the plates being assembled upon the valve stem 44 by a nut 45. The lower end of the stem is extended through the member 42, which acts as a guide therefor. The gasket 46 in this embodiment may be made with a laterally extending lip thereon, which, when the valve is seated, will be spaced slightly from the upper end of the valve ring, leaving a space as shown at 47 in Fig. 6.

The upper end of the valve stem is formed with an eye 48 thereon to receive a pivot pin 49 by means of which it is hinged to the lower end of the link 50.

The upper end of the link 50 is formed with a bearing 51 to enclose the crank arm 52 of the shaft 53. Said shaft is engaged at its ends within bearings 54 secured to the upper plate 28 of the pump body.

It will be noted that when the valve is moved to closed position, as shown in Fig. 6, the crank arm 52 will be extended directly downward and by means of the link 50 will restrain the movement of the valve beyond the position there shown. The gasket 46 will be slightly spaced from its seat and will be moved to sealing position by the weight of liquid above it. When the valve is moved to open position the pressure above the valve will be released and to assist in swinging the crank arm 52, so as to allow the valve to open freely, we provide a spring member 55, secured at one end to an eyelet 56 on the plate 28 and at its other end to the bearing member 51 at the upper end of the link. This will tend to swing the crank arm in the direction of the spring and allow the valve member to move freely in an upward direction.

It will be obvious that the bearing members for the crank arm may be made of hardened material and readily replaceable when desired. In all of the embodiments herein shown we provide for the stopping of the valve by a replaceable wear member, which, because it may be separately manufactured, can be made of hard and wear-resisting material which will not need frequent replacement. This wear member takes the shock of the operating valve away from the packing member which under ordinary circumstances is pounded to pieces by the excessive force of high pressure pumps and prevents the sealing of the valve after a short period of operation. By the use of our stop member in the manner described the valve will wear for materially longer periods of time without attention. The advantages of this construction will be obvious to those skilled in the art.

What we claim as new is:

1. In a high pressure pump, a body, a valve ring, a valve stem, a gasket, means to clamp said gasket on said stem, and means on said body to limit the downward movement of said stem, said ring having a flat seat, a seal lip formed on said gasket to be spaced from said seat when said means stops the valve, but flexible so that pressure will move it down against the seat to seal.

2. In a high pressure pump, a body, a valve

ring seat supported therein, a valve body formed to pass into said ring seat, a gasket projecting beyond said valve body to engage said seat but having a taper adapting it to engage the outer margin of said seat first, and means depending downwardly from said first-named body and independent of said ring seat to engage said valve stem and stop its downward movement before said gasket fully seals on said seat.

3. In a pump, a body, a valve ring fitted therein, a valve including a stem, a valve gasket thereon, a seat for said gasket on said valve ring, an enlarged head on the upper end of said valve stem, a yoke depending from the wall of the body above said valve, a passage through said yoke to receive said valve stem, and a stop washer disposed between said yoke and said head to receive the shock of closing of the valve and hold said gasket from pounding against said seat.

4. In a pump, a body, a valve ring fitted therein, a valve including a stem, a valve gasket, and means to clamp said gasket upon said stem, a seat for said gasket on said valve ring, a yoke fixed to the upper end of said valve stem, downwardly extending arms on said yoke, and an annular stop ring seated in a groove in the body surrounding said valve ring, said downwardly extending arms being positioned to contact said stop ring to transmit thereto the shock of closing of the valve.

5. In a pump, a body, a valve ring fitted therein, a valve including a stem, an eye on the upper end thereof, a valve gasket, and means to clamp said gasket upon said stem, a seat for said gasket on said ring, a plate secured to the wall of the body over said valve, a toggle connection between said plate and said eye, and a spring tending to displace the center point of said toggle, said toggle being adapted to permit the raising of said valve and to restrain the downward movement thereof.

6. A valve including a valve ring adapted to be supported in a body, a downwardly and inwardly inclined seat at the upper end of said ring, a valve stem, upper and lower valve plates thereon of less diameter than said ring, a downwardly tapered packing gasket between said plates, said gasket being of greater diameter than said plates to project above said seat, and removable wear-resisting stop means between said stem and body to stop the closing movement of said valve before said gasket fully seals upon said seat, the fluid pressure above said gasket acting to then force the same into sealing engagement.

7. A valve including a valve ring adapted to be supported in a body, a seat at the upper end of said ring, a valve stem, upper and lower valve plates thereon formed of a size less than said ring, a packing gasket between said plates, said gasket being of greater diameter than said plates to project above said seat but fitting entirely within the contour of said seat when closed, and removable wear-resisting stop means supported upon said body to stop the closing movement of said valve before said gasket is forced by said plates fully upon said seat, said stop means acting to take the wear of closing of the valve and to prevent pounding of said gasket on said seat.

8. In a high pressure pump, a body, a valve ring mounted therein, an inner downwardly-tapered seat on said ring, a valve stem, clamping plates on said stem, a gasket between said plates and having a downwardly tapered outer margin to engage entirely within said seat, said margin being tapered at a more obtuse angle than said seat so that said outer margin of said gasket will first engage said seat, and inter-engaging means on said body and said valve to stop said valve with the outer edge only of said gasket engaging said seat, said means being disposed above said valve, and a wear resistant removably positioned member thereon to absorb the rap of stopping said valve.

9. In a high pressure pump, a body, a valve ring mounted therein, an inner downwardly-tapered seat on said ring, a valve stem, clamping plates on said stem, a gasket between said plates and having a downwardly tapered outer margin to engage said seat, said margin being tapered at a more obtuse angle than said seat so that said outer margin of said gasket will first engage said seat, a stop ring of hardened wear-resisting material on said body and a stop member on said stem above said valve and engaging said stop ring to take the shock of closing said valve.

10. In a high pressure pump, a body, a valve ring mounted therein, an inner downwardly tapered seat on said ring, a valve stem, a valve body on said stem, a gasket mounted on said valve body and having a downwardly tapered outer margin to engage said seat, said margin being tapered at a more obtuse angle than said seat so that said outer margin of said gasket will first engage said seat, a stop ring of hardened wear-resisting material on said body and a stop member on said stem engaging said stop ring to take the shock of closing said valve.

11. In a high pressure pump, a body, a valve ring supported therein, an upper steeply tapered seat on said ring, a valve stem, valve plates thereon, a packing gasket between said plates and projecting above said ring, the lower margin of said gasket being tapered more obtusely than said seat, a removable stop member on said body, and means formed to move with said valve stem and rigidly connected therewith to engage said stop member and adapted to limit the closing movement of said valve before said gasket fully seals upon said ring and with the outer edge only in contact with said seat and take the shock of closing from said gasket before said valve is fully sealed.

DUDLEY C. SHARP.
THOMAS W. ADAIR.