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A. S. VOLPIN
SLUSH PUMP VALVE

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2 Sheets-Sheet 1

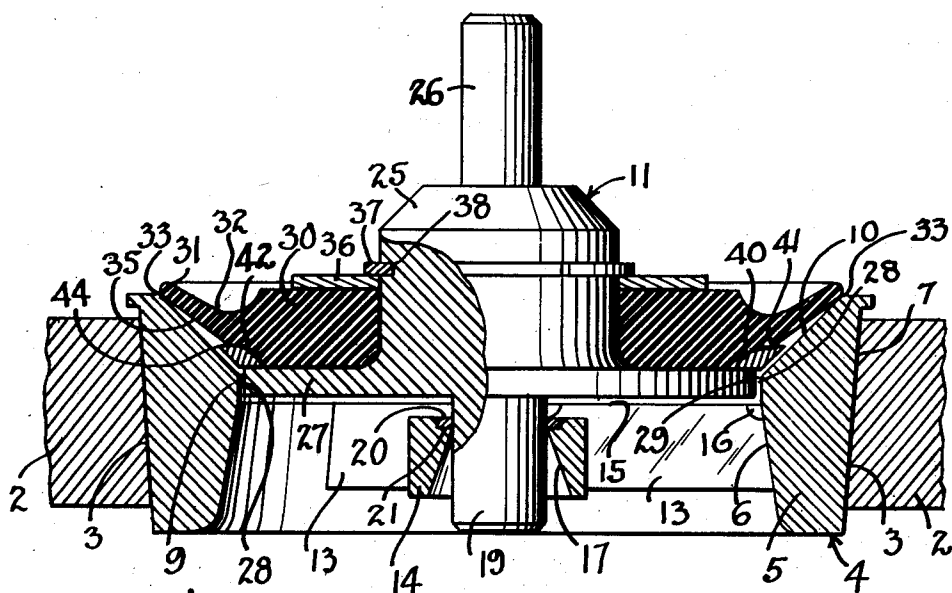


Fig. 1.

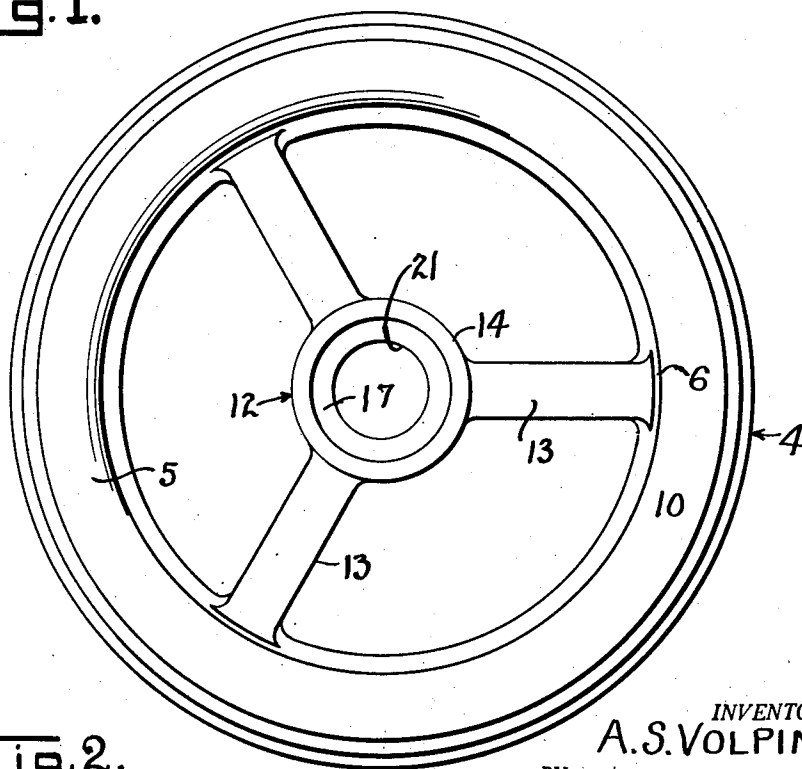


Fig. 2.

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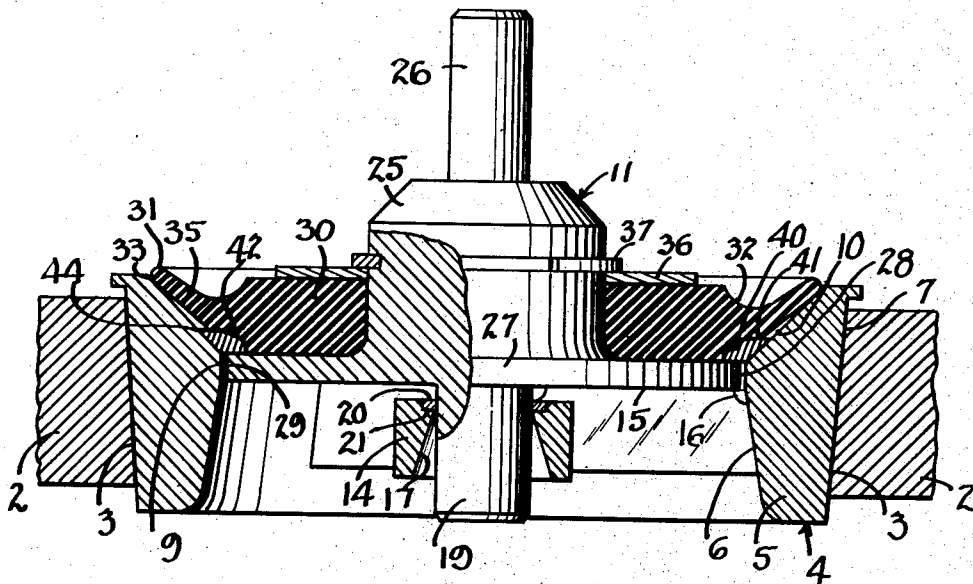
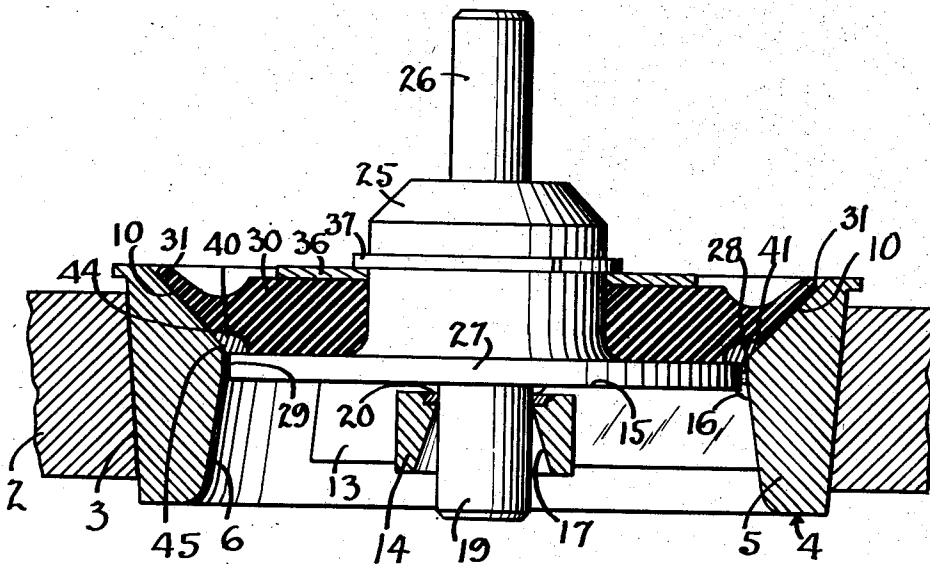
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UNITED STATES PATENT OFFICE

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SLUSH PUMP VALVE

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5 Claims. (Cl. 251-127)

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The invention relates to a valve of the type utilized in slush pumps for circulating drilling fluid in the rotary method of drilling wells.

Such valves are subjected to high pressures and the flow of abrasive materials which results in substantial wear of the various parts and the present valve has been conceived with a view of rendering a maximum of service while compensating for wear upon the various parts.

When a slush pump valve closes, the pressure of the liquid being pumped closes the valve as the reciprocating pump piston reverses its direction of movement so that for instance, if the pressure of the liquid being pumped is one thousand pounds per square inch and the slush pump valve should have an area of fifty square inches, the pressure closing the valve would be fifty thousand pounds. There are two operations which must be performed upon closing the valve, one is a structure which will absorb this rap or load on the valve to bring it to a stop and the second function is to provide a seal so that there will be no leakage of the abrasive fluid because even the slightest leak will soon grow to greater proportions due to the abrasive action and the high pressure applied thereto.

It is, therefore, one of the objects of the present invention to provide a slush pump valve wherein there will be compensation for wear of the stopping portions of the valve so as to prevent destruction and injury to the sealing parts thereof.

Another object of the invention is to provide a wear compensating ring which will span the area between the valve body and the valve seat so as to support the sealing member.

Another object of the invention is to provide the combination of a slush pump valve seat and wear compensating ring which will span the area between the valve and the seat as the valve moves to closed position and which will serve to close such space until the maximum amount of wear has occurred on the valve parts.

Another object of the invention is to provide a tapered guide hub for a slush pump valve stem where the minimum area is in engagement with the stem for the guiding thereof.

Another object of the invention is to avoid clogging of the guide stem on a slush pump valve.

Another object of the invention is to avoid pinching and wearing away of a slush pump valve sealing ring by providing a wear compensating support for the ring at the junction of the valve and seat.

Another object of the invention is to provide a

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wear compensating ring which will support the seal ring independently of wear between the valve and its supporting seat.

Other and further objects will be readily apparent when the following description is considered in connection with the accompanying drawings wherein:

Fig. 1 is a vertical sectional view of the valve and seat assembly with the valve just moving to closed position and with the seal ring just contacting the seat.

Fig. 2 is a bottom plan view looking into the valve seat ring.

Fig. 3 shows the valve as just having moved to closed position, but not yet having absorbed the full load of the drilling liquid which will be applied to the top of the valve.

Fig. 4 is a view showing a valve in closed position after considerable wear has occurred upon the various parts and illustrating the wear as having been taken by the wear compensating ring.

In Fig. 1 the slush pump body 2 is provided with an opening 3 to receive the tapered valve seat ring 4. This ring is made up of a body 5 which is annular in configuration and has the passage 6 therethrough. The outer periphery 7 is tapered so as to wedge into the opening 3 in the slush pump body. This seat ring is of a particular construction and might be said to form a Venturi opening due to the inward taper of the passage 6 up to the point 8 which may serve as the throat through the seat ring. The seating face 10 then tapers away from the throat 8 so as to form an escape or discharge passage for the liquid being pumped as it moves upwardly through the valve seat.

In order to form a guide and stopping structure for the valve 11 the seat is provided with a spider 12 which is made up of the radial legs 13 and the hub 14. The legs as seen in Figs. 1 and 2 join the inner periphery of the seat ring and the hub and are provided with a flat upper surface 15 which serves as the stopping surface for the valve 11. These legs may be cut away slightly at 16 where they join with the seat ring so as to provide an escape area for any particles which might otherwise accumulate in the corner between the leg and the seat ring.

The hub 14 is of particular construction and has a passage 17 therethrough which is tapered downwardly and outwardly as best seen in Fig. 1. This arrangement prevents the accumulation of grit or other material in the passage 17 and permits of free sliding movement of the guide stem 18 on the valve 11. In order to provide maximum

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wear and the minimum of replacement of material a ring 20 of hardened or other suitable material has been deposited in the recess 21 formed in the upper face of the hub 14. This ring may be welded or otherwise affixed in position and it will be noted that it is rather thin so as to provide a minimum contact with the guide stem 19, but at the same time to provide sufficient guiding action for the valve. It seems obvious that this ring 20 can be readily replaced. The tapered opening 17 permits the flushing of the opening on each stroke of the valve and when the valve moves to closed position abrasives or other materials which may have moved up into the opening 17 will fall out by gravity.

The valve 11 is made up of a body 25 having the lower guide stem 19 and the upper guide stem 26. This body has a radially extending flange 27 which is just slightly smaller than the diameter of the throat 9 of the valve seat so that as the valve moves down toward closed position as seen in Fig. 1 there will be a slight space 28 between the periphery 29 of the flange 27 and the throat 9 of the valve seat.

A resilient sealing ring 30 is disposed about the body 25 and deposited upon the flange 27. This sealing ring has a flexible lip 31 whose flexibility is enhanced by the hollowed out area 32. It will be noted that the lower surface 33 of this seal ring is tapered at a slightly different angle than is the seating face 10 of the seat ring 5. This construction causes the area 33 of the seal ring to first contact the seating face 10 as the valve moves to closed position so that the seal is formed just slightly before the valve comes to rest.

This sealing ring is held in position by a plate or plates 36 which are in turn held in position by a lock ring snapped into the recess 38 formed in the periphery of the body 25.

In normal operation of a slush pump valve the seal is accomplished as the valve arrives in its downward movement in the position of Fig. 1 and then the valve body is stopped as the under surface of the flange 27 comes into engagement with the stopping face 15 on the legs 13 as seen in Fig. 3 where the valve has just come to rest. It seems obvious that in other types of valves the space 28 would have to be closed by the seal ring 30 which spans such opening 28. When the load of the pumped liquid comes upon this resilient seal ring the ring is forced into this opening 28 tending to fatigue and pinch away the lower corner of the resilient sealing ring. Such fatiguing and pinching action increases considerably in proportion as wear upon the stopping face 15 develops and thus if such faces were pounded down and worn away so that the valve moves down to the position of Fig. 4, before being stopped, the lower corner of the seal ring 30, where it spans this opening 28, would be caused to be pinched away due to recurring extreme flexure at this point.

The present invention contemplates an arrangement for avoiding this pinching action of the resilient material at the corner and in the crevice 28 by providing a wear compensating ring 40 which, as seen in the drawings, is of a size to rest or float upon the upper outer edge of the flange 27 and to overhang the periphery 29 of the flange 27 so as to span the crevice 28. The periphery of this wear compensating ring 40 is tapered at 41 at the same angle as the seating face 10 on the valve seat ring 5. The sealing ring 30 is provided with a suitably shaped an-

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nular shoulder 42 which receives the wear compensating ring as seen in Fig. 1. This ring is preferably snugly positioned against the shoulder 42, but it may be vulcanized or otherwise affixed if desired. Particular attention is directed to the fact that the corner 44 on this wear compensating ring extends out beyond the lower margin of the tapered face 35 on the seal ring.

As the valve comes to rest as seen in Fig. 3, when the valve is new, the parts will be in a position as they are shown with the wear compensating ring engaging the seating face 10 spanning the opening or crevice 28 and serving as a support for the resilient seal ring 30 so as to prevent it from being pinched in the crevice 28. When the load of liquid comes on the valve after it has stopped as seen in Fig. 3 then the pressure in the hollowed out area 32 may cause the tapered face 35 to squat down on the seating face 10 to form a complete seal with the seat ring.

After the valve has been subjected to considerable wear, however, it seems obvious that the valve will move downwardly before being stopped by the legs 13 a greater distance than seen in Fig. 3 and in fact, may move down to the position of Fig. 4 or even farther depending upon the wear which occurs. The wear compensating ring 40 will be of such a composition that it will wear before the seat ring 5 wears away so that this ring will wear off to a configuration which spans the opening 28 and fits the corner 45 of the seating ring. With such an arrangement the wear compensating ring spans the opening 28 regardless of the elevation at which the valve is stopped and it will compensate for additional downward movement of the valve due to wear on the parts. If the valve had worn so that it stopped in the position of Fig. 4 with prior constructions the lower corner of the seal ring 30 would have been pinched away to such an extent that a blow-by would probably occur due to the fact that recurring flexure and pinching would have weakened the resilient material of the seal ring at the location of the crevice 28. With the wear compensating ring present, however, the sealing material cannot be pinched away in the manner which previously occurred and the wear ring tends to prevent extreme flexure of the sealing ring regardless of the position in which the valve comes to rest.

Particular attention is directed to the small amount of metal required in the slush pump valve which results in a light weight valve which reduces the pounding action of the valve. The stopping action occurs entirely across the flange of the valve which gives a wide distribution for the forces which must stop the valve. The wear on the seal ring is reduced by the provision of the wear compensating ring and this ring is of a composition which is less hard than the seat and spans the place between the valve and the seat to prevent pinching and fatiguing of the rubber as it flexes into sealing position. This wear compensating ring will wear faster than the seat so that it will follow the valve down as wear occurs between the valve and the stopping portions of the seat ring.

When the valve moves down beyond its new or original position it would normally upset the balance of the sealing ring as it moved to sealing position against the valve and the seat and might even cause a tilting action of the seating face of the resilient ring which would result in leakage, but with the present construction the seal-

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ing action is maintained in the same position against the seat ring at all times because the sealing ring is supported by the wear compensating ring and there is less change in the relative position of the seal ring and the seat ring due to wear because of the provision of this wear compensating ring.

What is claimed is:

1. A slush pump valve and seat assembly, said valve comprising a body, a flange thereon, a resilient seal ring on said flange, said seat comprising an annular seat ring, stop means therein to stop the closing movement of said valve, tapered faces on each said seal and seat rings, said flange having its periphery fitting loosely into the annular opening of said seat ring whereby an annular space is formed between the periphery of said flange and the periphery of said opening, and a floating wear compensating ring normally bridging said opening when the valve is closed.

2. A slush pump valve and seat assembly, said valve comprising a body, a flange thereon, a resilient seal ring on said flange, said seat comprising an annular seat ring, stop means therein to stop the closing movement of said valve, tapered faces on each said seal and seat rings, said flange having its periphery fitting loosely into the annular opening of said seat ring whereby an annular space is formed between the periphery of said flange and the periphery of said opening, and a floating wear compensating ring normally bridging said opening when the valve is closed and so constructed and arranged that as said stop means wears and said valve flange advances further into the opening said seal ring is stopped by said compensating ring to avoid pinching of such ring.

3. A slush pump valve and hollow seat ring assembly, a valve body of a size adapted to move in and out of the hollow seat ring and to provide a space between the seat ring and valve body, means on said seat ring to stop the valve in its closing movement, a wear compensating ring loosely disposed on the edge of the valve body to span the space between the seat ring and body when the valve is closed, and a resilient seal ring carried by said valve body to bear against said wear ring and to seat on said seat ring and be supported over the space between the body and seat ring by said wear ring.

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4. A slush pump valve and hollow seat ring assembly, a valve body of a size adapted to move in and out of the hollow seat ring and to provide a space between the seat ring and valve body, means on said seat ring to stop the valve in its closing movement, a wear compensating ring to span the space between the seat ring and body when the valve is closed, and a resilient seal ring carried by said valve body to seat on said seat ring and be supported over the space between the body and seal ring by said wear ring, said wear compensating ring being carried by said seal ring.

5. A slush pump valve and hollow seat ring assembly, a valve body of a size adapted to move in and out of said hollow seat ring and to provide a space between the seat ring and valve body, means on said seat ring to stop the valve in its closing movement, a wear compensating ring movably disposed on said body to span the space between the seat ring and body when the valve is closed, and a resilient seal ring carried by said valve body to bear against said wear ring and to seat on said seat ring, whereby said compensating ring prevents pinching of said resilient ring between said seat ring and body, when wear occurs on said stop means.

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