June 25, 1946. A. S. VOLPIN 2,402,713

SLUSH PUMP VALVE

Filed March 20, 1943 3 Sheets-Sheet 1

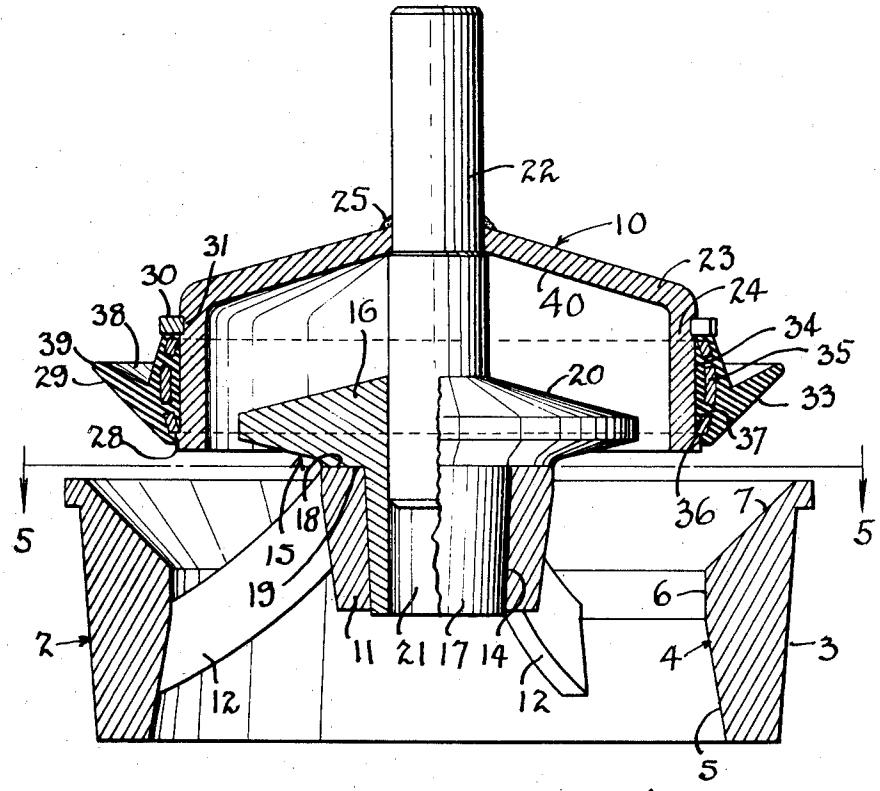


Fig. 1.

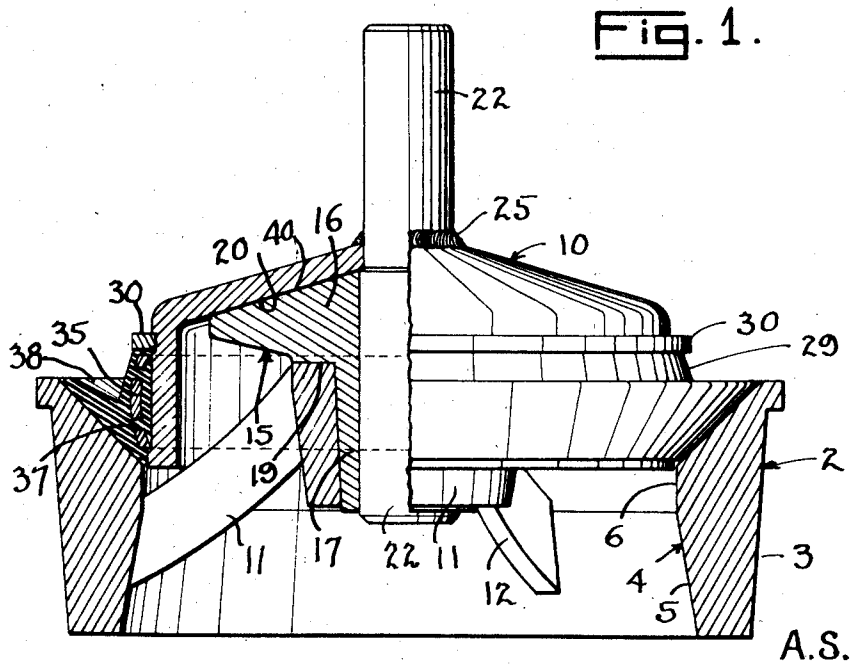


Fig. 2

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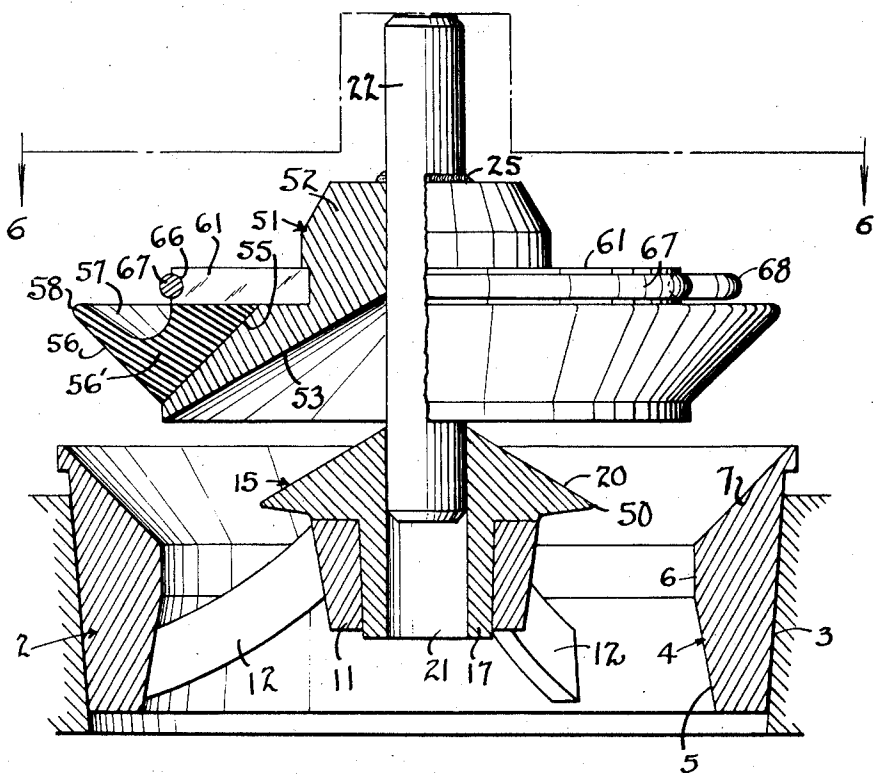


Fig. 3

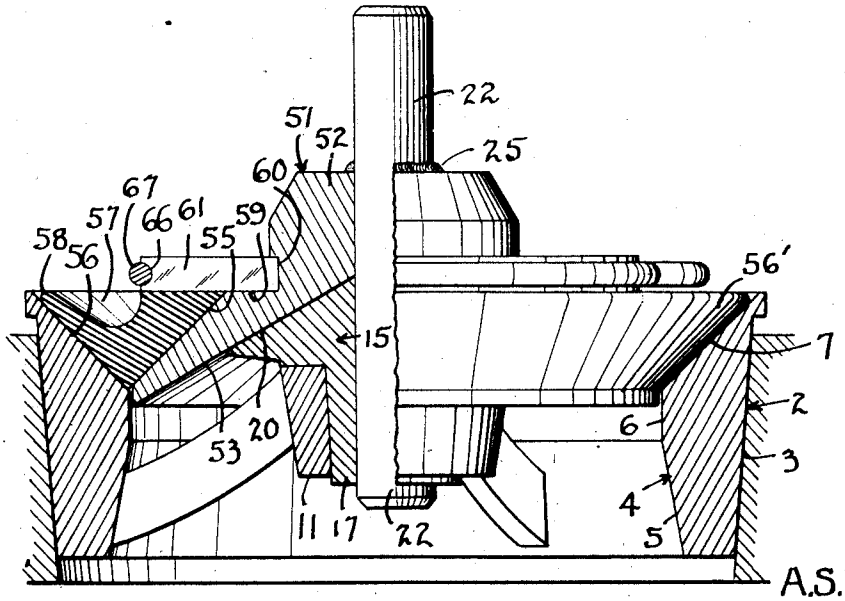


Fig. 4.

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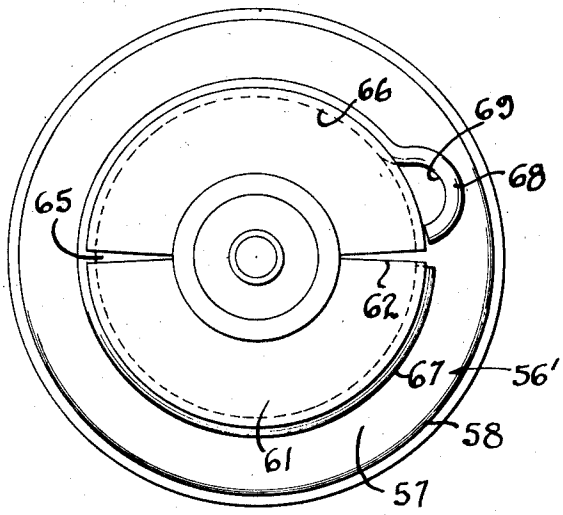


Fig. 6.

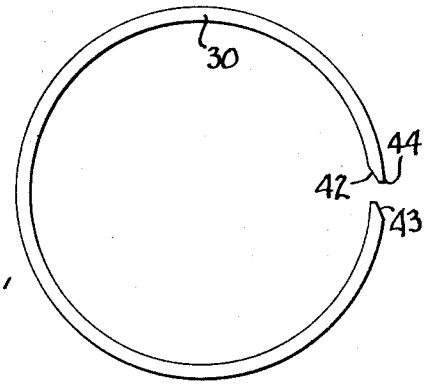


Fig. 7.

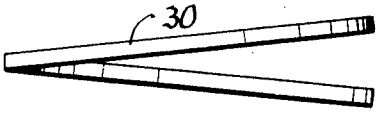


Fig. 8.

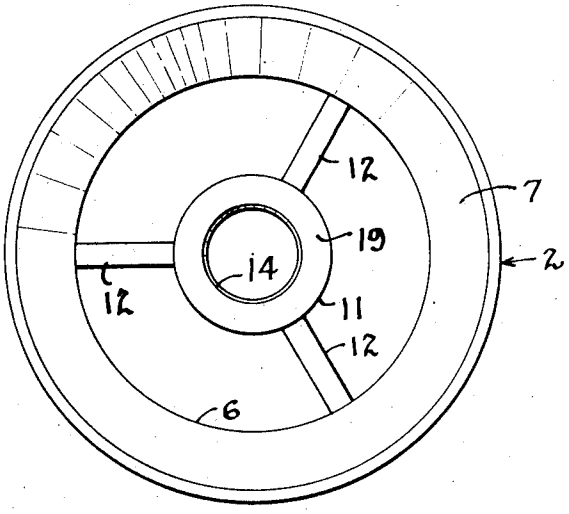


Fig. 5.

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UNITED STATES PATENT OFFICE

2,402,713

SLUSH PUMP VALVE

Alexander S. Volpin, Houston, Tex.

Application March 20, 1943, Serial No. 479,839

1 Claim. (Cl. 251—127)

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The invention relates to a slush pump valve assembly wherein the parts are very light in weight and the distribution of the metal is such that the stresses encountered are resisted with a lesser amount of metal than in valves heretofore produced.

In operation a slush pump valve is subjected to a tremendous shock when the reciprocating pump piston reverses its stroke because the pressure may drop from some 1500 pounds per square inch to zero, whereupon the pressure of the mud above the valve causes it to settle to closed position very quickly and when the valve is stopped, the pressure upon it immediately rises to the pump pressure so that this tremendous load of some 1,000 or 1,500 pounds per square inch on the upper surface of the valve must be absorbed when the valve closes. On the other hand, it is desirable therefore that the valve be very light in weight so as to assist in its ready opening and to avoid excessive wear on the seating surfaces.

The present valve is therefore designed with a view of obtaining a maximum throat opening to permit a full flow of mud on the one hand while providing a sturdy stop for the valve on the other hand.

It is one of the objects of the invention to provide a valve seat with a Venturi shaped passage therethru.

Another object of the invention is to provide a guide hub in a slush pump valve seat which is positioned within or above the seat ring and supported by truss or strut members, which will take the shock of closing the valve in compression.

Another object of the invention is to provide a stop bushing for slush pump valves which will have an enlarged tapered stop surface to be contacted by the valve member.

Still another object of the invention is to provide a valve member having a frusto-conical under surface which permits a stop for the valve to be positioned above the center of the valve seat.

Still another object of the invention is to provide a stop member for a slush pump valve which fits up into the valve.

Still another object of the invention is to provide a slush pump valve in a cap configuration to fit down over a stop bushing.

Still another object of the invention is to provide an enlarged frusto-conical stop area above the normal flow stream thru the valve.

Another object of the invention is to provide a throat portion for a slush pump valve seat ring so as to facilitate the flow of mud therethru.

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Another object of the invention is to provide a truss support for the center hub of a slush pump valve seat ring so that the supporting members are in compression and the thrust on the seat is also in compression, tending to hold it in position in the pump body.

Another object of the invention is to provide a self centering stop construction for slush pump valves, wherein the stop bushing and valve are frusto-conical shaped so that the valve tends to center itself on the stop at each closing.

Another object of the invention is to provide a cooperating valve and seat structure so that a resilient sealing ring will form a seal partly on the valve and partly on the seat.

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

Fig. 1 is a vertical sectional view showing a valve in open position.

Fig. 2 is a vertical sectional view showing the valve in closed position.

Fig. 3 is a vertical sectional view with part of the valve in elevation and illustrating a modified form thereof with the valve in open position.

Fig. 4 is the valve of Fig. 3 in closed position.

Fig. 5 is a plan view of the seat structure taken on the line 5—5 of Fig. 1 with the bushing removed and illustrating the seat and truss supported hub.

Fig. 6 is a top plan view looking down on the top of the valve and illustrating the latching construction, as shown in line 6—6 of Fig. 3.

Figs. 7 and 8 are top and edge views respectively of one form of snap ring.

In Fig. 1 the valve seat ring 2 is shown in section and has the outer tapered surface 3 which is arranged to fit in the slush pump body.

This ring has a passage 4 therethru which can be described as a Venturi shaped passage or opening, in that it has a tapered face 5 as an entrance for the mud, which has a throat 6 and the outwardly tapered surface 7 which, of course, forms a seat for the valve. An opening of this sort facilitates the flow of fluid or liquid therethru because of the short throat section and the fact that the fluid is caused to increase in velocity gradually by the tapered face 5 and is then allowed to escape from the throat 6 by the enlarged tapered surface 7.

In order to provide a support and stop for the valve structure 10, a supporting hub 11 has been shown as positioned above the throat area 6 in the center of the passage 4, by means of the

truss members or struts 12. Particular attention is directed to the fact that these struts are upwardly and inwardly inclined so that any thrust or load applied to the hub 11 is taken by these struts in compression. It is, of course, well established that most metals will carry a greater load in compression than in tension, so that a minimum of metal need be provided in forming these struts.

It might be mentioned that in connection with the usual form of slush pump valves, that the hub support members extend downwardly from the bottom of the seat ring in a curved configuration to support the hub portion. When thus arranged, the braces would take the load in tension and this tension tends to pull the seat ring inwardly to an out-of-round configuration. This eventually causes leakage along the outer surface 3 and destruction of the seat and often the pump body occurs.

As distinguished from this, in the present construction, the load will be taken in compression and the strut 12 tend to force the ring 2 against the pump body and assist in maintaining a seal at the surface 3.

The hub 11 is provided with a central opening 14 which is preferably formed and arranged to receive the stop bushing 15. This bushing is made up of a body 16 having a shank portion 17, which is formed to fit into the opening 14.

A shoulder 18 on the underside of the body 16 is arranged to seat upon the upper surface 19 of the hub 11 and it will be noted that these contacting faces are of considerable area so that the bushing will be rigidly supported upon the head.

The body 16 is of a peculiar construction, in that it has an upper frusto-conical surface 20 which tapers outwardly and downwardly from the central portion, which is formed with a guide passage 21.

Particular attention is directed to the large area of this tapered surface 20 which forms a stop face for the valve 10.

The valve 10 is made up of the stem 22, which is arranged to be guided in the opening 21 and the valve body 23, which is in the form of a cap structure, having a skirt portion 24. This body may be molded, forged or drawn, as desired, but is of particularly light weight and may be welded at 25 to affix it to the stem.

The outer surface of the skirt 24 is formed with a shoulder 28, upon which the resilient packing ring 29 is arranged to seat. A snap ring 30 disposed in the groove 31 holds the packing ring 29 in position so that it can be readily removed in effecting replacement.

The sealing ring 29 is of particular configuration in order to provide the sealing face 33 to engage the seat 7 of the seat ring 2 and is downwardly and inwardly tapered. The annular portion 34 of this ring is arranged to seat against the outer surface of the skirt 24 and the ring has embedded therein an annular band 35 of metal, which is of a width to contact the shoulder 28 as seen at 36, while the upper edge of the band will not quite contact the snap ring 30 so as to facilitate assembly. There is thus a metal-to-metal contact and support for the resilient ring on the valve body at 36. The band 35 may have a plurality of openings 37 therein thru which the rubber or resilient material has been molded. A dished surface 38 on the upper side of the seat ring merges with the tapered face 33 to provide a lip 39 against which the mud will act in forcing the ring against the seat 7 to provide a seal.

In actual operation the valve will be lifted to the position of Fig. 1 when the mud surges upwardly thru the passage 4 and will remain in this position until the flow is reversed upon the return of the pump piston, whereupon the fluid on top of the valve and the packing will force the valve down sharply to the position of Fig. 2. In this position the inside surface 40 of the valve 10 will contact sharply against the surface 20 on the stop bushing 15. This contact stops the valve and the pressure forces the face 33 against the seat face 7 to form a seal until the valve is again lifted.

Particular attention is directed to the large area of the surfaces 20 and 40 which come in contact, as seen in Fig. 2. In this manner the load is distributed over a large area so that the unit pressure will be small and the metal will in this manner withstand long service because it will be subjected to pressures below that which will tend to deform the metal.

A valve of this sort is very light in construction and has a large stopping surface against the bushing. The tapered arrangement of the surfaces 20 and 40 tends to center the valve at all times, so that it will be properly seated and prevent destruction of the resilient sealing ring. The skirt portion of the valve closely approaches the seat ring when the valve is closed as seen in Fig. 2 to provide a limited annular space. The reinforcing of the resilient packing serves to hold it in proper position to prevent the pressure from blowing it thru this limited annular space between the valve and the seat. In event of wear on the stop bushing, the valve will move downwardly an additional distance but this will be accommodated by the resilient packing. Attention is directed to the small amount of rubber required in the resilient ring, due to its reinforcing construction.

The snap ring 30 may be of any desired configuration. That shown in Figs. 7 and 8 has a beveled face 42 on the inside of one end of the ring which terminates in a blunt end 44 and has a companion beveled face 43 on the outside of the other end of the ring. In this manner an area is provided, due to the blunt end 44, which will accommodate a tool in removing the ring. The ring will normally have an offset spring in it, as shown in Fig. 8. In order to replace the resilient ring 29, it is only necessary to remove the snap ring so that replacement may be had very readily.

Figs. 3 and 4 show a slightly modified form of construction, wherein the parts of the seat and supporting hub are substantially the same except that the hub is placed downwardly in the passage 4, as compared with the position in Fig. 1.

The stop bushing 15 is of substantially the same configuration except that the body 16 terminates in a thin edge 50, so as to reduce the overall height of the hub and bushing to permit the valve 51 to engage the seat.

The valve 51 is designed for lightness in weight and comprises a body portion 52 which has a frusto-conical undercut area 53 arranged on the underside. This area is arranged to serve as a stop surface by contacting the upper face 20 on the stop bushing. The fact that the bushing enters into the valve, or it might be said that the valve fits down over the bushing, allows the valve to move to closed position, as seen in Fig.

4, and still permits the positioning of the hub within the opening 4 thru the seat ring.

The valve body 52, due to the frusto-conical end surface, is very light in weight when it is considered that the outer surface 55 thereof is also frusto-conical but of a different taper than the end surface. This surface 55 is arranged to support the packing ring 56' thereon and to position the sealing face 56 of this ring so as to contact the seat face 7 of the seat ring. The upper surface of the packing ring is provided with an annular groove 57, which reduces the amount of material used and forms a flexible lip 58 which can be forced against the seat ring, due to the mud pressure.

The body 52 is formed with a shoulder 59 and a groove 60 which are arranged to receive the hold-down plates which are best seen in Fig. 6, as being substantially semicircular, so as to fit into the groove 60 and rest upon the shoulder 59. The adjacent edges 62 are beveled slightly so as to provide a space 65 in which a suitable instrument can be inserted to pry the plates loose, should they adhere to the rubber or the valve body. These plates are provided with an outer groove 66 which is arranged to receive the snap ring 67. This ring may be of the type shown in Fig. 7 or it may have the curved hook or loop 68 thereon, as seen in Fig. 6. This loop permits the introduction of an instrument inside the opening 69 thereof so that the ring can be pried loose very readily.

Broadly the invention contemplates a simple and economical type of slush pump valve wherein the parts which are subjected to wear can be readily replaced.

What is claimed is:

A slush pump valve and seat assembly including a seat ring for positioning in a pump, a Venturi shaped passage through said ring, a hub mounted within the throat of the venturi, upwardly and inwardly directed truss leg members extending from the seat ring and supporting said hub, a combination guide and stop bushing carried by said hub including an enlarged frusto-conical upper surface on said bushing, a valve having a stem thereon slidingly engaged in said bushing, said valve including a body to fit into said Venturi throat and having a conical under face complementary to said bushing surface so as to fit thereon and center the valve and having a beveled upper face to meet the lower edge of the upper slope of the Venturi passage when the valve is seated, and a resilient sealing member carried by the valve to seat on the upper beveled face of the valve and on the upper slope of the Venturi passage, said bushing being of a size to project over said hub and provide a substantial area for contact in stopping the downward movement of said valve in spaced position above said legs.

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