June 19, 1962 H. E. BOWERMAN 3,039,488

SLUSH PUMP VALVES

Filed May 14, 1958

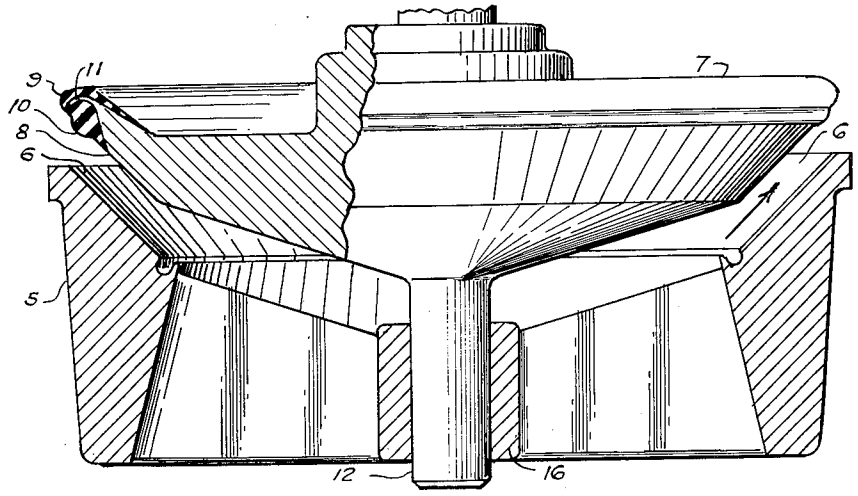

Fig. I

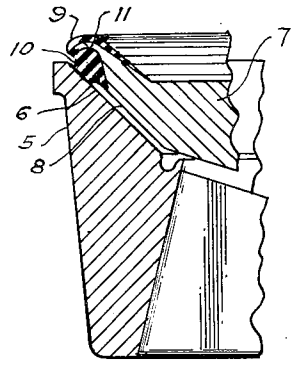

Fig. II

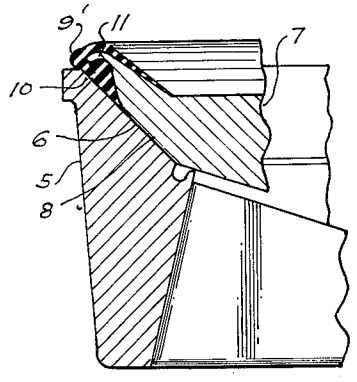

Fig. III

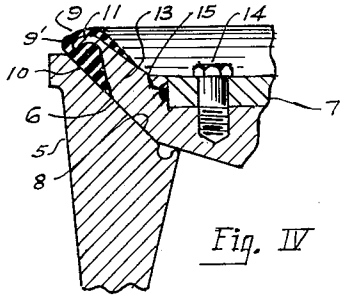

Fig. IV

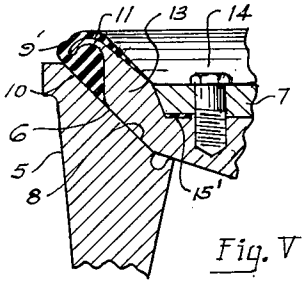

Fig. V

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3,039,488
SLUSH PUMP VALVES

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This invention relates to valves and seats commonly associated with reciprocating piston-type pumps. Due to the severity of operating problems encountered in circulating the drilling fluids in the drilling of wells by the rotary process, I will direct the disclosures of my invention to that art although my several novel features are equally applicable to pumps of this type in other services.

As is well understood by those skilled in the art, the circulating medium employed in the drilling of wells or earth boring commonly receive additives in the mixing vats designed to condition this medium for superior performance in cooling the bit and in floating the cuttings from the bit to the surface of the earth through the bore hole about the rotating hollow drill shaft. These additives also are designed to seal or close openings in water bearing sands or crevices in other formations and to provide a suitably weighted material to shore up the sections of the well bore which may be inclined to cave or sluff and also to provide desired resistances to pressures encountered in the penetrated formations to prevent or control "blow-outs."

The circulating medium returned to the surface bears cuttings and other contaminations from the bit and well bore as penetration progresses and these cuttings of varying formations, after conventional, though frequently quite ineffective screening or separating measures, finds its way again into the mixing vats where it again receives additives or conditioning agents and is again returned by the pumps through the drill shaft to and through the bit back to the surface. The pumps applying the energy to this circulating medium may normally provide operating pressures of 4,000 p.s.i. or greater while operating at high rates of strokes per minute. This in turn causes the circulating medium to pass over the faces of the valves and their respective seats at high velocities, and as the valves approach a closing and sealing mate with their seats a jetting action of the contaminated medium occurs against these mating surfaces which results in a destructive channelling of these faces which erodes them away and renders them more susceptible to the hammering of the valve as it closes under its own weight, the urging of the sealing spring and the impulse of the medium. A severe hammering occurs by the valve on the seat and the retained contamination of the medium is hammered and ground quite destructively between and into the faces of both the valve and seat.

It is to the correction of these faults that my invention is directed, which invention broadly provides a cushion and sealing ring of a distortable resilient material between the valve and seat, which ring also acts to impede or interrupt the velocity of the medium as the valve approaches seating, thus alleviating the jetting and abrasive actions of the medium. A relief recess is provided into which a portion of the resilient material may be received upon being distorted as the valve and seat surfaces are brought together. Valves and seats embodying my invention are easily and economically manufactured and installed in present pumps and have demonstrated service records far in excess of valves and seats heretofore in use. My invention will be readily understood by those skilled in the art from the following description together with the accompanying drawings in which:

FIGURE I is an elevation partially in section of a preferred form of my valve in open position;

FIGURE II is a section of valve and seat in partially closed position;

FIGURE III shows the elements of FIGURE II in closed position;

FIGURE IV shows a modification of the parts of FIGURES I, II and III;

FIGURE V shows a modification of FIGURE IV.

In the several figures, like references indicate similar elements wherein 5 is a valve seat of conventional design having a face 6 adapted to mate with a valve element 7 at its seating face 8. A rubber or other resilient and distortable sealing ring-like element 9 is carried by the valve and projects in part beyond the face of the valve as by sealing bead 10.

Conventional valve seats may have guides and bushings 16 adapted to receive reciprocally guide pin 12 of the valve as the latter opens and closes during the stroking of the pump. Through other conventional means a compression spring is mounted and retained to exert a constant sealing urge against the valve. None of these are shown since they comprise no part of my invention.

It will be noted in the several figures that element 9 for convenience in manufacture entirely surrounds the peripheral terminus which comprises the lip 11 of the valve element 7. This arrangement permits of great economies in manufacture since the element 9 may be molded to quite accurate surface dimensions about valve terminus 11 which latter may be possessed of the usual variations incident to forgings, leaving only the seating surface 8 of the valve to be machined to close seating tolerance.

In operation, I first prepare valve body 7 of suitable design to receive seal element 9 which with its ring-like projection 10 is preferably secured to the body 7 by vulcanization. Guide pin 12 is projected into guide bushing 16 of the seat and the compression spring not shown is operably positioned on the valve. On the suction stroke of the pump valve 7 assumes the open position in FIGURE I, as fluid enters the cylinder of the pump, not shown, in the direction indicated by the arrow. Now as the suction stroke ends and the piston movement in the pump reverses to propel the medium which has entered the cylinder outward through other valve ports not shown, the valve of the operation presently being described closes and as it does so ring seal protrusion 10 first contacts face 6 of the seat 5 and intercepts and interrupts the reverse flow of the medium between the valve and seat near its point of entry. At this juncture the pressure face of the valve exposed to the compressed medium receives the full force of the power stroke on its face which is required to overcome the resistance offered to the circulating medium by the working pressures. As my valve approaches seating protrusion 10 first intercepts the flow of the circulating medium which stops its jetting rush action through the closing part, then as the seating action continues the seating ring 10 is distorted under the compressive forces and provides a cushioned mating of the parts as they assume successively positions indicated in FIGURES II and III at which position part of the seal element has been distorted outwardly of the seat faces 6 and 8 as indicated at 9' of FIGURE III.

It will be readily understood that by a suitable modification of the parts with the selective hardness of element 9—10 any desired cushioning of the stroke may be achieved as the pressures or other variable factors are encountered. By these variables also the speed of escape by the interrupted circulating medium from between the mating faces of the parts may be regulated to effect the minimum of retention of detrital therebetween as final mating occurs. This greatly prolongs the life and efficiency of the metal parts. The shape of the terminus 11 of the valve may be varied to effect desired retention of the sealing element 9 between the valve and seat as desired.

As indicated in FIGURES IV and V a renewable valve mating face 8 with rubber seal and cushion may be provided by a metal ring member 13 of desired form which is secured by suitable means as by cap screws 14 to modified valve body 7, between which I may provide a rubber-like seal 15.

While I have described preferred forms of my invention other modifications will readily be apparent to those skilled in the art and all such are contemplated as fall within the scope of the following claims.

What is claimed is:

1. In combination, a pump valve element and a seat element each of rigid material and each having a pressure end and said elements including mutually-mating frusto-conical seating faces tapering with increasing diameter toward the pressure end of each element, one of said elements having an annular groove adjacent its seating face and opposite the seating face of the other element and located near its pressure end when said faces are engaged; a sealing member of resilient material filling said groove flush with the associated face and having an annular bead extending therebeyond toward the seating face of the other element, the other element including a transverse surface at its pressure end and the bead including enough resilient material that when deformed by the mating of said faces the material will extrude out and partly overlie the transverse surface of said other element.

2. In the combination set forth in claim 1, the valve element having a transverse pressure face at its pressure end and said annular groove being located between its seating face and its pressure face; and said resilient sealing member having a transverse portion at least partly overlying said pressure face.

3. In the combination set forth in claim 2, the valve element having a peripheral lip located between the pressure face of the valve element and the annular groove and extending toward the seating face of said other element when the seating faces are mated.

4. In the combination set forth in claim 2, a ring of rigid material overlying at least part of said transverse portion of the sealing member; and securing means fixing the ring to the body at the pressure face thereof.

5. In the combination set forth in claim 1, said resilient sealing member comprising rubber-like material bonded to the surface of the associated member.

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Notice of Adverse Decision in Interference

In Interference No. 93,731 involving Patent No. 3,039,488, H. E. Bowerman, SLUSH PUMP VALVES, final judgment adverse to the patentee was rendered Sept. 7, 1965, as to claims 1, 2, 4 and 5.

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