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VALVE SEAT PULLER

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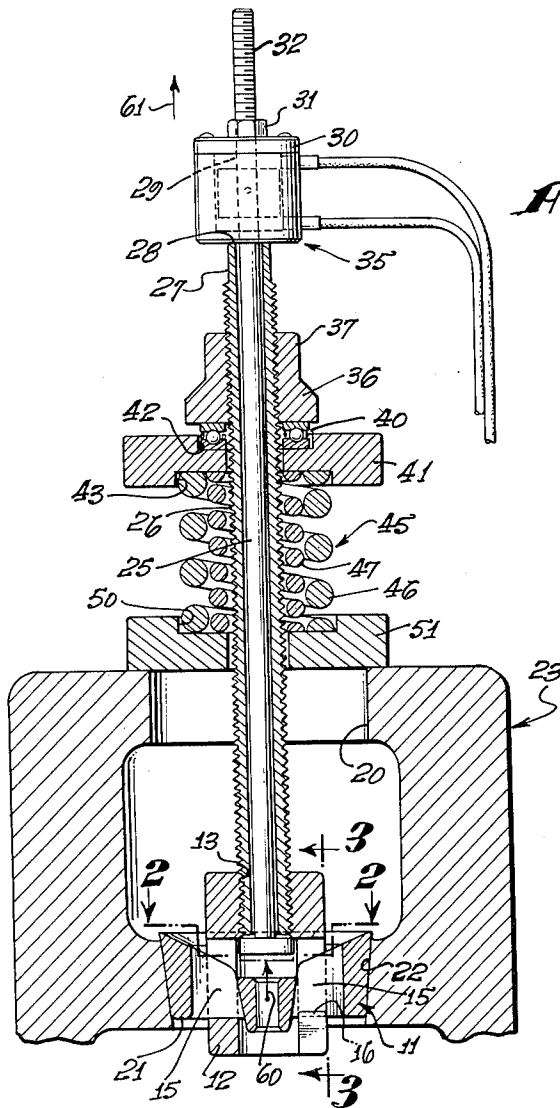


Fig. 1.

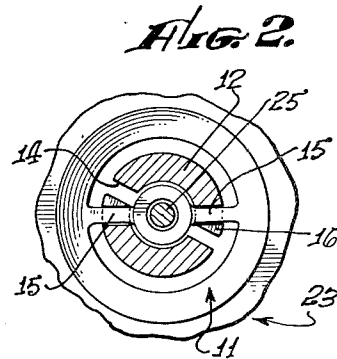


Fig. 2.

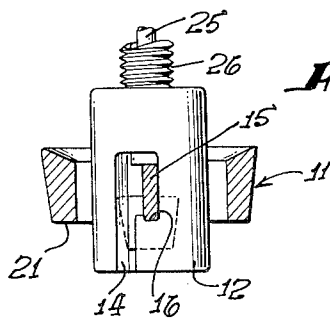


Fig. 3.

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VALVE SEAT PULLER

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This invention relates to a device for pulling an insert member from a bore, and more particularly to a device for removing valve seats and liners from the bore of a mud pump.

As is well known in the oil producing industry, a slush pump, or mud pump, is used to deliver and circulate drilling fluid under pressure to the drill bit which is operating at the bottom of the well. In the most usual construction of such pumps a mud pump valve moves into and out of engagement with a similarly shaped valve seat which is inserted into a bore within the pump body. Due to the constant operation of the valve and the abrasive character of the drilling fluid the valve and valve seats are subjected to considerable wear and must be regularly replaced. The valve seat is annular in configuration with a slightly tapered outer surface which mates with a similar taper of the surface of the bore. Due to the hammering action of the valve body against the valve seat and the high pressures involved, the tapered seat becomes wedged into the bore. For these and additional reasons, such as deformation of the seat and rusting in place, removal of the valve seat from the bore of the pump is difficult.

While the device of the present invention can be adapted for pulling levers, pistons and other valve pieces from oil-well pump tubing and bores, it is particularly adapted for pulling valve seats from the valve deck of a mud pump as hereinabove discussed. It is in this latter connection that the description of the present invention is directed.

Accordingly, it is an object of the present invention to provide an improved device operable from the exterior of a body to engage an insert member in a bore within the body and to exert a force sufficient to remove the insert from the bore.

It is another object of the present invention to provide an insert removal device which includes means for engaging the insert from the exterior of a mud pump and exerting a force to break the insert loose from its wedged position.

Another object of the present invention is to provide a valve seat removal device which is adjustable for operation on various mud pumps and which is easily adapted to valve seats or other inserts of various types and configurations.

The present invention is an insert removal device for removing an insert such as a valve seat from a bore in a pump body including an insert engaging means, a mandrel affixed to the insert engaging means, the mandrel extending longitudinally from the bore and being longitudinally movable with respect thereto. A first head plate is supported by the pump body, and it, together with a second head plate and an intermediate heavy spring are all disposed about the mandrel immediately above the pump body. The first plate is forced against the body by means of a nut which is threadably mated with the mandrel above the second plate. A vibratory motor is disposed proximate the top of the mandrel and above the nut. When energized, the vibratory motor serves to vibrate the mandrel and thereby break the valve seat loose.

The novel features which are believed to be char-

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acteristic of the present invention, both as to its organization and method of operation, together with other objects and advantages thereof, will be better understood from the following description considered in connection with the accompanying drawing in which one embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawing is for the purpose of illustration and description only, and is not intended as a definition of the limits of the invention.

In the drawing:

FIGURE 1 is a front elevation, partly in section, of the valve seat removal device in position on a pump body in engagement with a valve seat in accordance with the present invention;

FIGURE 2 is a view taken along line 2—2 of FIGURE 1 to show a plan view of the valve seat; and

FIGURE 3 is a view in elevation taken along line 3—3 of FIGURE 1.

Referring now to the drawing and more particularly to FIGURE 1, a device in accordance with the presently preferred embodiment of this invention is shown to be in position for removal of the valve seat 11. The valve seat shown herein, is of the center guide bearing type. Two types of valve seats are in general use, one being the center guide bearing type in which one or more radial spokes or bars extend across the seat to act as a guide bearing for the valve stem. A valve seat of this type is shown, for example, in United States Patent No. 2,178,876, entitled "Valve," issued November 7, 1939, to J. W. MacClatchie. The second type of valve insert, in general use, is that in which the seat has a cylindrical inner guide surface without bars or spokes extending across the seat.

Engaging means for engaging both types of seats are well known to the art and a center guide seat and seat engaging member 12 are shown and described in this application for purposes of illustration only. Herein shown, the seat engaging member 12 (see FIGURES 2 and 3) is a generally cylindrical metal body having a threaded bore 13 and an engaging slot 14. The slot 14 extends vertically from the lower surface of the body 12 a sufficient distance to allow the spoke 15 to move well into the body. A substantially horizontally disposed shoulder 16 is provided proximate the lower surface of the body by widening the slot at this point resulting in the formation of a generally J-shaped slot. That is, the slot 14 is so formed that the engaging body 12 is adapted to be placed downward into the pump bore 20 and over the spoke of the valve seat. The spoke moves into the slot 14 after which the engaging body 12 is rotated a fraction of a revolution to engage the lower edge of the spoke. For valve seats having no spoke, an engaging body of a type well known to the art for engaging the lower edge 21 of the valve seat is used.

As may be seen in FIGURE 1, the valve bore 22 is tapered downwardly and inwardly and is coextensive with the bore through the pump body 23. The bore 20 of the valve deck and the remainder of the pump body are hereafter referred to as the bore of the pump. It is clear that in use, the continual downward pounding of the valve against the valve seat will cause the seat 11 to become tightly wedged within the bore 20.

In accordance with the present invention the mandrel 25 includes two sections which are the outer threaded section and an inner mandrel. The threaded mandrel is threaded into engagement with the engaging member 12 and extends therefrom upward through the pumping bore 20 a substantial distance above the pump body 23. Toward the upper end of the mandrel 25 the threaded section terminates and defines a shoulder 28. The

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threaded section is tubular in configuration with a predetermined inside diameter. The internal mandrel is in turn mateable with the inside diameter of the threaded section of mandrel 25 and extends longitudinally there through. That is as shown in FIGURE 1, the internal mandrel has an outside diameter substantially equal to but less than the inside diameter of the threaded section. The inner mandrel extends above the shoulder 28 on the threaded mandrel to define an extension 29 which is male threaded as shown at 32. Disposed upon the extension 29 is a vibratory motor 35 which is connected to a source of voltage not shown. The motor 35 rests upon the shoulder 28 and is securely affixed to the inner mandrel by means of a nut 31 which is threaded over the upper extension 29 of the inner mandrel. At the lower, or the inner, end of the mandrel 25 the threaded section is threaded into engagement with the valve seat engaging member 12 but the lower end of the threaded section does not extend completely through the threaded bore 13 of the engaging member. The lower end of the inner mandrel terminates in a flange having an outside diameter substantially equal to the major threaded diameter of the threaded section, such that when the mandrel is in the assembled position as shown in FIGURE 1 the flange of the inner mandrel is spaced from the lower end of the threaded section but is in contact with a shoulder defined by the threaded bore 13 through the engaging member 12. The vibratory motor 35 thus acts upon the inner mandrel to vibrate it longitudinally and in turn vibrates against the shoulder of the engaging member 12. The motor 35 is of the type well known to the art for inducing longitudinal vibration.

The tightening nut is internally threaded and mateable with the threaded section of the mandrel 25 for longitudinally threaded engagement therewith. A circumferential protrusion 36 is provided on the nut and has an outside diameter substantially greater than that of section 37 thereabove which has a plurality of flats provided on the exterior thereof for turning the nut upon the mandrel. Immediately below the nut there is disposed a washer shaped ball bearing 40. A first head plate 41 having a central hole therethrough is fitted about the mandrel below ball bearing 40. A central recess 42 is provided on the upper face of the plate 41 to receive the ball bearing 40. A second recess 43 is provided in the lower face of the plate 41. A tubular coil spring 45 having a heavy outside winding 46 and a lighter inner winding 47 is fitted about the mandrel 25 with the upper end thereof extending within recess 43. The lower end of spring 45 is supported within a recess 50 within second head plate 51. The diameter of recess 50 is substantially equal to that of recess 43. Further, the outside diameter of plate 51 is substantially equal to that of plate 41. Head plate 51 is seated upon the pump body. It should be noted that although the head plate 51 is shown in this embodiment as being circular with a circular inside diameter, through which mandrel 25 may pass, other suitable configurations may be employed. It is only necessary that the head plate 51 span the pump bore 20 to rest upon the pump body.

In operation, after the seat engaging member 12 is in secure engagement with the valve seat 11 and the mandrel 25 is threaded within member 12, the plate 51, the spring 45, and the other plate 41 and the ball bearing 40, are all placed in position as shown. Thereafter, the nut is screwed down upon the threaded section of the mandrel 25 and tightened by the use of a wrench in order to compress spring 45, thus placing the mandrel into tension and exerting a substantially large force in the direction of arrow 60 upon the valve seat 11. As has previously been stated, after any degree of use of the pump, the valve seat becomes so firmly lodged within the valve that even the relatively large force exerted upon the mandrel by the tightening of the nut will not ordinarily free the valve seat.

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Accordingly, the vibratory motor 35 is positioned upon the shoulder 28 and is fixedly secured about the inner mandrel. The motor is then energized to cause a vibratory motion which is transmitted through the inner mandrel in a generally vertical direction as indicated by the arrow 60. As discussed here and before this vibratory motion is transmitted through the flange to the shoulder of the seat engaging member 12 to induce a vibratory force upon the seat engaging member. Thus, the threaded section of mandrel 25 exerts a large steady removal force upon the valve seat while the inner mandrel causes a vibratory force to be exerted upon the valve seat.

Thus, there has been described a device which utilizes a vibratory motion to remove an insert such as a valve seat from a bore in a mud pump body. The removal forces obtained by the present invention device are considerable and are therefore sufficient to remove the most tightly wedged valve seat from a valve deck bore with a maximum of efficiency.

What is claimed is:

1. An insert removal device for removing an insert from a bore within a body comprising: an insert engaging means; a mandrel affixed to said engaging means, said mandrel being adapted to extend from said engaging means through said bore to the exterior of said body; a head plate adapted to be disposed upon said body and surrounding said mandrel, said mandrel being longitudinally movable through said head plate; spring means disposed upon said head plate and surrounding said mandrel; means for placing said spring means in compression, said last named means being continuously coupled to said mandrel thereby placing said mandrel in tension; and means for vibrating said mandrel to loosen said insert whereby said spring force moves said mandrel and insert substantially longitudinally out of said bore.

2. An insert removal device for removing an insert from a bore within a body comprising: an insert engaging means; a mandrel affixed to said engaging means, said mandrel being adapted to extend from said engaging means through said bore to the exterior of said body, said mandrel being threaded over at least a portion of the length thereof; a first head plate adapted to be disposed upon said body in contact at a surface opposed to the direction of removal of said insert and surrounding said mandrel, said mandrel being longitudinally movable through said first head plate, spring means disposed upon said first head plate at the surface thereof opposed to said contact surface and surrounding said mandrel; a second head plate positioned atop said spring means surrounding said mandrel and longitudinally coupled thereto; means for forcing said second head plate toward said first head plate thus placing said spring means in compression, said last named means being rotatably coupled to said threaded portion of said threaded portion of said mandrel thereby placing said mandrel in tension; and means for vibrating said mandrel to move said mandrel substantially longitudinally out of said bore.

3. An insert removal device for removing a wedged insert from a tapered bore within a body comprising: an insert engaging means; a mandrel affixed to said engaging means, said mandrel being adapted to extend from said engaging means through said bore to the exterior of said body, said mandrel being threaded over at least a portion of the length thereof; a first head plate adapted to be disposed upon said body in contact at a surface opposed to the direction of removal of said insert and surrounding said mandrel, said mandrel being longitudinally movable through said first head plate; spring means disposed upon said first head plate at the surface thereof opposed to said contact surface and surrounding said mandrel; a second head plate positioned atop said spring means surrounding said mandrel and longitudinally coupled thereto; a tightening nut threadably engaged upon said mandrel proximate said second head plate adjacent the surface thereof opposed to said spring contacted sur-

face, said tightening nut being adapted upon rotation thereof to move said second head plate toward said first head plate to place said spring means in compression and said mandrel in tension; and an electric vibratory motor disposed upon and coupled to said mandrel whereby upon energization of said motor said mandrel will be longitudinally vibrated to free said wedged insert from said bore and allow movement of said mandrel and insert from said bore.

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