April 10, 1956 W. O. WEAVER 2,741,022

LINER REMOVER

Filed Sept. 7, 1951 2 Sheets-Sheet 1

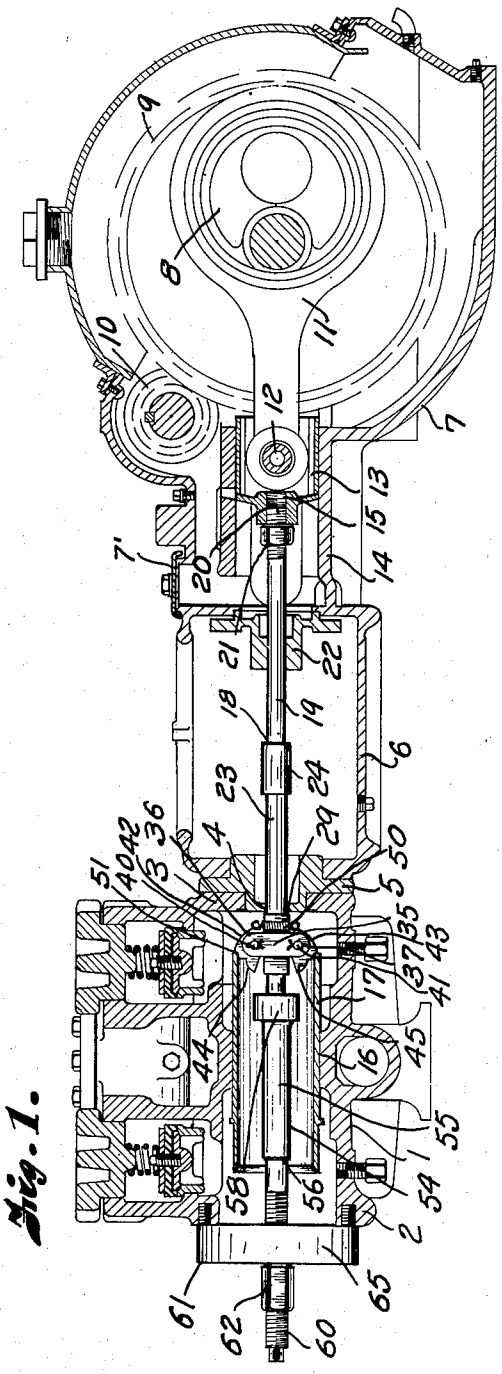


Fig. 1.

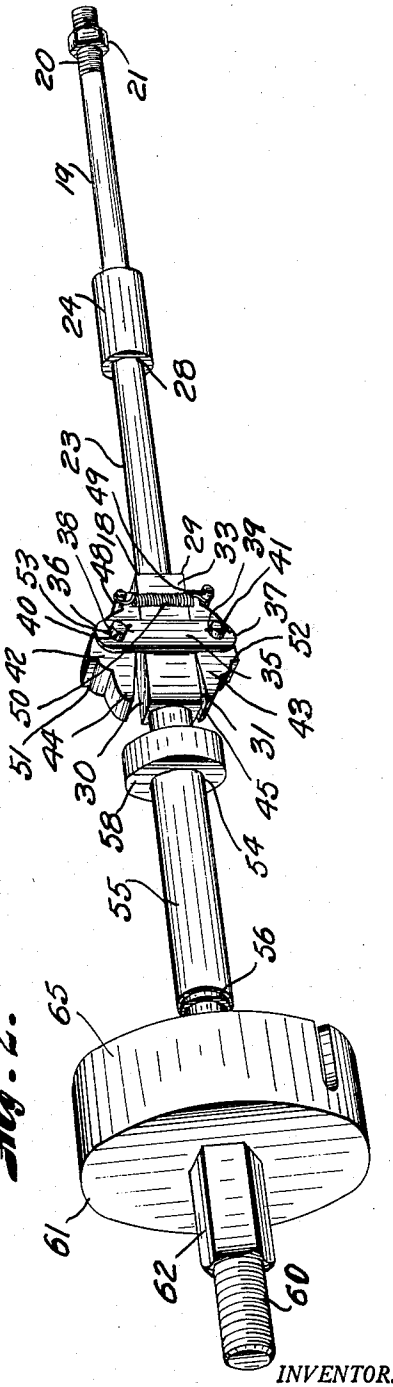


Fig. 2.

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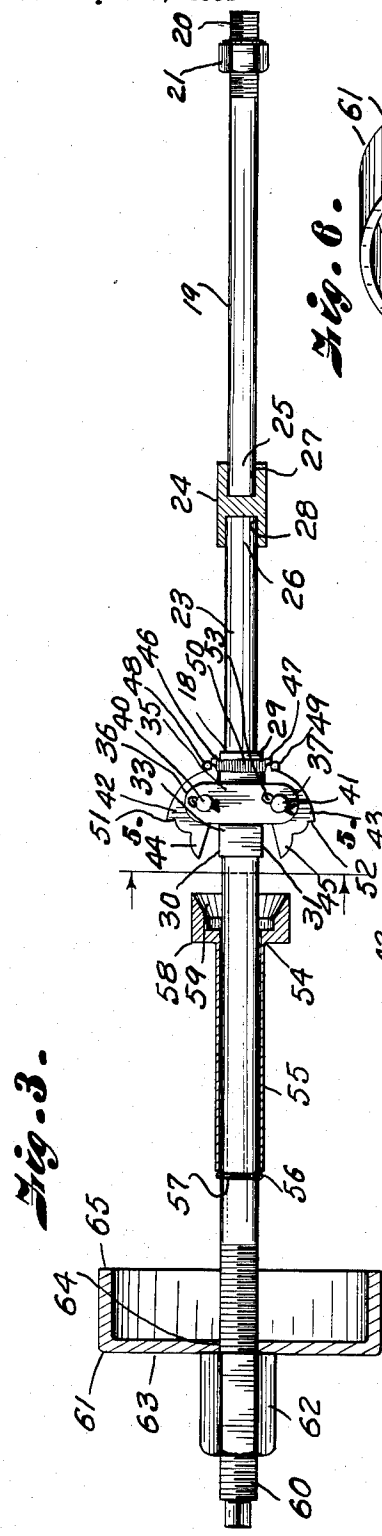


Fig. 3.

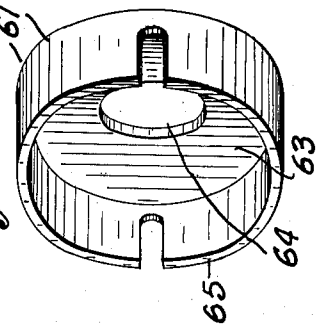


Fig. 6.

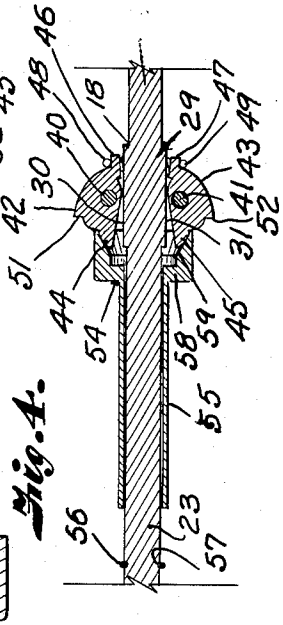


Fig. 4.

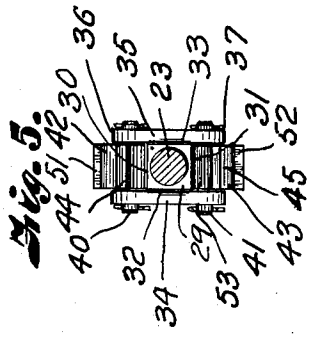


Fig. 5.

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LINER REMOVER

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Application September 7, 1951, Serial No. 245,525

3 Claims. (Cl. 29—244)

This invention relates to a tool for removing liners from the cylinders of pumps and the like, for example, mud pumps used in circulating drilling fluid in the rotary drilling of wells and which includes a cylinder having a removable liner in which a piston is reciprocated under action of a cross head that is connected with the piston through a piston rod. The liners of such pumps are subject to wear and abrasion so that it is necessary to remove the worn liners and replace them with new liners to maintain the efficiency of the pump. Such liners are pressed tightly within the pump cylinders and when the pumps have been in use for considerable time, the condition of the liners makes their removal difficult.

It is therefore the principal object of the present invention to provide a tool for removing such liners and which permits use of the pump power as the activating force in effecting removal of the liners.

Other objects of the invention are to provide a tool wherein the pump power may be supplemented by the force of a jack which forms a part of the tool, and to provide a tool for removing liners that is easily applied to the pump and readily connected with the cross head that normally reciprocates the pump piston.

In accomplishing these and other objects of the invention hereinafter pointed out, I have provided improved structure, the preferred form of which is illustrated in the accompanying drawings, wherein:

Fig. 1 is a side elevational view of a liner removing tool constructed in accordance with the present invention and showing the tool in position within the pump, the pump being shown in longitudinal section.

Fig. 2 is an enlarged perspective view of the tool.

Fig. 3 is a side elevational view of the tool.

Fig. 4 is a fragmentary longitudinal section through the jaw portion of the tool illustrating operation of the sleeve to effect contraction of the jaws for facilitating removal of the tool from the liner of a pump.

Fig. 5 is a cross section through the tool on the line 5—5 of Fig. 3.

Fig. 6 is a perspective view of the bridge or cap member that is used in connection with the tool when it is desired to supplement the power of the pump actuator.

Referring more in detail to the drawings:

It is to be understood that the invention is adapted to the removal of various type liners; the tool illustrated is described for removing liners from a mud pump. Such pumps include a cylinder 1 closed at the outer end 2 by a removable head (not shown). The opposite end of the cylinder is closed by a head 3 having an axial opening 4 that slidably passes the piston rod (also not shown) of the pump. Connected with the head 3 is a plate 5 which normally carries the usual stuffing box and junk rings required in effecting a seal about the piston rod. Connected with the pump cylinder through a frame 6 is a crank case 7 enclosing an eccentric or crank 8, which in the type of pump illustrated, is actuated by a gear 9 which meshes with a drive pinion gear 10 that is adapted to be connected

with a prime mover or other actuator (not shown). Connected with the eccentric 8 is a pitman 11 having a wrist pin connection 12 with the cross head 13, the cross head being mounted in a suitable guide 14 and provided with an internally threaded axial bore or socket 15 with which the end of the piston rod is connected.

Pressed within a bore 16 of the pump cylinder is a liner or sleeve 17. The liner or sleeve 17 contains the usual piston (not shown) by which the drilling fluid is drawn into and discharged from the respective ends of the cylinder.

The liner is thus mounted so that it may be removed when worn and replaced with a new liner. However, after such liners have been in use for some time, they become difficult to remove.

The present invention pertains to a tool for facilitating removal of such liners under power effected through the cross head of the pump. The tool includes an elongated rod assembly 18 composed of a push rod section 19 having a threaded end 20 conforming with the threaded socket 15 of the cross head and which is provided with a jamb nut 21 that is mounted on the threads for a purpose later described.

The rod section 19 preferably conforms with the diameter of the piston rod of the pump so that it is adapted to be slidably supported in a guide and stuffing box 22 closing the opening in the casing 7 through which the piston rod extends.

The tool also includes a rod section 23 that is connected with the rod section 19 by means of a coupling 24, the adjacent ends 25 and 26 of the rod sections being snugly engaged within sockets 27 and 28 that are provided in the ends of the coupling, as best shown in Fig. 3. The rod section 23 has a cylindrical cross section so as to be slidably supported within the opening 4 of the pump cylinder head 3, as later described. The rod section 23 has a body portion 29 intermediate the ends thereof that is preferably of square cross-section to provide substantially flat sides 30—31 and 32—33. Attached to the sides 32—33 are transverse straps 34 and 35 having oppositely projecting ends 36 and 37 which are provided with openings 38 and 39 (Fig. 2). Supported in the openings are pivot pins 40 and 41 to pivotally mount jaws 42 and 43 respectively for engaging the end of the liner.

The jaws have forwardly projecting cam or latch portions 44 and 45 which have their outer edges curving forwardly and inwardly toward the axis of the rod member for a purpose later described. The opposite ends of the jaws have tail portions 46 and 47 carrying transverse pins 48 and 49 that are suitably attached thereto as, for example, by welding. The ends of the pins project beyond the sides of the jaws and are interconnected by coil springs 50 which normally retain the cam portions of the jaws in spread-apart position and with the tail portions in abutting contact with the upper and lower side faces 30 and 31 of the portion 29 of the rod. The jaws also have transverse shoulders 51 and 52 which project outwardly thereof between the cam ends and the pivot pins for engaging the end of the pump liner. The pivot pins 42 and 43 are retained by cotter pins 53 that extend through openings in the ends of the pivot pins at the outer sides of the mounting straps 34 and 35.

The rod section 23 carries a jaw contracting device 54 which has a tubular body 55 slidably mounted on the rod member between the end of the square portion 29 and a stop ring 56, the stop ring being engaged within an annular groove 57 of the rod member, as best shown in Fig. 3.

The end of the sleeve adjacent the jaws includes a head 58 having an inwardly tapering socket 59 that is adapted to engage the cam portions of the jaws when the sleeve member is moved into engagement therewith as shown in

Fig. 4 so as to contract the jaws by rocking them inwardly on their pivot pins as later described.

The outer end of the rod member 23 is externally threaded as indicated at 60 to form a jack screw which mounts a cup-shape bridge or abutment member 61 and a draw nut 62. The member 61 has a disc-shape end 63 provided with an opening 64 for passing the threaded end of the rod and the periphery thereof is provided with a laterally extending annular flange 65 adapted to engage the outer end of the pump cylinder when the jack screw portion of the tool is needed to supplement the power exerted through the cross head.

Assuming that the liner 17 is to be removed with a tool constructed as described, the packing glands, packing and junk rings are removed from the pump along with the pump head which closes the outer end 2 of the pump cylinder. With the cross head 13 on the complete back stroke of the eccentric 8 the push rod section 19 of the tool, without the nut 21 thereon, is inserted through the stuffing box 22 until the threaded end 20 of the rod section 19 appears through a service opening 7' in the top of the crank case. The jamb nut 21 is then inserted through the service opening 7' and is turned onto the threaded end 20. After the jamb nut 21 has been applied, the rod 19 is pushed on through the stuffing box until the threaded end 20 is in position to enter the threaded socket 15 of the cross head. The rod section 19 is then turned into the threaded socket 15 of the cross head, after which the jamb nut 21 is tightened against the cross head to complete the connection. The coupling 24 is then slipped over the end 25 of the push rod 19, as shown in Fig. 3. The rod section 23 is then passed through the open end 2 of the cylinder 1, liner 17, and opening 4 of the stuff box plate 5 so that the end 26 thereof engages in the socket 28 of the coupling 24.

During insertion of the rod section 23, the jaws 42 and 43 pivot inwardly against action of their springs 50. However, when the jaws issue from the inner end of the liner, the springs 50 snap the jaw outwardly into open position so that the shoulders 51 and 52 thereof are in position to engage the end of the liner, as shown in Fig. 1. When the tool is in this position the rod sections are slidably supported within the openings of the respective stuffing boxes to hold the tool in the axis of the liner.

To remove the liner power will be applied through the cross head 13 under control of the usual lever operated clutch (not shown). Upon engagement of the clutch the pinion 10 will rotate to effect turning of the larger gear 9 to cause the eccentric to push the pitman 11 and cross head 13 forwardly in the guide 14 of the pump so as to exert pushing force on the end of the liner through the jaws 42 and 43. This force is ordinarily sufficient to free the liner and push it out of the bore 16, but should the liner be more difficult to remove the bridge or cap member 61 may be applied over the threaded end 60 of the rod section 23 followed by the draw nut 62 so that the flange 65 is moved into engagement with the end 2 of the pump cylinder. Then when the nut 62 is drawn up against the cap or bridge 61, a pull is effected on the rod in an axial direction and against the end of the cylinder to give the sufficient additional power simultaneously with the power through the cross head to assure loosening of the liner within the cylinder. It will be understood that as the draw nut 62 is tightened the power on the cross head, tending to move the cross head in the guide 14, will keep the end 25 against the bottom of the socket 27 of the sleeve and the bottom of the socket 28 against the end 26 of the rod section 23 so that the pushing force of the jaws on the liner will continue to function when the pulling force is applied through the draw nut 62. Thus, pushing and pulling forces are simultaneously applied to the cylinder liner to affect removal in difficult cases.

To remove the tool from the liner when the liner is in the pump, the clutch should be disengaged to release pressure on the push rod section 19. The pump is then

turned back until the shoulders 51 and 52 on the jaws 42 and 43 are free from the ends of the cylinder. The jaw contracting sleeve is then moved inwardly over the outer end of the rod section 23 so that the tapered socket 45 thereof engages the cam portions 44 and 45 of the jaws to cause the jaws to swing inwardly toward the rod section and permit the shoulders 51 and 52 of the jaws to clear the inner circumference of the liner when the rod section 23 is withdrawn from the open end of the cylinder.

After removal of the liner the section of the tool is withdrawn from the cylinder of the pump with the end 26 slipping out of the socket 28 of the coupling. The coupling is then removed from the rod section 19 and the rod section is unthreaded from the cross head.

Should the pump be mounted where the motor power cannot be used, the tool may be operated without the use of the push rod section 19. In this instance, the rod section 23 is inserted through the open end 2 of the cylinder 1 until the shoulders 51 and 52 of the jaws 42 and 43 pass the inner end of the liner whereupon the jaws spring outwardly. The member 61 is then placed over the threaded end of the rod 63 to engage the open end of the pump cylinder, after which the draw nut 62 is tightened up against the member 61 to exert the force necessary for loosening the liner and pulling the liner from the bore 16 of the pump cylinder.

It is obvious that the same tool may be used for liners of various size by changing the puller jaws 42 and 43. This is readily effected by removing the pivot pins 40 and 41 and unhooking the spring 50. Proper size jaws are then inserted between the ends 36 and 37 after which the pins 40 and 41 are reinserted. The springs 50 are then engaged with the tail portions of the jaws to complete the change. It is obvious that by use of my improved tool, removal of pump liners is much easier and faster thereby saving time and labor.

What is claimed is:

1. A device for removing a liner from the cylinder of a pump or the like utilizing power from the cross head of the pump, said device including a push rod having an end adapted for connection with the cross head, a coupling engaging the other end of the push rod, a rod engaged with the coupling and adapted to extend axially through the liner, jaws pivotally mounted on said last named rod and having portions adapted to engage an end of the liner, a spring for expanding the jaws to effect said engagement with the liner, and a jaw contracter slidable upon said last named rod and engageable with the jaws to effect contraction of the jaws against action of the spring to permit retractive movement of the jaws through the liner in case the device must be withdrawn through the liner.

2. A device for removing a liner from the cylinder of a pump wherein the pump includes a cross head having a connection for a piston rod and powered by an actuator for the pump for reciprocatory movement of the cross head in alignment with the stuffing box of the pump cylinder in which a liner is slidably contained, said device including a pair of rod sections, one of the rod sections having means on an end thereof for connection with the rod connection of the cross head, jaws on the other rod section and adapted to engage an end of the liner immediately adjacent the said stuffing box when the rod member is inserted through the liner and projected through the opening of the stuffing box for abutment with said one rod section, and a coupling for said registering ends of the rod sections to support the rod sections in abutting alignment and effect movement of the liner from said cylinder upon actuation of the cross head.

3. A device for removing a liner from the cylinder of a pump wherein the pump includes a cross head, having a connection for a piston rod and powered by an actuator of the pump for reciprocatory movement in alignment with the stuffing box of the pump cylinder in which a liner is slidably contained, said device including a pair

of rod sections, one of the rod sections having means on an end thereof for connection with the rod connection of the cross head, jaws pivotally mounted on the other rod section and having cam portions, springs normally spreading the jaws apart for engagement with an end of the liner immediately adjacent the said stuffing box when the rod member is inserted through the liner from the end opposite the stuffing box, a coupling for the ends of the rod sections to support the rod sections in abutting alignment and effect movement of the liner from said cylinder upon actuation of the cross head, and a sleeve member slidable on the said other rod section and having means for engaging said cam portions to move the jaws out of engagement with said end of the liner.

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