Jan. 16, 1945. A. P. CARY 2,367,185

PISTON

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FIG. 1.

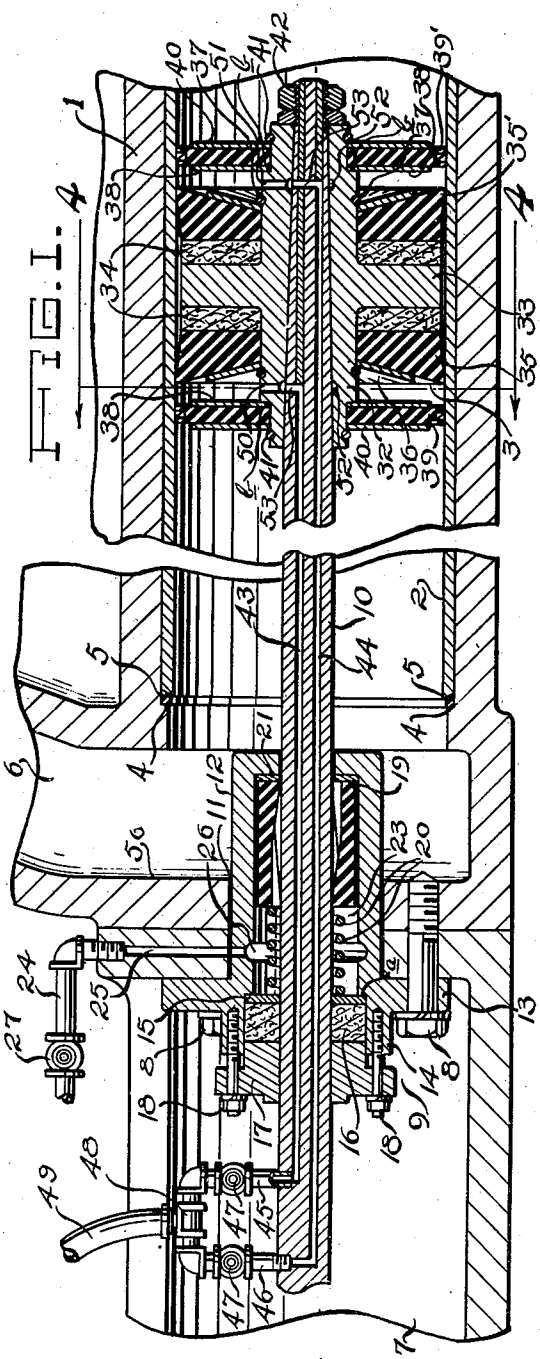
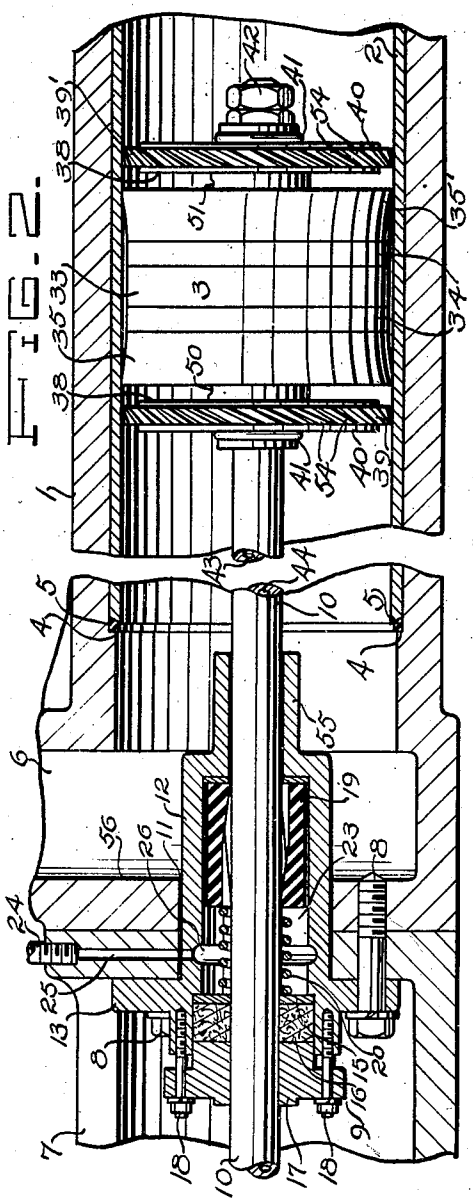


FIG. 2.



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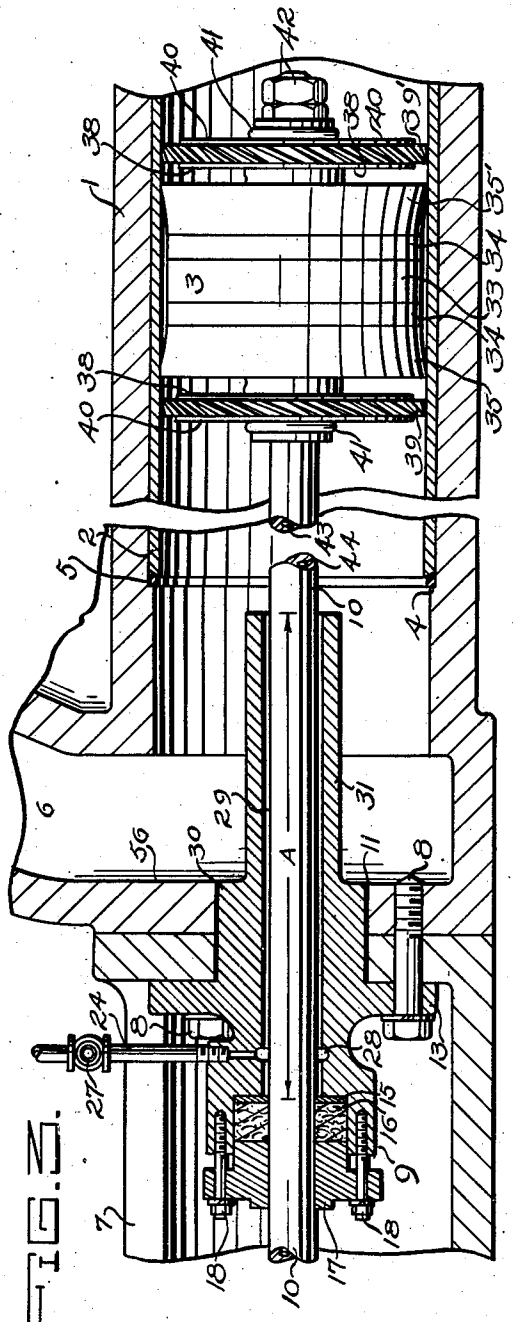


FIG. 3.

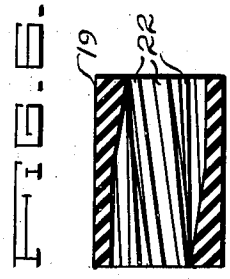


FIG. 6.

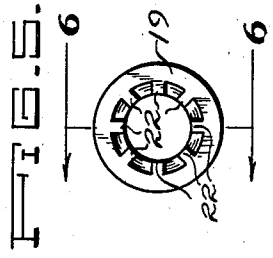


FIG. 5.

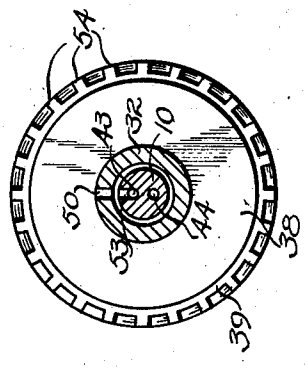


FIG. 4.

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2,367,185

PISTON

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Application November 6, 1941, Serial No. 418,008

2 Claims. (Cl. 309—4)

This invention relates to improvements in pumps of the type commonly referred to as mud pumps employed in connection with rotary drilling of wells, and it has particular reference to improvements calculated to prevent or minimize excessive wear by abrasive materials in suspension in the fluid pumped and its principal object resides in the provision of wiping elements for the piston and piston rod of the pump designed to cooperate with the piston and the piston rod, as well as the pump liner, to prevent the accumulation of abrasive substances on the wearing surfaces in the path of the piston and piston rods as these elements are operated in the fluid.

Another object of the invention resides in the provision of an irrigating system whereby a stream of fluid is injected into the pump to aid in removing the abrasive substances clinging to the working surfaces and thus prevent cutting of the surfaces and wear resulting in leakage.

Still another object of the invention resides in the provision of an assembly of wiping elements adapted to operate in the path of the piston to remove the attendant accumulation of sand and grit in front and behind the piston to prevent excessive wear on this member, as well as the lining within the cylinder, affording substantially a squeegee action on the surfaces of the liner, thus prolonging the life of the assembly resulting in a great saving of expense and time.

Yet another object of the invention is manifest in the provision of a structure adapted to afford an irrigated housing or sleeve suitably proportioned to the longitudinal movement of the piston rod to insure a clean surface thereabout throughout the length of the piston rod passing through the stuffing box opposite the piston.

An object of the invention is also that of providing for the injection of water, or a suitable lubricant, into contact with the operating surfaces of the piston rod and the piston, as well as the cylinder liner, such injections occurring upon the movement of the piston in the cylinder.

A further object of my invention is to provide a means of cleaning the engaging surfaces of the rods, pistons and liners, without the necessity of providing an auxiliary pump to supply water or other cleaning fluid under high pressure, and without the injection of water in such excessive volume as to unduly dilute the drilling fluid with resultant injurious lowering of its viscosity; for the viscosity of a drilling fluid must be carefully controlled to obtain maximum efficiency in drilling operations.

Broadly, the invention seeks to comprehend the provision of an assembly of cleaning apparatus adapted to keep the engaging surfaces of the piston and piston rod clear of all abrasive substances in suspension in the fluid pumped, thus prolonging the life of the several parts of the pump beyond that common to the conventional type of equipment yet capable of being provided at a nominal cost for installation in standard makes and designs of pumps.

While the foregoing objects are paramount, other and lesser objects will become manifest as the description proceeds taken in connection with the appended drawings wherein:

Figure 1 is a fragmentary longitudinal cross-sectional illustration of a pump showing a tensioned wiping gland surrounding the piston rod and illustrating the wiping rings arranged on each side of the piston.

Figure 2 is a fragmentary cross-sectional illustration of a pump in which the invention is shown slightly modified, with respect to the tensioned wiping assembly for the piston rod, and illustrating the piston and wiping rings in elevation.

Figure 3 illustrates the invention installed in a pump and shows a modified form of stuffing box having an integral sleeve or housing in which the piston rod is enclosed, the said housing being irrigated to clean the piston rod in its movement therethrough.

Figure 4 is a side elevational illustration of one of the wiping rings employed in combination with the piston for cleaning the liner within the cylinder.

Figure 5 is an end elevational view of the wiping gland shown installed in Figures 1 and 2, and

Figure 6 illustrates, in longitudinal cross-section, the wiping gland shown in Figure 5, and is a view taken on lines 6—6 of Figure 5.

Drilling fluid, employed in the drilling operations of oil and water wells, of necessity contains much abrasive materials which are drawn through the pump for such fluids and such abrasive materials quickly wear the surfaces of the working parts of the pump unless these surfaces are cleaned constantly. The most practical means of cleaning these surfaces seems to be that of flushing the piston rod and liner with water, or other suitable fluid, at each operation of the moving part and, at the same time, provide wiping means for the moving part to remove the abrasive substances from the contacting surfaces before the packing on either the piston or in the

stuffing box of the rod comes into contact with the moving surfaces. An object of the invention, therefore, is that of providing for these elements.

My experience with pumps handling severely abrasive fluids has demonstrated that it is not necessary to inject water under pressure from an auxiliary pump to the various engaging surfaces, since my construction either protects the rod entirely from contact with the abrasive mud, or wipes the rod and liner clean of adhering abrasives, the same then being flushed away from the various wiping elements by the action of water drawn into the pump by its own suction from an outside source at atmospheric pressure and the volume of water required for such sealing and/or flushing action is negligibly small compared with the volume of drilling fluid being handled by the pump. The volume of flushing fluid employed with my structure can be controlled by the inclusion in the supply line of a conventional valve.

The invention is designed to be installed in a conventional pump which has been fragmentarily illustrated in cross-section. The pump cylinder 1 is provided with a liner 2 within which the pump piston 3 operates. The piston 3 will be presently described in detail. The liner 2 terminates at a shoulder 4 formed within one end of the cylinder 1, as illustrated in Figures 1, 2 and 3, against which a packing ring 5 is placed and which is designed to prevent leakage around the outer wall of the liner 2. The cylinder 1 is provided with suitable inlets or outlets 6.

The pump operating mechanism is housed within a casting 7, fragmentarily illustrated, adapted to be arranged adjacent the cylinder 1 and secured thereto by bolts 8, or the like, which also serve to secure the stuffing box assembly 9 for the piston rod 10 operating therein.

The engaging ends of the cylinder 1 and the member 7 are each provided with openings 11 registering to afford a circular passage receiving an integral cylindrical extension 12 of the stuffing box assembly 9 which extends into the cylinder 1, in the manner illustrated in Figures 1, 2, and 3. The stuffing box assembly 9 is shown in modified form in the several illustrations but generally consists of a casting formed with a circular flange 13 through which the bolts 8 extend for securing the assembly to the members 1 and 7. The cylindrical extension 12 of the assembly 9 is integral with the flange 13. On the opposite side of the flange 13 there is provided an integral boss 14 projecting from the flange 13 and having an internal diameter sufficient to accommodate a junk ring 15 adapted to repose against a shoulder *a* and a packing ring 16, of a suitable packing material, secured in position by a follower 17 retained by bolts 18 threaded into the boss 14.

The piston rod 10 is adapted to slide through the packing ring 16 and the junk ring 15 adjacent thereto and function to prevent leakage of fluids past the stuffing box assembly and into the member 7. Forwardly of the junk ring 15 a wiping gland 19 is arranged within the cylindrical extension 12 of the stuffing box assembly and is retained in position by a tension spring 20 bearing against the end of the wiping gland 19 at one end, and against the junk ring 15 at its opposite end. Thus the wiping gland 19 is constantly urged against the end of the member 12 opposite the packing ring 16 secured by the follower 17. A junk ring 21 is also provided in the end of the member 12 against which the wiping gland 19 engages. The end of the member 12 is upset or flanged inwardly and reduced to an opening slightly larger than the piston rod 10 operating therein.

The wiping gland 19 is substantially cylindrical in form but is provided internally with integral ribs 22 arranged spirally or diagonally with respect to the longitudinal axis of the member 19 and such ribs engage the piston rod 10 and serve to wipe this member free of abrasive substances in advance of the packing ring 16 as the rod passes through this member. The wiping member 19 is preferably composed of a flexible material such as rubber, neoprene, or the like.

As the rod 10 is operated through the stuffing box assembly the chamber 23 formed within the member 12 of the stuffing box assembly 9 is intermittently irrigated or flushed with fresh water, or other suitable lubricant, supplied through a line 24 extending from a source at atmospheric pressure into a passage 25 formed in the end of the member 7 adjoining the pump cylinder 1, as illustrated in Figures 1 and 2, which passage communicates with a circular groove 26 formed within the chamber 23 in the member 12. Fluid is drawn into the member 12 and into contact with the piston rod 10 upon each movement of the piston 3, as illustrated, away from the stuffing box assembly 9 since the piston 3 creates a suction therebehind which exerts a pull on the fluid in the line 24 and, by reason of a check valve 27 in the line 24, the irrigating fluid is permitted to pass through the line only when suction is applied by the piston 3 in the manner just described.

The flushing action of the water drawn into the chamber 23 and into contact with the rod 10 serves to remove from the surface of the rod any adhering abrasive substances when applied in cooperation with the contacting ribs 22 of the wiping gland 19 previously described. Figure 3 shows a modified form of stuffing box assembly 9 wherein the wiping gland 19 and the tensioned device 20 are omitted and the fluid introduced for flushing the rod passes through a line 24 and directly into the stuffing box casting communicating with a circular groove 28 within the bore 29 through which the rod 10 is adapted to function. The condition under which this modified form may be used will be discussed presently.

The stuffing box assembly 9 illustrated in Figure 3 comprises a casting having a flange 13 for securing this member to the members 1 and 7 and an integral portion 30 extending into the passage formed by the openings 11 in the members 1 and 7, an integral extended portion of which projects into the cylinder 1 forming a sleeve 31 housing the piston rod 10. The sleeve 31, coupled with the portion 30 of the stuffing box assembly, provides for an elongated bore 29 protecting the piston rod 10 along that portion of its length exposed on the piston side of the packing ring 16 secured by the follower 17 around the rod 10. In other words, the complete operative surface of the rod 10 is protected by the extension 31 whose inner bore 29 provides an annular chamber around the rod 10 through which the irrigating fluid entering through the line 24 flows to wash out the adhering abrasive materials on the surface of the rod 10 upon each rightwardly movement (as illustrated) of the rod 10 longitudinally within the cylinder. The check valve 27 prevents the passage of fluids through the line 24 when the piston is urged (as illustrated) leftwardly or in the direction of the stuffing box assembly 9.

It will be noted that the shoulder 4 for the liner 2 is shown in Figures 1, 2 and 3 progressively farther removed from the left end 56 of the cylinder casting 1 to correspond with the construction employed in various pumps. Since the location of this shoulder determines the point of maximum leftwardly travel of the piston in any given pump, it also determines the greatest length possible for the extension 12 in Figure 1, or 12 plus 55 in Figure 2, or 31 in Figure 3; for clearance must be provided between the extension and the piston at its point of maximum leftwardly travel. In types of pumps represented by Figure 1, there is not sufficient space for an additional extension 55.

In Figure 2 is shown a type of pump in which such an additional extension 55 is possible. While in Figure 3 a type of pump is shown in which the extension or sleeve 31 can be made so long that the wiping gland is not necessary, since the distance A is greater than the stroke of the pump. That is, no part of the rod which passes through the packing 16 is ever in contact with abrasive-laden mud, even when the rod is at its point of maximum rightwardly travel. In Figure 2 such is not the case, but the short extension 55 reduces the amount of abrasive which the rod 10 carries to the wiping gland 19 and thus prolongs the useful life of the latter.

The piston 3, being substantially conventional in construction, comprises a body 32 which is cylindrical in form and which is provided with an integral flange 33 intermediate its ends, as illustrated in Figure 1. Rings 34 of a fibrous material are arranged over the body 32 and engage the opposite faces of the flange 33. Composition rings 35 and 35', composed of rubber, neoprene, or the like, their outer faces being concave or recessed, are retained against the fibrous rings 34 by conical or concave plates 36 secured upon the body 32 by retaining rings or clips 37.

The body 32 is formed at each end with an annular shoulder *b* against which circular disks 38 engage, the latter being engaged by wiping disks or rings 39 and 39', illustrated in Figure 4, which are secured by similar plates 40 by retaining rings 41 surrounding the extreme ends of the body 32, as illustrated in Figure 1. The piston assembly, including the body 32, rings 34, 35 and 35', as well as the wiping disks 39 and 39', are secured to the tapered end of the rod 10 by lock nuts 42 threaded upon the rod 10, in the manner illustrated in Figures 1, 2 and 3.

The irrigating fluid is also introduced through passages 43 and 44 extending longitudinally through the rod 10, as illustrated in Figure 1, each of which connect with separate inlet conduits 45 and 46, respectively, and which are provided with check valves 47, similar to the check valve 27 in the line 24, and merge through a T-connection 48 with a flexible line 49 connected to a source. The passage 43 in the shaft 10 communicates exteriorly of the body 32 through a port 50 between the inner wiping disk 39 and the inner composition piston ring 35 to inject the irrigating fluid into the cylinder 1 in the path of the piston and the wiping disk 39. The passage 44 in the rod 10 communicates interiorly of the cylinder 1 through a port 51 in the body 32 between the outer piston ring 35' and the outeer wiping disk 39' on the opposite end of the piston assembly. Each of the ports 50 and 51 in the body member 32 communicates respectively with each of the circular grooves 52 surrounding the tapered portion of the rod 10 within the body 32, as illustrated in Figure 1, obviating the necessity of registering the outlet passages 53 of the passages 43 and 44 with the ports 50 and 51. The passages 43 and 44 are preferably bored through the shaft from one end thereof and plugged to each of the passages 53, respectively, as shown in Figure 1.

Upon each operation of the piston assembly the irrigating fluid passing through the line 49 from the source is injected into the cylinder 1 and in the path of the piston and the wiping disks 39 and 39' by reason of the suction created by the piston in its movement. Thus, as the piston travels away from the stuffing box assembly a suction is created therebehind drawing the fluid through the passage 43 into the liner 2 and in the path of the wiping disk 39 on the inner side of the piston assembly, while the fluid is subsequently introduced to the opposite or outer side of the piston assembly and in the path of the wiping disk 39' through the passage 44, the check valves 47 functioning to open only when a suction is created in either of the lines 45 or 46, alternating in accordance with the travel of the piston assembly 3.

The peripheral faces of the wiping disks 39 and 39' are provided with diagonal ribs 54, illustrated in Figures 2, 3 and 4, adapted to contact the inner surface of the liner 2, yet having their ends overlapping so that there is no direct passage in a straight line therebetween but allowing for the passage of the irrigating fluid past the ribs 54 and into contact with the surface of the liner 2. This arrangement provides for the thorough cleaning of the inner surface of the liner 2, cooperating with the fluid introduced through the outlet ports 50 and 51 between the wiping disks 39 and 39' and the piston assembly 3 removing all abrasive substances from such surface.

The conservation of space is an important object of the invention and particular attention is directed to the compact design of the stuffing box assembly 9, as especially illustrated in Figures 1 and 2. It will be noted that the major portion of the assembly extends into the cylinder 1 on the piston side of the stuffing box assembly not only for the purpose of housing the wiping gland 19 cooperating with the stuffing box packing 16, but also for the purpose of protecting the rod 10 presenting thereto a greater irrigated surface within the chamber 23 of the member 12. In Figure 2 greater protection is provided for the rod 10 by an integral extension 55 forming a part of the portion 12 of the stuffing box assembly 9 surrounding the rod 10. An annular space around the rod 10 within the member 55 provides for the passage of the irrigating fluid therethrough and around the rod 10 to clean its surface. This arrangement is similar to that illustrated in Figure 3.

It is obvious, also, that the members 1 and 7 of the pump assembly may be spaced apart when desirable by placing suitable spacing members (not shown) therebetween and lengthening the retaining bolts 8. The stuffing box assembly may be accordingly increased in length, as well as the rod 10, if desirable. Under certain conditions such an arrangement might expedite the operation of the assembly.

As a homely illustration of the effectiveness of the cleaning mechanism employed in certain forms of my invention, as well as of the small volume of water required for such cleaning action, the wiping gland 19 and wiping disks

39—39' may be compared with a conventional windshield wiper, which is effective even in a light drizzle. While older methods of cleaning both piston rod and liner by the injection of water under high pressure from an auxiliary pump may be compared with attempting to clean a windshield with water from a hose without benefit of wiping during the process. A large volume of water would be required under high pressure with indifferent results.

It is not intended that the invention be restricted to the specific construction herein shown and described since modifications thereof which may be considered as falling within the spirit and intent of the invention may also be considered as falling within the scope of the appended claims.

What is claimed is:

1. In a pumping mechanism for drilling fluids carrying abrasives having a pump cylinder and a cylinder liner and a piston and piston rod, flexible wiping disks for the said liner adapted to cooperate with the said piston, each of the said disks having a series of diagonal ribs disposed around their peripheral faces defining fluid passages therebetween and engaging the operative surfaces of the said liner in the paths of the said piston in either direction of its travel.

2. In a pumping mechanism for drilling fluids in an oil well including a cylinder having a liner and a piston and piston rod operatively arranged therein, flexible wiping disks for the said liner arranged on each side of the said piston on the said rod, the said disks formed with a peripheral arrangement of diagonal ribs defining grooves therebetween for the passage of fluid and engaging the inner surfaces of the said liner in either direction of travel of the said piston.

ARTHUR P. CARY.