April 21, 1953 K. W. HALEY 2,635,554

SAND PUMP PLUNGER

Filed Sept. 21, 1950

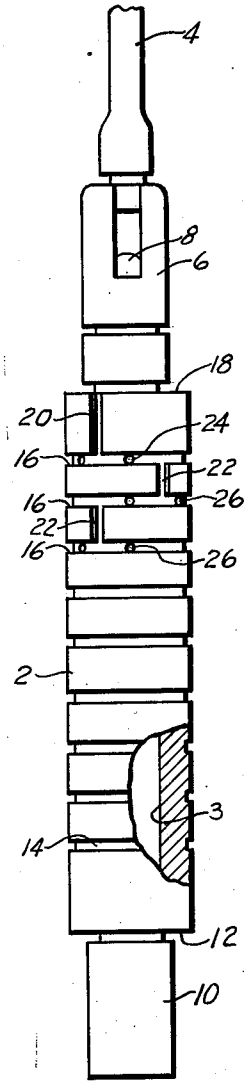


Fig. 1

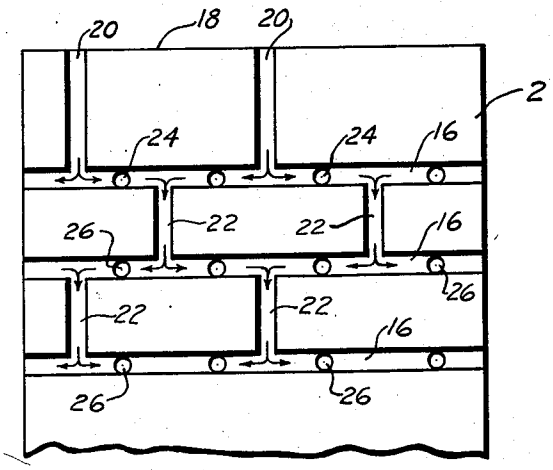


Fig. 2

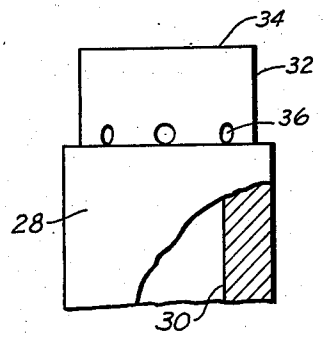


Fig. 3

INVENTOR.

K. W. Haley

BY C. M. McKnight

ATTORNEY

Patented Apr. 21, 1953 2,635,554

UNITED STATES PATENT OFFICE

2,635,554

SAND PUMP PLUNGER

Kenneth W. Haley, Tulsa, Okla.

Application September 21, 1950, Serial No. 186,020

7 Claims. (Cl. 103—220)

1

This invention relates to pump plungers and more particularly, but not by way of limitation, to pump plungers for use in pumping fluids containing abrasive foreign matter such as sand and the like.

It is well known to those skilled in the art that the presence of sand in the production fluid of an oil well greatly reduces the efficiency of the oil well pump. During operation of the usual sucker rod pump, a small portion of the sand will invariably be worked in between the pump plunger and the walls of the cylinder. Obviously, the sand will wear the plunger, as well as the cylinder wall, to increase the clearance between the plunger and cylinder and consequently decrease the efficiency of the pump.

One of the well known ways of reducing the abrasive action of the sand is to provide one or more circumferential grooves in the pump plunger adjacent the upper end thereof to catch the sand as it is worked downwardly along the outer periphery of the plunger. However, this type of plunger is designed and constructed with the purpose of preventing the entrance of sand between plunger and the walls of the pump cylinder, with the secondary purpose of trapping the sand as soon as possible to prevent abrasion of the entire plunger. It will, however, be readily seen that as the sand is being worked down along the plunger to the first groove, the upper end of the plunger will become worn, causing a substantial portion of the cylinder to become worn due the length of the stroke of the plunger therein, thereby increasing the clearance between the plunger and cylinder with a consequent decrease in the efficiency of the pump.

The present invention contemplates a novel pump plunger principally for use in pumping fluid having a relatively high sand content. The sand depositing on the top of the plunger is induced to flow downwardly along the plunger in confined paths and returned to the interior of the plunger during the upstroke thereof. Suitable grooves are provided in the outer periphery of the plunger communicating with the upper end of the plunger to permit movement of the sand in such a manner that neither the plunger nor the cylinder will become worn.

An important object of this invention is to provide a pump plunger particularly adapted for use in pumping fluids having abrasive foreign matter therein.

Another object of this invention is to provide a pump plunger whereby the sand deposited on the top of the plunger will be transferred to the interior of the plunger on the upstroke thereof.

2

A further object of this invention is to reduce abrasion in sucker rod well pumps to a minimum.

A still further object of this invention is to provide an efficient pump plunger having a long service life and which may be economically manufactured.

Other objects and advantages of the invention will be evident from the following detailed description, read in conjunction with the accompanying drawings, which illustrate my invention.

Figure 1 is an elevational view of the preferred form of my pump plunger, partially in section for clarity.

Figure 2 is a diagrammatic view of the upper portion of the plunger shown in Figure 1 illustrating the plunger evolved into a flat plate.

Figure 3 is an elevational view of the upper portion of a modified pump plunger partially in section.

Referring to the drawings in detail, and particularly Figure 1, reference character 2 designates a cylindrical pump plunger having a longitudinal bore 3 therethrough. The plunger 2 is adapted to be reciprocated in an oil well pump cylinder (not shown) by suitable surface equipment (not shown) through the medium of sucker rods 4. The rods 4 are connected to the plunger 2 by a valve cage 6 having a ball valve 8 therein. The valve cage 6 is threadedly secured to the plunger 2, and the ball valve 8 seats in the upper end of the plunger bore 3 in the usual manner. A suitable valve cage 10 having a traveling valve (not shown) disposed therein is threadedly secured to the lower end 12 of the plunger 2. The plunger 2 may be provided with a plurality of vertically spaced circumferential grooves 14, or suitable cups (not shown) in the usual manner.

A plurality of vertically spaced circumferential grooves 16 are provided in the outer periphery of the plunger 2 adjacent the upper end 18 thereof. A plurality of vertical grooves 20 (see also Fig. 2) are provided in the plunger 2 to establish communication between the upper end 18 thereof and the uppermost circumferential groove 16. A plurality of vertical grooves 22 are also provided to establish communication between the lower adjacent grooves 16. It will be noted that the grooves 20 and 22 are vertically offset approximately ninety degrees for purposes as will be hereinafter set forth. The grooves 20 and 22 need not be vertical as shown, but may be angled or curved if desired. As clearly shown in Fig. 2, an aperture 24 is provided in the uppermost annular groove 16 substantially medial between the lower end of each vertical groove 20 and the upper end of the adjacent vertical groove 22. The apertures 24 com-

municate with the bore 3 of the plunger 2. A series of apertures 26, also communicating with the bore 3 of the plunger 2 are provided in a similar manner in the remaining circumferential grooves 16.

Operation

As previously set forth, the plunger 2 is adapted to be reciprocated in a pump cylinder (not shown) by suitable surface equipment through the medium of the sucker rods 4. On the down stroke of the plunger 2 a quantity of the sandy well or production fluid is displaced through the traveling valve unit 10 and the bore 3 of the plunger 2 to above the plunger 2. As the plunger 2 reaches the end of its down stroke, the ball valve 8 seats in the plunger bore 3 and the traveling valve (not shown) seats in the cage 10. During the upstroke, the plunger 2 forces the production fluid upwardly into the production column (not shown) and hence to the surface of the well.

It is readily seen that any sand that may be precipitated from the well fluid disposed above the plunger 2 will tend to accumulate on the top 18 of the plunger. However, during the upstroke of the plunger 2 an infinitesimal amount of the well fluid will flow through the grooves 20 to carry the precipitated sand downwardly into the uppermost circumferential groove 16. The well fluid in flowing through the uppermost groove 16, as shown by the arrows in Fig. 2, must obviously pass over at least one of the apertures 24, and in doing so a portion of the well fluid, as well as a portion of the sand being washed thereby, will flow back into the bore 3 of the plunger 2. The remaining well fluid in the upper groove 16 will flow through the grooves 22 and lower grooves 16. As the fluid flows through a middle groove 16 a portion of the fluid will flow through the upper row of apertures 26 into the plunger bore 3. The fluid reaching a lowermost groove 16 will readily flow through the lower row of apertures 26 into the plunger bore 3, since the pressure in the plunger bore will offer less resistance to the flow than the minute clearance between the plunger 2 and the pump cylinder. The sand precipitating onto the upper end 18 of the plunger 2 will therefore be efficiently washed or returned to the plunger bore 3 and will not be worked into the space between the plunger 2 and the pump cylinder to wear the plunger and cylinder.

Referring to Fig. 3, reference character 28 indicates a modified pump plunger having a longitudinal bore 30 therethrough. Suitable upper and lower traveling valves (not shown) are provided on the plunger 28 in the same manner as on the plunger 2. In addition, suitable grooves or cups (not shown) are provided in the outer periphery of the plunger 28. A portion 32 of the plunger 28 communicating with the upper end 34 thereof has a slightly smaller diameter than the remaining portion of the plunger. A plurality of circumferentially spaced transverse apertures 36 are provided in the plunger 28 adjacent the lower end of the reduced portion 32 and communicate with the plunger bore 30.

The plunger 28 is adapted to be operated in a pump cylinder (not shown) in the same manner as the plunger 2. During the downstroke of the plunger 28, well fluid will be transferred from below the plunger 28 through the plunger bore 30 to a position above the plunger 28. On the upstroke of the plunger 28, sand, or other abrasive foreign matter, tending to precipitate on the upper end 34 of the plunger 28 will be washed downwardly over the outer surface of the reduced portion 32 and through the apertures 36 back into the plunger bore 30 by a small portion of the well fluid. The clearance between the reduced portion 32 and the pump cylinder (not shown) should be of sufficient magnitude to allow passage of the largest abrasive foreign matter encountered from above the plunger 28 into the apertures 36. Therefore, during operation of the plunger 28 all of the abrasive foreign matter tending to accumulate on the upper end 34 thereof will be returned to the plunger bore 30, and will not be worked into the minute clearance provided between the main body portion of the plunger 28 and the walls of the pump cylinder.

From the foregoing it is apparent that the present invention provides an efficient and practical pump plunger particularly adapted for use in pumping fluids containing abrasive foreign matter. Sand attempting to accumulate on the top of the plunger is washed downwardly in confined paths and back into the plunger bore to reduce abrasion of the plunger and pump cylinder to a minimum. The plunger will obviously have a long service life and be economically manufactured.

Changes may be made in the combination and arrangement of parts as heretofore set forth in the specification and shown in the drawings, it being understood that any modification in the precise embodiment of the invention may be made within the scope of the following claims without departing from the spirit of the invention.

I claim:

1. In a pump plunger comprising a cylindrically shaped body, a longitudinal bore through the body, a plurality of vertically spaced circumferential grooves in the outer periphery of the body, a plurality of grooves providing communication between the circumferential grooves and the upper end of the body to provide for passage of fluid and abrasive foreign matter from above the body to the circumferential grooves, and a plurality of apertures in each of the circumferential grooves to provide for passage of the fluid and foreign matter into the longitudinal bore.

2. In a pump plunger for pumping sandy fluids comprising a tubular body, a circumferential groove in the outer periphery of the body adjacent the upper end thereof, a second groove in the body providing communication between the upper end of the body and the circumferential groove to induce the passage of sand deposited on the top of the body into the circumferential groove, and a plurality of apertures in the circumferential groove to provide for passage of the sand into the body.

3. In a pump plunger for pumping sandy fluids comprising a tubular body, a pair of vertically spaced circumferential grooves in the outer periphery of the body adjacent the upper end thereof, a plurality of grooves in the outer periphery of the body interconnecting the circumferential grooves with the top of the body to provide for passage of sand from above the body into the circumferential grooves, and a plurality of apertures in each circumferential groove to provide for passage of the sand inwardly into the body.

4. In a pump plunger for pumping sandy fluids comprising a tubular body, a pair of vertically spaced circumferential grooves in the outer periphery of the body, essentially vertical grooves

interconnecting the upper circumferential groove with the top surface of the body to induce the washing of sand deposited on the top of the body into the upper circumferential groove, a pair of apertures in the upper circumferential groove adjacent the lower end of each of said vertical grooves to allow passage of a portion of the sand inwardly into the body, a second set of essentially vertical grooves interconnecting the circumferential grooves and vertically offset from the first mentioned vertical grooves providing passageways for the remaining sand to the lower circumferential groove, and apertures in the lower circumferential groove providing passageways for the remaining sand into the body.

5. In a pump plunger for use in pumping sandy fluids comprising a tubular body, a plurality of vertically spaced circumferential grooves in the outer periphery of the body, a plurality of essentially vertical grooves interconnecting the circumferential grooves and providing passageways for sand from the top surface of the body to the circumferential grooves, and a plurality of apertures in each circumferential groove providing passageways for the sand into the body so constructed and arranged to be in the path of the sand when moving through the circumferential grooves.

6. In a pump plunger for use in pumping sandy fluids comprising a tubular body, a plurality of

vertically spaced circumferential grooves in the outer periphery of the body, a plurality of essentially vertical grooves interconnecting the circumferential grooves and providing passageways for sand from the top surface of the body to the circumferential grooves, a plurality of apertures in each circumferential groove providing passageways for the sand into the body so constructed and arranged to be in the path of the sand when moving through the circumferential grooves, and a traveling valve carried by the body.

7. In a pump plunger comprising a cylindrical body having upper and lower end faces, a plurality of longitudinally spaced circumferential grooves in the outer surface of the body, a plurality of apertures in one of the end circumferential grooves, and a groove in the outer surface of the body providing communication between said end circumferential groove and the adjacent end face of the body.

KENNETH W. HALEY.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,588,705	Cope et al.	June 15, 1926
1,703,354	Nevill	Feb. 26, 1929
2,061,060	Carlson	Nov. 17, 1936
2,074,591	Rood	Mar. 23, 1937