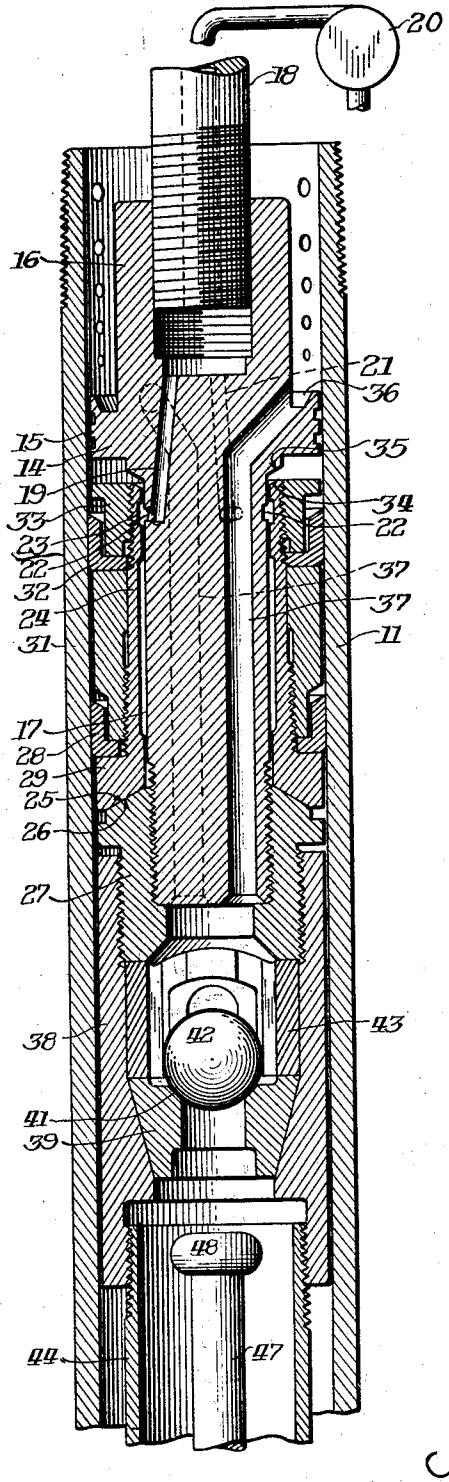
Aug. 4, 1931. I. A. WEAVER 1,817,659

PUMP

Filed Oct. 8, 1927



Inventor
Ira A. Weaver
By Walter M. Gulley
Atty

Patented Aug. 4, 1931 1,817,659

UNITED STATES PATENT OFFICE

IRA A. WEAVER, OF SPRINGFIELD, ILLINOIS

PUMP

Original application filed March 31, 1927, Serial No. 179,830. Divided and this application filed October 8, 1927. Serial No. 224,806.

My invention concerns pumps and similar appliances adapted to pump liquids containing abradant materials, such as grit or sand, or containing acids or other ingredients having a tendency to wear, corrode, or otherwise injure the parts of the mechanism.

One aim of the invention is the provision of a pump of this type incorporating means to prevent the dirt, grit, acid or the like from having access to the space between the pump plunger or piston and the cylinder or casing in which it reciprocates, and, in the preferred embodiment of the invention, a suitable liquid under adequate pressure is forced between the two thereby precluding the injurious liquid from entering the already filled space and preventing the harm or damage which might otherwise occur.

Such an improved and novel pump is especially valuable in dealing with oil containing sand, the latter quickly cutting and injuring the metal parts of ordinary pumps and rendering them either inefficient in action or practically or wholly inoperative.

In extremely deep oil wells, the expense of withdrawing the pump for repairs and the loss of production incident thereto, is frequently prohibitive requiring that many such wells be abandoned, resulting in an obvious economic loss.

Furthermore, as deep well pumps are usually of the single acting type, the column of liquid comes to complete rest while the plunger is on its downward stroke and an enormous force is required to overcome the inertia effect of the liquid on the upward stroke of the pump plunger.

Accordingly, a further purpose of the invention is the provision of means to discharge compressed air or the like with the sealing liquid referred to as delivered to the plunger, the expansion of the discharged air preventing the column of liquid coming to a complete rest during the downward movement of the plunger, the air bubbles throughout the column of liquid also forming an advantageous air cushion on the ascent of the pump plunger.

In order to enable those skilled in this art to fully understand the invention both from structural and functional standpoints, in the accompanying drawing forming a part of this specification, I have illustrated a present, desirable and preferred embodiment of the invention and in the views of this drawing like reference characters have been employed to designate the same parts of the structure.

In this drawing:

The figure is a central vertical section through the top portion of the pump showing its plunger rod associated with a supplemental pump.

Referring to such drawing, it will be perceived that the pump includes a round cylinder or casing 11.

Such cylinder is desirably made of seamless drawn tubing, reamed and polished to a fine high finish, so that the leather packing referred to hereinafter will not wear unduly under the enormous pressure under which the pump functions.

The pump includes a plunger characterized as a whole by numeral 14 having an intermediate section 15 of large diameter slightly less than the internal diameter of the cylinder, an upper reduced diameter portion 16, and a lower part 17 also of less diameter.

A tubular rod 18, conveniently of seamless drawn tubing, is screwed into the hollow threaded interior of the upper portion 16 of the plunger, and the chamber therein with which it communicates is connected by a plurality of passages 19, 21 with a groove 22 around the exterior of the portion 17 of the plunger, the rod 18 being joined at its upper end with a pump 20 adapted to force down through it any suitable cleaning liquid charged with air or the like.

In case oil is pumped by the plunger 14, then such cleaning liquid could be clean oil charged or laden with air bubbles, or, in case the pump is handling an acid, the supplemental liquid could be of a neutralizing character and likewise charged with air or a gas.

In order to be effective in the performance of its intended function, such auxiliary liquid should be pumped or forced down the tu-

bular rod at a pressure greater than that at which the main pump is working.

Channel 22 cooperates with a somewhat wider groove 23 on the inside of a sleeve valve 24 around and movable slightly lengthwise of the plunger section 17, the lower end of the sleeve-valve member having a conical valve surface 25 adapted to coact with a mating or correlated surface 26 on the upper end of a sleeve 27 screwed on to the lower threaded section of the plunger.

A leather or other suitable packing 28 is held on the sleeve-valve element between its enlarged lower end or head 29 and a sleeve 31 screwed on the valve-member 24 and a similar packing 32 is clamped between the part 31 and another holding sleeve 33 screwed on the upper part of the sleeve-valve member 24, all as is clearly shown in the drawing.

Part 24 has a flaring valve face 34 designed and arranged to coact with a companion conical surface 35 of the plunger 14 near the junction of its intermediate and lower sections 15 and 17 respectively.

Thus the valve-member 24, by means of its double packing, has a tight sliding fit in the cylinder and may move longitudinally a small distance relative to the plunger on which it is loosely mounted and these two parts, the plunger and the valve-member, may be considered as conjointly forming a plunger or piston proper, even though these elements are movable a limited distance relative to one another.

A gutter or trough 36 in the upper surface of the part 15 of the plunger connects with a plurality of passages 37, 37 extended downwardly through the full length of the plunger portion 17 being open at their lower ends thereby communicating directly with a larger passage through the threaded sleeve 27.

A hollow follower 38 is screwed on to the sleeve 27 and internally it accommodates an externally-tapered, centrally-apertured, renewable valve-seat member 39 having a seating surface 41 with which a ball-valve 42 cooperates, the latter being housed in a cage or skeleton member 43, which, with the part 39 on which it bears, is held firmly in place by the lower end of the sleeve 27, all as is clearly depicted.

The appliance functions substantially as follows:

On the upward stroke of the plunger, the lower conical end 25 of the sleeve-valve member rests or bears on the sloping surface 26 of the sleeve 27, which, of course, is fixed to and travels with the plunger, the groove 22 being fully uncovered by the channel 23, so that the air-laden sealing-liquid forced down the tube 18 is discharged upwardly between the sleeve-valve member 24 and the plunger section 17 and between the valve faces 34 and 35 into the annular space above the sleeve-valve packing so that abradant-laden liquid which is being pumped by the appliance cannot come into contact with the packing where it would wear the latter and the cylinder-wall.

The larger part 15 of the plunger is desirably externally supplied with circumferential grooves forming riffles to assist in washing the abrasive material from the cylinder wall in advance of the oncoming or approaching packing.

On the downward stroke of the plunger, the displacement of the liquid below it causes the liquid to open and flow by the ball-valve 42, through its cage 32, and through the passages 37 into that portion of the cylinder above the descending plunger.

The friction of the packing against the cylinder wall causes the valve member 24 to move upwardly relatively to the plunger closing the annular port between the valve seats 34 and 35 which will then be in contact with one another, thereby cutting off the delivery of the sealing-liquid above the packing, but permitting it to flow down between the plunger and the loosely encasing valve member and be discharged through the now open port between the valve faces 25 and 26 below the packing where it can clean the cylinder wall of abradant in advance of the downwardly moving packing and thereby prevent any detrimental effect thereof on such packing or the cylinder wall.

As the pressure is small during such downstroke of the plunger only a reduced quantity of cleaning liquid is required at that time and this result is accomplished by so locating the channel 23 in the sleeve-valve member that the annular port 22 will be partly closed when the member 24 is in such position that the faces 34 and 35 are in contact, that is, during the descent of the plunger.

In order to prevent the column of oil or other liquid from coming to absolute or complete rest and to cushion the inertia in effect on the upward stroke, the air or other gas forced down the hollow plunger rod with the sealing cleansing liquid is employed.

The entire pump is so designed that many of its parts may be economically made on an ordinary automatic screw-machine, and all of the threaded parts are straight so that the elements of the construction when assembled will be in desirable absolute alignment.

Many minor mechanical changes may be made in the structure presented without departure from the heart and essence of the invention as defined by the appended claims and without the sacrifice of any of its substantial benefits and advantages.

This patent is a division of my earlier filed patent application, Serial No. 179,830, for Pumps, filed March 31, 1927.

I claim:—

1. In a pump, the combination of a cyl-

inder, a reciprocatory plunger in said cylinder having its intermediate section with a working fit in said cylinder and its upper and lower end portions of reduced diameter, and means to force a sealing fluid between said closely fitting portion of said plunger and its smaller end portions at a pressure greater than that of the fluid which the plunger pumps.

2. In a pump, the combination of a cylinder, a reciprocatory plunger in said cylinder having its intermediate section with a working fit in said cylinder and its upper and lower end portions of reduced diameter, and means to force a sealing fluid alternately between said closely fitting portion of said plunger and one of said reduced diameter parts and between said closely fitting portion and the other reduced diameter part and at a pressure greater than that of the fluid which said plunger pumps.

3. In a pump, the combination of a cylinder, a plunger reciprocatory in said cylinder, means to force a sealing fluid in advance of said plunger in both of its directions of travel and at a pressure greater than that of the fluid pumped by said plunger, and valve means to cause the delivery of said sealing fluid in greater quantity on the up-stroke of the plunger than on its down-stroke.

4. In a pump, the combination of a cylinder, a plunger having a working-fit portion reciprocatory in said cylinder, a hollow plunger-rod connected to and adapted to reciprocate said plunger, means to force a sealing fluid down said plunger-rod and deliver it in advance of the working fit portion of said plunger in said cylinder in both directions of travel of the plunger and valve means to cause such delivery in greater quantity on the up-stroke of the plunger than on its down-stroke.

5. In a pump, the combination of a cylinder, a plunger reciprocatory in said cylinder having a portion with a working fit in said cylinder and a portion having groove means on its outer surface, and means to force a liquid between said portions of said plunger at a pressure greater than that of the fluid pumped by said plunger, said groove means causing riffles in said sealing fluid to assist in cleaning the cylinder wall from abrasive material in advance of the working fit portion of the plunger.

6. In a pump, the combination of a cylinder, a plunger reciprocatory in said cylinder and having a portion with a working fit in said cylinder slidable relatively to the main body of the plunger, means to feed a supplemental fluid to said plunger at a pressure greater than that of the fluid pumped by said plunger, and valve-means actuated by the movements of said portion of the plunger on the main body thereof governing the delivery of said supplemental fluid.

7. In a pump, the combination of a cylinder, a plunger reciprocatory in said cylinder and having a portion with a working fit in said cylinder slidable relatively to the main body of the plunger, means to feed a supplemental fluid to said cylinder in advance of said plunger in both of its directions of travel and at a pressure greater than that of the fluid pumped by said plunger, and valve-means actuated by the relative movements of said portion of the plunger and its main body to effect such delivery of said supplemental fluid alternately at opposite sides of the plunger.

8. In a pump, the combination of a cylinder, a plunger reciprocatory in said cylinder and having a portion with a working fit in said cylinder slidable relatively to the main body of the plunger, means to feed a supplemental fluid to said cylinder in advance of said plunger in both of its directions of travel and at a pressure greater than that of the fluid pumped by said plunger, and valve-means actuated by the relative movements of said portion of the plunger and its main body to effect such delivery of said supplemental fluid alternately at opposite sides of the plunger and in greater quantity at one side of the plunger than at the other side.

9. In a pump, the combination of a cylinder, a plunger having a liquid passage therethrough reciprocatory in said cylinder, a valve controlling said plunger passage, means to force a supplemental fluid into said cylinder in advance of said plunger, valve-means governing the delivery of said supplemental fluid, and means for operating said valve-means by the resistance offered to the pumped liquid through said passage in one direction.

In witness whereof I have hereunto set my hand.

IRA A. WEAVER.