E. C. CRITCHLOW.

PUMP PLUNGER.

APPLICATION FILED JULY 11, 1921.

1,423,197. Patented July 18, 1922.

Fig. 1

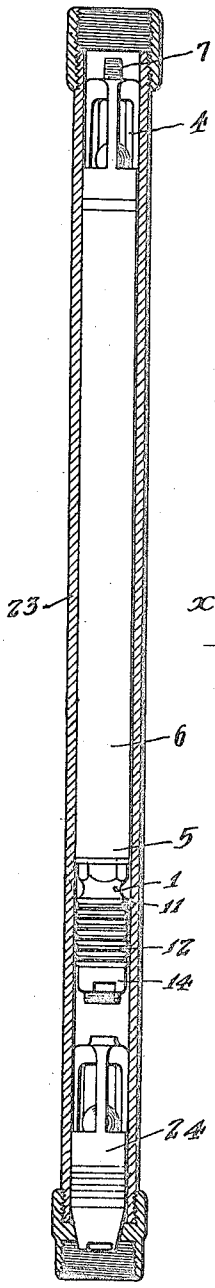


Fig. 2

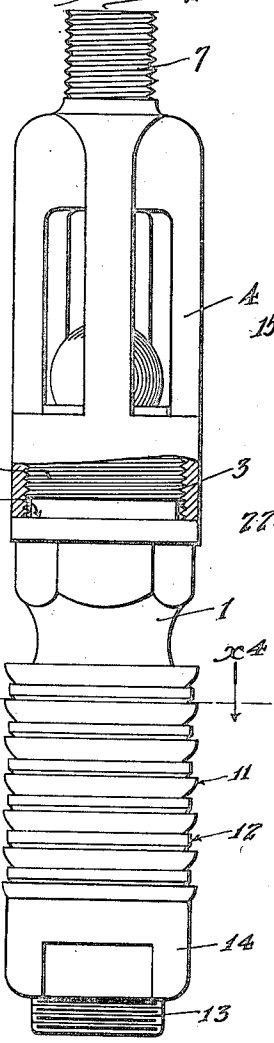


Fig. 3

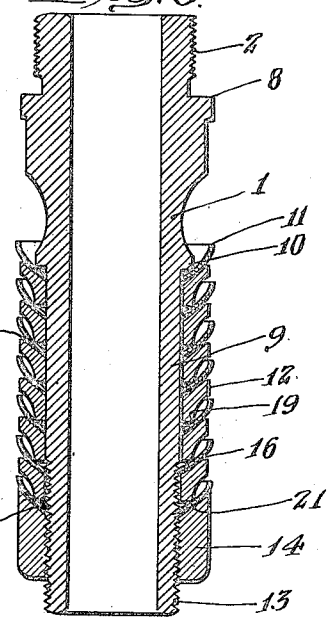


Fig. 5

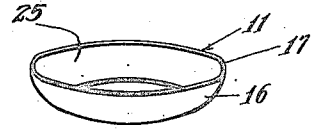


Fig. 6

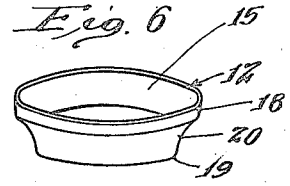
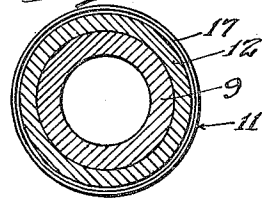


Fig. 4



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PUMP PLUNGER.

1,423,197. Specification of Letters Patent. Patented July 18, 1922.

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To all whom it may concern:

Be it known that I, EDWARD COE CRITCHLOW, a citizen of the United States, and a resident of Orcutt, in the county of Santa Barbara and State of California, have invented certain new and useful Improvements in Pump Plungers, of which the following is a specification.

This invention relates to a plunger of the type employed, for example, in oil pumps, and an object of the invention is to provide improved packing for the plunger.

Another object is to prevent the passing of sand past the packing, the sand in passing producing scouring and cutting of the walls of the working barrel, as well as destruction of the plunger packing.

Another object is to provide a metal packing, expansible by the weight of the superposed column of liquid on the upstroke of the plunger, so as to preclude leakage of liquid past the packing and cutting by sand.

The invention may be applied as an attachment to the ordinary plunger or may be connected directly with a discharge valve cage.

The accompanying drawings illustrate the invention:

Figure 1 is an elevation of a plunger made in accordance with the provisions of this invention as it appears applied to the lower end of an ordinary tubular pump plunger of the type in common use. Both plungers are shown in position inside of a working barrel which is represented in section, and the working barrel is provided at its lower end with a standing valve.

Figure 2 is a side elevation of the plunger connected with a discharge valve cage, which is shown partly in section.

Figure 3 is a sectional elevation of the newly invented plunger.

Figure 4 is a plan section on the line indicated by x^4—x^4, Figure 2.

Figure 5 is a perspective view of one of the spring metal packing cups.

Figure 6 is a perspective view of one of the cup-spacing rings.

There is provided a tubular member 1 having screw threads 2 at its upper end for connection with the screw threads 3 of a discharge valve cage 4, as in Figure 2, or with the screw threads 5 at the lower end of an ordinary tubular pump plunger 6, as shown in Figure 1. In Figure 1 the discharge valve cage 4 is shown connected with the upper end of the plunger 6. The valve cage 4 is provided with suitable means, in this instance screw threads 7, whereby it may be connected with a sucker line, not shown. Neither the plunger 6 nor valve cage 4 is involved in the present invention, and they are shown to make clear how the invention may be used.

The member 1 is provided with a shoulder 8 adapted to seat against one end of the valve cage 4 or plunger 6, as the case may be. The tubular member is provided with an exteriorly reduced portion 9 extending from one end of said member to an annular terminating shoulder 10. Loosely fitting on the reduced portion 9 is a series of annular spring metal packing cups 11 spaced from one another by cup rings 12, the cups 11 and cup rings 12 being alternately positioned when they are being assembled on the tubular member 1. The reduced portion 9 is provided with screw threads 13 engaged by a nut 14 which is applied to the tubular member 1 to hold the cups and cup rings in place on said tubular member.

Preferably the cup rings 12 have internally beveled faces 15 against which the outer convex faces 16 of the packing cups seat. Because of the comparative thinness of the metal of which the cups 11 are made, the rims of the cups are comparatively sharp, as indicated at 17.

The rings 12 have a portion 18 of slightly less external diameter than the external diameter of the cups 11, and the rings are provided with portions 19 externally reduced in diameter, the faces between the portions 18, 19, in this instance, being externally concave, as indicated at 20. The inside faces 25 of the cups 11 are concave, and thus the outer portions of the cups 11 are spaced from the rings 12 so as to permit the fluid being lifted to enter the cups 11 and exert an expanding pressure on said cups. It will be clear from Figure 3 of the drawings that the junction of the concave faces 20 with the ends of the rings produces only annular line contacts 21 between the inner face of each of the cups 11 and the associated ring 12. The nut 14 is also provided with an internally beveled face 22 to receive the outer face of the adjacent cup 11.

The packing cups 11 will be formed out of any suitable thin sheet metal and the metal, either before or after being formed, will be treated in a manner to give resilient charac-

teristics to the cups. It will be understood that when the cups and rings are assembled in place the cups, owing to their shape, will be comparatively stiff and will not readily bend, but when the plunger is installed in the working barrel 23 of the pump and the pump is located many feet below the surface of the earth beneath a column of liquid, the extremely high pressure produced by the superposed column of liquid causes slight expansion of the rims of the cups 11 so as to make said cups fit snugly against the inner surface of the working barrel 23. This is especially true on the upstroke of the plunger; and on the downstroke, the pressure being relieved somewhat, the cups do not bear so hard against the working barrel, and consequently wear is minimized. Because of the very close fit of the cups in the working barrel, during the upstroke of the plunger, sand cannot pass between the cups and the working barrel so as to scour and cut the cups, the working barrel, and the outer face of the ordinary plunger 6, if such plunger should be employed.

In Figure 1 of the drawings the working barrel 23 is shown provided at its lower end with a standing valve cage 24. It is obvious that pumping may be effected with the construction shown in Figure 1 of the drawings by reciprocating the plungers and that, if desired, the plunger 6 may be eliminated and the assembly shown in Figure 2 installed in the working barrel 23 and operated to effect the pumping. It is believed to be clear without further illustration that an ordinary piece of pipe may be substituted for the ordinary plunger 6 for connecting the tubular member 1 with the valve cage 4, thus eliminating a machining operation which is necessary in the manufacture of the plunger 6.

The advantage of the construction above described will be more readily understood when it is considered that in the pumping of oil and other fluids from deep wells, sand, shale and other sedimentary material, suspended in the fluid, tend to work in between the working barrel and the traveling plunger or cup valve, as the case may be, thus soon wearing the contacting surfaces. Such wear necessitates frequent renewal of the working barrel and the traveling plunger or cup valve.

By my construction, the sand and other sedimentary material in the liquid being pumped are prevented from passing between the packing and the working barrel, and such sand and other sedimentary material are pushed ahead by the cups 11. Wear is compensated for over an extended period of time by expansion of the cups by pressure of the superposed column of liquid.

It will be understood that the packing cups 11 and rings 12 may form a single series, as shown in the drawings, or that, if desired, several series thereof may be used inside of the working barrel, and that the different series may be spaced from one another.

As an example of the amount of pressure exerted on the cups to expand the same, it may be assumed that the pump is positioned at a depth of three thousand feet. At this depth there is approximately a pressure of one thousand pounds per square inch on the cups, and under this enormous pressure the cups readily expand into intimate contact with the smooth inner surface of the working barrel, so that the finest sand cannot pass between the cups and the working barrel.

The rims of the cups are of greater diameter than any other portion thereof, thus minimizing the area of contact of the cups with the working barrel 23. This has the two-fold advantage of reducing the friction and effecting a very close fit of the cups in the working barrel.

I claim:

In a pump plunger, the combination of a tubular member, spring metal packing cups on the tubular member, the greatest diameter of said cups being only at their rims, said cups being concave interiorly and convex exteriorly, spacing rings between adjacent packing cups and of less diameter than said cups, said rings having internal beveled faces engaging the outer faces of the cups and said rings having portions of externally reduced diameter engaging the inner faces of the cups, there being only annular line contact between the inner faces of the cups and the outer faces of the rings and there being spaces between the cups and rings for the entrance of liquid to the cups, and means to hold the cups and rings in place.

Signed at Orcutt, California, this 29th day of June, 1921.

EDWARD COE CRITCHLOW.

Witnesses:
WILLIAM R. RYAN,
MARGARET E. WALKER.