PACKING FOR FLUID PUMP PISTONS.
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Packing for Fluid-Pump Pistons.


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To all whom it may concern:

Be it known that I, EDMUND J. FEENY, a citizen of the United States, and a resident of Ottawa, in the county of LaSalle and State of Illinois, have invented certain new and useful Improvements in Packing for Fluid-Pump Pistons; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in pumps of that class designed more especially for pumping a fluid containing a greater or less percentage of solid or gritty substances—such, for instance, as crude oil mixed with sand or crushed stone and in the condition in which it leaves the oil-well.

Among the objects of the invention is to provide a novel construction of the pump piston or plunger so constructed as to afford an efficient packing between the same and the pump-cylinder and at the same time so arranged as to minimize the wear of the cylinder and piston by reason of the presence of solid or gritty substances in the fluid being pumped.

In my prior application for United States Letters Patent, Serial No. 251,245, I have shown a pump of this character wherein the pump-plunger fits closely within the cylinder and means are provided for forcing a fluid under pressure against the inner surface of the cylinder in advance and during the working stroke of the piston so as to wash away solid or gritty substances clinging to the inner surface of the cylinder during the working stroke of said piston, and thereby prevent entrance of such gritty substance between the piston and cylinder and wear upon said parts incident to thereto. In the above-mentioned construction the cleaning fluid, which is projected against the wall of the cylinder in advance of the piston, is a fluid free from grit or solid substances. In another application filed on the same date, Serial No. 251,244, I have shown a construction wherein the piston does not fit closely within the cylinder and means are provided for forcibly ejecting a stream of fluid in advance of the piston during the working stroke thereof across the annular space between the piston and cylinder at such speed as to provide an effectual fluid packing between said parts. In the latter construction the fluid relied upon for packing the piston may be the fluid being pumped, a portion of said fluid being diverted from the discharge-pipe for that purpose and directed to the piston, as set forth in said application.

The present construction embodies in a measure a combination of the operative parts shown in my prior application, the piston being so constructed that the contact of the piston with the cylinder is relied upon principally to effect the packing of the piston during the working stroke thereof and operate to direct a fluid under pressure against the inner surface of the cylinder to wash away the grit from the cylinder in advance of the piston during its working stroke. At the same time the fluid so delivered under pressure to the piston may act to pack any spaces or leakages between the cylinder and piston or in the piston itself and to that extent operate in the manner of the construction set forth in the second application referred to. In the present construction the effective packing element of the piston is so formed as to be expandable and contractible, it being designed to be expanded against the inner cylindrical surface of the cylinder during the working stroke and to be collapsed out of contact with the cylinder during its inoperative stroke. The said packing element of the piston is expanded by the force of the jet of fluid delivered thereto under pressure and also by the weight of the column of liquid which the piston is lifting or moving when by reason of imperfect fitting of the parts of the packing element of the piston relatively to each other or to the cylinder the fluid delivered under pressure to the piston acts to fluid-pack the spaces or openings in the piston or between the piston and cylinder.

As shown in the drawings, Figure 1 is a vertical section, partly broken away, of a pump embodying my invention. Fig. 2 is a cross-section taken on line 2 2 of Fig. 1. Fig. 3 illustrates the expansible and contractible packing element of my improved piston.
Fig. 4 is a detail, on larger scale, illustrating the construction of the piston and the relation of the piston to the cylinder.

As shown in the drawings, A designates the pump cylinder or barrel, and B the piston, of a lifting-pump.

A' designates the discharge-tube of the pump, which, as herein shown, is made of the same diameter as the cylinder, and A' designates a discharge-spout leading therefrom. Said discharge tube and spout have screw-threaded connection with a tubular fitting A", located at or near the level at which the liquid is to be discharged.

B' designates a pump-rod which extends upwardly through the discharge-tube A', the fitting A", and through a stuffing-box a at the upper end of said tubular fitting. The cylinder is shown as closed at its lower end by a screw-threaded plug B", provided with an opening that is controlled by a gravity-acting downwardly-closing check-valve B".

The piston B is shown as made of two principal parts, it comprising a spider-like top b, and a cylindric lower part b', which fits loosely in said cylinder. The pump-rod B' is hollow and communicates with said passage b' through an opening in the top of the upper part of the piston, and said hollow pump-rod constitutes a conduit through which is forced a fluid that acts to expand the packing element of the piston B in a manner hereinafter to be described and to also fluid-pack any leakages in the piston or between the same and the cylinder. Said lower end of the cylinder is provided with an axial opening b' which is controlled by a downwardly-closing check-valve b" and through which opening liquid passes from the part of the cylinder below the piston to the part thereof above the piston during the down or inoperative stroke of the pump. Said lower part b' of the piston is provided also with an upwardly-opening annular recess b", which receives and has screw-threaded connection with a tubular extension b's of the upper part of the piston, whereby said parts of the piston are connected together.

The annular expansible and contractible packing element of the piston may be varied in its construction and is herein shown as made of metal and is divided into three curved segments B", which rest in sockets formed in the upper curved margins of the lower part b' of the piston and are adapted to swing outwardly at their upper curved margins against the cylindric inner face of the cylinder and also to swing inwardly out of contact with said cylinder. The hinge connection of the segments B" with the upper margin of the lower section of the piston comprises curved ribs b's at the lower ends of the segments, which rest in correspondingly-shaped sockets in said upper margin of the lower section of the piston, as more clearly shown in Fig. 4. The packing-segments are overlapped upon each other at their side margins along oblique lines of contact, as shown in Fig. 3, so as to permit the same to be freely expanded to constitute at their upper or packing margins an annular packing-surface in contact with the cylinder. If the parts of the expansible and contractible packing-segments of the piston do not fit together or fit against the inner surface of the pump-cylinder with such accuracy as to avoid the passage of the liquid being pumped therethrough, the fluid which is discharged into the interior of the piston for the purpose of spreading the packing-segments outwardly will be forced over or across said openings at such speed as to effectively fluid-pack the same. Said packing-segments are made widest at their lower ends and taper toward their upper ends, as clearly shown in Fig. 4, and the spider-like arms b of the upper section of the piston are obliquely cut away at their sides to receive the inner oblique sides of said packing-segments.

In the type of pump herein shown the working stroke of the piston is its upward stroke, and during such working or lifting stroke fluid is admitted to the piston B through the rod B' and the passages b' of the upper section of the piston inside the segmental packing members, with the result of forcing the same outwardly into packing engagement with the cylinder. The weight of the liquid column being lifted by the piston also aids to hold the packing-segments outwardly after they have been expanded by the force of the liquid delivered through the hollow pump-rod b'. In the construction of the packing element of the piston herein shown the joints between the segments are not so close as to prevent leakage between the same. Moreover, the upper margins of the segments may wear to such extent as to permit slight leakage between the same. In case such leakage occurs the fluid delivered through the hollow pump-rod into the piston is discharged against or over the leak-openings as to pack the same against the backward passage of liquid being pumped. When the lower end of the cylinder is provided with the downwardly-closing check-valve B" shown, said check-valve is opened during the working stroke of the piston to permit the fluid being pumped to enter the lower end of the cylinder. On the next downward stroke of the piston the fluid in the lower end of the cylinder is transferred through the valve-opening b'', controlled by the check-valve b', to the space in the cylinder above the piston. During such down or inoperative stroke of the piston the packing-segments are swung inwardly to their inner...
most position, as shown in full lines in Fig. 4, so as to have no contact with the inner surface of the cylinder, with a consequent absence of wear during such stroke.

The means for furnishing the supply of fluid under pressure for the purpose of packing the piston in the manner described are made as follows: C designates a cylinder located, as herein shown, above the discharge-spout A

of the pump and in alignment with the pump discharge-tube. Said cylinder is open at its lower end and closed at its upper end. Located within said cylinder C is a piston C' of any suitable construction, and said piston is attached to the pump-rod B', which extends upwardly into said cylinder. C' designates a continuation of the pump-rod, which is adapted to be operatively connected with the pump-operating mechanism and extends through a stuffing-box e in the upper end or head of the cylinder C. As herein shown, said rod or extension is provided at its lower end with an axial screw-threaded socket and the upper end of the hollow rod B' is screw-threaded to enter said socket, whereby said parts are attached together. In this instance the piston C' of the upper cylinder is confined between a shoulder or collar b\(b^{n}\) on the pump-rod and the lower end of the socket-extended extension-rod C'. The hollow pump-rod B' is provided above the piston C' of the cylinder C with a plurality of apertures b\(b^{n}\), through which fluid may pass from the cylinder downwardly through said hollow pump-rod to the piston or plunger B of the pumping cylinder or barrel. The lower end of said extension-rod C' is also provided with apertures c\(c^{n}\) in line with the apertures b\(b^{n}\) whereby a fluid may pass from the cylinder C above the piston C' into the pump-rod B' for the purpose set forth. Fluid is supplied to the upper part of the cylinder C from a tank D through the medium of a passage d, provided with an outwardly-opening check-valve d'.

The operation of this feature of the invention is as follows: During the downward stroke of the pump-rod B' both pistons B and C', carried thereby, move downwardly, and the partial vacuum thereby produced in the upper end of the cylinder C permits the valve d' to open and fluid to pass from the tank D into the upper end of the cylinder C. During the upward or lifting stroke of the piston B and at which time also the piston C' is moved upwardly the check-valve d' is closed and the fluid in the cylinder C is forced through the openings c\(c^{n}\) b\(b^{n}\), before referred to, through the pump-rod B' and thence to the piston B and acts upon said piston in the manner before described to pack the pump-piston.

I claim as my invention—

1. In a pump, the combination with the pump cylinder or barrel and its piston, the latter including an annular expandable and contractible packing member, of means acting during the working stroke of the piston for forcibly delivering a fluid to said piston to expand the packing member outwardly against the inner surface of the cylinder.

2. In a pump, the combination with the pump cylinder or barrel and its piston, the latter including an annular expandable and contractible packing member, of means acting during the working stroke of the piston for forcibly delivering a fluid to said piston to expand the packing member outwardly against the inner cylindrical surface of the pump-cylinder, said packing member and piston being so constructed that fluid under pressure is directed also against the inner wall of the cylinder in advance of the piston.

3. In a pump, the combination with a pump cylinder or barrel and its piston, said piston including a packing element consisting of a plurality of segmental packing-sections having overlapping engagement at their margins, and means acting during the working stroke of the piston for delivering liquid under pressure to the pump-piston to force outwardly the packing-segments against the inner face of said cylinder.

4. In a pump, the combination with the cylinder or barrel thereof and its piston, said piston including a packing element embracing a plurality of segmental packing-sections which are hinged to the body of the piston to swing toward and from the inner wall of the pump-cylinder, of means for delivering a fluid under pressure to the piston, within said packing-segments, to force the same outwardly against the wall of the cylinder, said fluid being delivered to fluid-pack leakage-openings between the packing-segments.

5. In a pump, the combination with the pump cylinder or barrel and its piston, the latter including an annular packing member which is expandable and contractible, of a hollow pump-rod communicating at its lower end with said piston and at its upper end with a source supplying a fluid.

6. In a pump, the combination with the pump cylinder or barrel and its piston, the latter including an annular packing member which is expandable and contractible, of a hollow pump-rod communicating at its lower end with said piston, a second cylinder through which the upper end of the pump-rod extends, a piston in said latter cylinder fixed to said pump-rod, said pump-rod being provided within the upper cylinder above its piston with a plurality of openings, and means for delivering a fluid to the said last-mentioned cylinder above its piston.

7. In a pump, the combination with the pump cylinder or barrel and its piston, the latter including an annular packing member which is expandable and contractible, of a hollow pump-rod communicating at its lower
end with said piston, a second cylinder through which the upper end of the pump-rod extends, a piston in said latter cylinder fixed to said pump-rod, said pump-rod being provided within the upper cylinder above its piston with a plurality of openings, a fluid receptacle connected by a passage with the upper end of said upper cylinder, and an outwardly-opening check-valve in said passage.

In testimony that I claim the foregoing as to my invention I affix my signature, in presence of two witnesses, this 24th day of June, A. D. 1905.

EDMUND J. FEENY.

Witnesses:
FRED W. WIDMER,
M. O'BRIEN.