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PUMP LINER

George W. Walton, Dallas, Tex.

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6 Claims. (Cl. 309-3)

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This invention relates to new and useful improvements in pump liners.

The invention has to do with pump liners, particularly those used in slush pumps or pumps handling liquids carrying more or less abrasive matter in suspension; however, the invention is not limited to such use.

It has been customary to make these liners removable so that when worn, they may be replaced. It has also been the practice to provide packings at the end portions of such liners. However, such packings have been of the so-called compression type wherein a packing of rubber or elastic composition, is deformed into the entire packing space until it becomes a substantially dead mass, having little or no elasticity or "life" when in place. Under such conditions, the liner is normally held against longitudinal movement, but there is no positive means for maintaining the liner fixed against endwise play. It is therefore one object of the invention to overcome these objections.

An important object of the invention is to provide an improved pump cylinder having one or more liners arranged so that each liner has spaced metal to metal contacts with relative fixed abutments and while employing packings, is not dependent upon such packings to hold the liner against endwise play.

A particular object of the invention is to employ liners which, while positively held against endwise movement during the strokes of the pump piston or plunger, are capable of being longitudinally adjusted to compensate abutment and flange wear, in combination with fluid-pressure sealing packings which function independently of the means holding the liners against endwise movement.

Another object of the invention is to provide a pump liner packing including an elastic packing, preferably circular in cross-section and retained in a recess between walls so that the packing is slightly deformed radially, but is free to undergo lateral deformation when subjected to fluid pressure, whereby the packing retains a major portion of its elasticity or "life" when in place.

A further object of the invention is to provide a liner of the double sleeve type wherein one end of a sleeve engages a relatively fixed abutment and the opposite end of the other sleeve engages a fixed abutment, with provision, whereby the sleeves may be longitudinally adjusted to compensate wear and with fluid-pressure sealing members contacting the sleeves, thus compensat-

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ing endwise wear and more efficiently packing off the sleeves.

A construction designed to carry out the invention will be hereinafter described together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, wherein examples of the invention are shown, and wherein:

Fig. 1 is a partial, longitudinal sectional view of a reciprocating pump, showing a liner constructed in accordance with the invention,

Fig. 2 is a partial, longitudinal sectional view of a portion of a pump cylinder and liner showing another form of the invention,

Fig. 3 is a view, similar to Fig. 2, of still another form, and

Fig. 4 is an enlarged, sectional view of the double liner packing shown in Fig. 1.

In the drawings, the numeral 10 designates a pump cylinder which has a cylindrical bore 11 and a hollow head 12 at one end, as is shown in Fig. 1. An inwardly-directed annular flange 13 separates one end of the bore from the interior of the head; however, this flange may be omitted. The bore 11 has a counterbore 14 and an annular internal shoulder 15 adjacent its opposite end. Between the flange 13 and the shoulder 15, a circumferential relief sump or recess 16 is formed in the main bore 11. Since the width of the recess is equal to a major portion of the length of the bore 11, said bore has only relatively narrow supporting surfaces adjacent the flange and shoulder.

An outer cylindrical liner 17 is fitted snugly in the bore 11 of the cylinder and has an inwardly-directed annular lip 18 at its inner end spaced from the flange 13. The outer liner has a cylindrical bore 19, an annular shoulder 20 and a counter-bore 21 adjacent the counterbore 14 and shoulder 15 of the cylinder.

An external cylindrical boss 22, fitting snugly in the counterbore 14 and abutting the shoulder 15, is formed on the liner 17 in surrounding relation to its counterbore 21. The counterbore 14 of the cylinder is extended into an outer head 23, through which the outer liner 17 may be inserted into the cylinder and removed therefrom.

An inner cylindrical liner 24 is snugly fitted in the liner 17 with its inner end abutting the lip 18 and its bore 25 substantially flush with the inner circumferential face of said lip. The usual pump plunger or piston 26, reciprocates in the bore 25. A follower ring or cage 27 has a snug-

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sliding fit in the counterbore 14 of the cylinder. The ring abuts the outer end of the inner liner 24 so as to hold said inner liner against the lip 18, whereby the boss 22 of the outer liner 17 is held against the shoulder 15.

A narrow annular flange 28, extending laterally from the inner side of the follower ring 27, has a sliding fit in the counterbore 21, but only extends therein a short distance. It will be observed that while the liners are normally securely held against endwise movement, the inner end of the outer liner 17 is spaced from the flange 13 and the outer end of said liner is spaced from the ring 27; thus, the end thrust of the outer liner is taken by the shoulder 15, in one direction, and in the opposite direction, by the engagement of the lip 18 with the inner end of the inner liner 24. The inner liner is held against endwise movement in either direction by its engagement with the lip 18 and the ring 27. It is pointed out that the liners have a metal to metal contact with the elements 15, 18 and 27, which form relatively fixed abutments, thus, positively holding the liners against endwise movement during the piston strokes. The follower ring is held in place by a hollow cap or closure plate 29, fastened on the head 23, by bolts 30. The inner side of the cap is reduced to fit in an annular seat 31 in the outer face of the ring 27 and a metallic gasket 32 is confined in the counterbore 14 between the ring and the cap.

An important feature of the invention resides in fluid-pressure sealing packings surrounding the liner. Adjacent the lip 18, the outer liner 17 is formed with an external, circumferential recess 33, while the boss 22 is formed with a pair of spaced external, circumferential recesses 34. These recesses each have the same general cross-sectional shape, as is shown in Fig. 4. Each recess has its inner side 35 inclined or flared outwardly. Elastic packing ring or members 36 and 37 are confined in the recesses 33 and 34, respectively. These rings are preferably solid, being circular in cross-section and formed of synthetic rubber or some other suitable elastic composition.

The ring 36 resting on the bottom of its recess 33 engages the bore 11 of the cylinder 10. The thickness of the ring annulus is such that when said ring is in place, said annulus will be slightly deformed and thus in intimate contact with the bottom of the recess and the bore of the cylinder. This arrangement prevents a pressure fluid from transversely by-passing the ring. Since the ring 36 is subjected to pressure fluid from the inner end of the cylinder, such pressure fluid will act to force the ring against the inclined side 35 of the recess, whereby it will be further deformed and an effective seal provided. With respect to the rings 37, the arrangement and action is similar, except that a seal is provided for pressure fluids acting from each side of the boss 22; said rings sealing in the counterbore 14.

The inner liner 24 has an external, circumferential recess 38 and an elastic packing ring or member 39 therein at its inner end, similar to the elements 33, 34, 36 and 37. At the opposite end of the inner liner, an external, circumferential groove 40 is formed and a metallic spacer ring 41 is seated in this groove. The ring 41 projects outwardly from the outer surface of the inner liner and has sides 35', inclined or flared, so as to produce the same configuration as the inclined sides 35 and to provide recesses 34' on each side of the spacer ring, similar to the recesses 34. The recesses 34' are preferably located in radial align-

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ment to the recesses 34. Packing members or rings 42 are confined in the recesses 34' within the counterbore 21 and are elastic and act like the rings 37.

Since wear or imperfect structure may cause a leak past the packing rings, a tell-tale is provided. In the outer circumferential surface of the spacer ring 41, a circumferential sump 43 is formed and a similar sump 44 is formed in the outer surface of the wall or abutment 45, separating the recesses 34 (Fig. 4). These sumps are connected by a small radial duct 46 in the liner 17 and abutment 45. A port 47 in the cylinder wall is aligned with the duct and communicates with the sump 44. A bleeder nozzle 48 is countersunk in the cylinder wall at the port. If there should be a leak from the inner or outer packings, the presence of oil at the nozzle will so indicate. It is pointed out that the ring 41 and abutment 43 perform identical functions so as to be equivalents and merely represent different constructions for accomplishing the same result.

The form of the invention shown in Fig. 2 is quite similar to Fig. 1. Instead of the separate spacer ring 41, an integral rib or ring 49 is employed and this rib is substantially identical to the abutment 45. If desired, a metallic gasket 50 may be interposed between the boss 22 and the shoulder 15 of the cylinder. The counterbore 21 and the flange 28 are omitted while the packings are substantially the same.

Fig. 3 shows a single liner 51, similar to the outer liner 17, in that it has an external packing recess 52 with an elastic member or ring 53 therein at its inner end and a circumferential boss 54 at its outer end. The flared sides 35 are omitted from the recess 52. An abutment or stop ring 55 partially embedded in a circumferential groove 56 in the liner, fits in the counterbore 14 of the cylinder and abuts the shoulder 15. A spacer ring 57, rectangular in cross-section, is partially embedded in a groove 58 in the outer surface of the liner and fits in the counterbore 14. A follower ring 27' having a marginal annular lip 59 which extends into the counterbore 14, bears against the outer end of the liner. The ring 57 is spaced sufficiently from the ring 55 and the lip 59 to provide annular recesses 60 on each side of said ring 57, which receive elastic packing members or rings 61. The port 47 in the cylinder wall communicates with a peripheral sump 62 in the ring 57. While the flared sides 35 are not used, an adequate fluid pressure seal is provided.

It will be observed that in each form the liner is held against endwise movement by a relatively fixed abutment and a metal to metal contact. These structures assure positive holding and any adjustment due to wear or other cause, is accomplished by means of the bolts 30. These bolts have no direct bearing in the packings and said packings function independently of the holding means for the liners. Since the rings 41, 55 and 57 and 141 may be of the split type, the expense of manufacture is reduced.

The foregoing description of the invention is explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:

1. In combination, a pair of cylindrical liners, one fitting in the other in intimate contact there-

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with, an inwardly directed annular lip at the inner end of the outer liner, an annular outwardly directed boss surrounding the outer end of the outer liner, the inner end of the inner liner abutting the lip of the outer liner and the outer end of the inner liner being relatively within the boss of the outer liner, the inner liner having a circumferential recess adjacent the lip, an annular packing in the recess of the inner liner between said liners, and an annular packing between the liners at the outer ends thereof and relatively within the boss of the outer liner, the outer liner being arranged to be mounted in the bore of a pump cylinder.

2. The combination set forth in claim 1, with a pump cylinder having a bore in which the outer liner is snugly fitted, packing between the boss of the outer liner and the cylinder, and packing between the inner end of the outer liner and the cylinder.

3. The combination set forth in claim 1, with a follower ring engaging the outer end of the inner liner and holding said inner liner against the lip, said ring being free of contact with the outer liner.

4. In combination, a pump cylinder having an inner end and an outer end with a bore between said ends, an annular shoulder in the bore nearer the outer end thereof, an outer liner having a circumferential projection having a metal to metal contact with said shoulder, fluid pressure seal packings carried by the liner within the bore of the cylinder at the outer end portion thereof free to undergo deformation in response to a fluid pressure, an inner liner fitting in the outer liner in intimate contact therewith, an annular lip carried by the inner end of the outer liner abutting the inner end of the inner liner, and pressure seal packing between the inner ends of the liners.

5. In combination, a pump cylinder having an inner end and an outer end with a bore between said ends, an annular shoulder in the bore nearer the outer end thereof, an outer liner having a circumferential projection having a metal to metal contact with said shoulder, fluid pressure

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seal packings carried by the outer liner at the outer end portion thereof within the bore of the cylinder free to undergo deformation in response to a fluid pressure, an inner liner within the outer liner in intimate contact therewith, an annular lip carried by the inner end of the outer liner, pressure seal packing between the inner ends of the liners, and holding means engaging the outer end of one of the liners and secured to the cylinder.

6. In combination, a pump cylinder having an inner end and an outer end with a bore between said ends and a counterbore at the outer end thereof, a liner in the bore, a pressure seal packing ring between the inner ends of the liner and the cylinder bore, an annular external boss surrounding the outer end of the liner and disposed in the counterbore of the cylinder having an external annular rigid member with annular ring recesses on each side thereof enclosed within the counterbore of the cylinder, packings surrounding the boss on each side of the annular member and free to undergo expansion, and a follower ring in the counterbore of the cylinder at the outer end of the liner having an annular member engaging the outer end of the liner.

GEORGE W. WALTON.

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