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PACKING FOR LIQUID OXYGEN RECIPROCATING PUMPS

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Fig. 1.

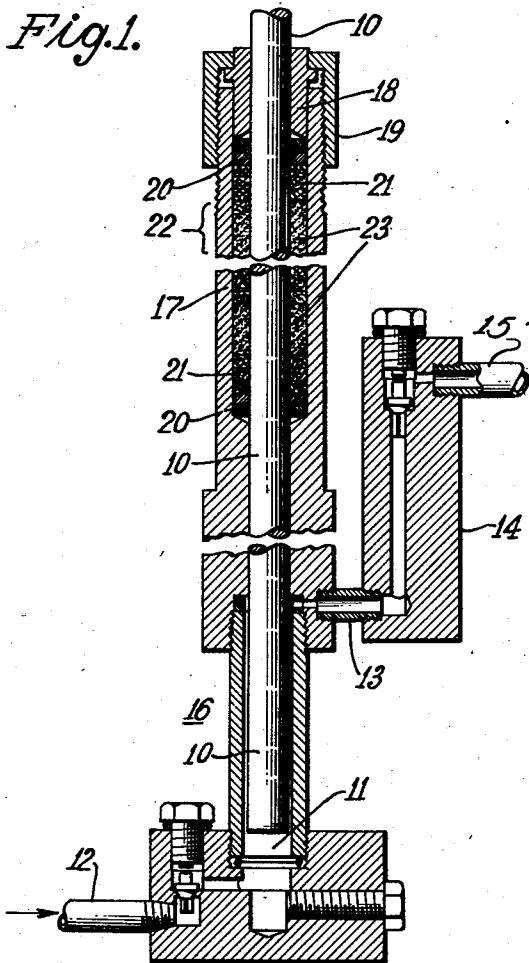


Fig. 2.

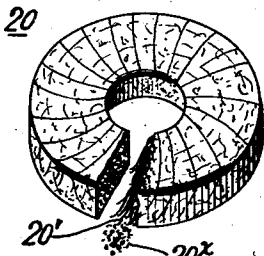


Fig. 4.

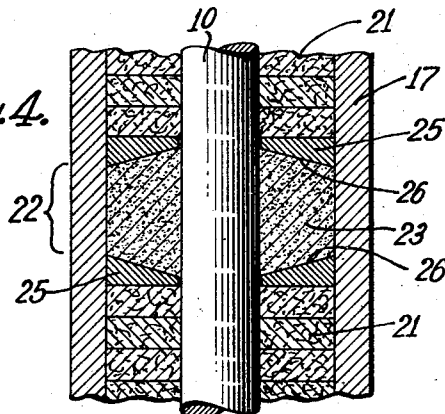
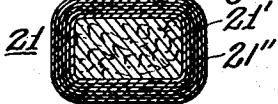


Fig. 3.



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PACKING FOR LIQUID OXYGEN RECIPRO-
CATING PUMPS

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9 Claims. (Cl. 286—31)

This invention relates to packing for reciprocating pumps and more particularly to a packing for a plunger pump adapted for the pumping of liquid oxygen.

The invention has for its object generally the provision of an improved arrangement of packing for pump plungers that has wear-resisting properties and uses a dry comminuted lubricant that is inert to liquid oxygen.

More specifically, the object of the invention is to provide a packing for plunger pumps intended for pumping liquid oxygen that is of a character which is not only wear-resisting but lubricating.

Another object is to provide a suitable comminuted lubricant in concentrated amounts along reciprocating plungers in a manner adapted to provide not only lubricant for the plunger but also a seal where the liquid pumped is of low viscosity, such as liquid oxygen.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

Fig. 1 is a view, partly in section and partly in elevation, showing a plunger pump adapted for pumping liquid oxygen and provided with a packing in accordance with the invention;

Fig. 2 is an enlarged perspective view of a hard packing ring, such as employed in Fig. 1, with part broken away to show the fibrous nature of the filling in the ring;

Fig. 3 is a cross-sectional view of a soft, or asbestos cored, packing ring that is also employed in Fig. 1; and

Fig. 4 is an enlarged fragmentary sectional view showing a modified form of the packing shown in Fig. 1.

Referring now to the drawing, and particularly to Fig. 1, 10 denotes a pump plunger adapted to be reciprocated vertically in a pump chamber 11 in a manner clearing the side walls thereof sufficiently to admit the countercurrent movement of liquid and piston. To this end, the pump chamber 11 has a liquid inlet 12 communicating at its lower end and an outlet 13 communicating with the upper end. The outlet connection 13

leads to a valve block or casing 14, in which there is a gravity controlled outlet valve. The outlet 15 from this casing passes the discharged liquid to receiving means not shown.

The pump cylinder, shown generally at 16, may be constructed in any convenient manner, i. e., it may be made of a bored integral member, or of assembled parts, that shown comprising an arrangement of assembled parts which facilitates manufacture. The cylinder employed has a stuffing box including a relatively long packing sleeve 17 at the upper end which is also relatively large in diameter. In the present arrangement, the sleeve has substantially the same diameter as the pump cylinder and may be regarded as a continuation thereof. By reason of this construction, the annular space for the reception of packing about the upper end of the plunger is relatively wide and extends inwardly a relatively long distance in comparison with that used in plunger pumps for the pumping of ordinary liquids. Here the pump plunger is, of course, also made relatively long so that the end at which power is applied is relatively remote from the end which effects liquid displacement.

The packing in accordance with the invention is of a character that is intended not only to provide a liquid seal but to lubricate the plunger without the employment of hydrocarbons or other lubricants for which oxygen has a chemical affinity. Accordingly, one or more packing rings, such as shown at 20, are introduced into the packing sleeve and disposed in the annular space between the plunger and sleeve. Such rings are conveniently provided in the form of washer-like bodies composed of shreds of compressed inert material, which are both flexible and wear-resisting. Shreds of Babbitt metal or other bearing metal may be cited as examples of suitable materials. In order, however, to reduce the friction of such a ring, a suitable amount of inert solid lubricant in comminuted form is preferably introduced into such ring; for example, flakes of graphite may be dispersed among the metal shreds.

A relatively hard ring of this character is shown in perspective in Fig. 2, with a part broken away in order that free ends of the shreds may be seen, as indicated at 20'. Flakes of graphite, indicated as having dropped out by reason of the break in the ring, are shown at 20x.

While for certain purposes a packing composed entirely of shredded metal packing rings may be sufficient to pack the plunger when pressed into place by means of a gland follower 18 that is slipped over the plunger and held in position by

a threaded nut, such as that at 19, it is preferable to employ in addition one or more soft cored packing rings, as indicated at 21. Such soft cored rings are preferably arranged in groups adjacent the harder packing rings 20; the latter being advantageously positioned at each end of the packing sleeve. A cross-section of a soft packing ring is indicated in Fig. 3, where the ring is indicated as having a soft core 21' of soft fibrous material, such as filaments of asbestos, and an outer envelope 21'' of woven asbestos. The groups of soft cored rings are preferably disposed in mutually spaced relation in the sleeve along the plunger, as indicated in Fig. 1, to provide intervening spaces, as shown at 22. Each of such spaces serves as a reservoir for a filling comprising a quantity of a suitable comminuted solid lubricant 23, for example, flake graphite. This filling of finely divided solid material when introduced is tightly compressed by the pressure of the gland follower 18 while retained by nut 19.

By this arrangement, the one or more reservoirs containing comminuted solid lubricant not only lubricate the plunger as it reciprocates, but also provide at the same time a liquid seal of a very high order by reason of the close adhering nature of the comminuted solid lubricant. The soft packing rings tend, in consequence, to wipe the plunger clean and prevent small quantities of graphite from adhering to the plunger as it reciprocates. In the event that any asbestos fibers or graphite should tend to work loose and adhere to the plunger, the hard cored rings 20 operate to remove them. A relatively clean working plunger, adequately lubricated, is thus provided, without the use of a hydrocarbon or other liquid lubricant for which oxygen may have an affinity.

In the modification shown in Fig. 4, means are provided for more positively demarking the reservoirs, that are to be filled with the comminuted solid lubricant. Here, each group of packing rings that is next to a reservoir has a solid metal separating ring shown at 25, introduced between it and the space to be occupied by the comminuted solid lubricant. Such ring may be of cast iron or steel and preferably has its inner face tapered, as shown at 26, in order that there may be a wedging action on the lubricant, when pressure is applied, which tends to urge the lubricant against the plunger. This wedging action operates to enhance the strength of the liquid seal provided by the comminuted solid lubricant and to insure a positive lubricating effect.

Thus it is seen that the long packing sleeve here provided, together with the long plunger, not only reduces to a very small value the possibility of heat entering the liquid while being pumped, from outside sources, but also makes it possible to use one or more reservoirs of comminuted solid lubricant, such as a flake graphite, to provide a liquid seal of as high an order as may be reasonably required. While a plurality of reservoirs is preferred, one such reservoir may be depended on to reduce the leakage to a substantially negligible amount.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In apparatus having a reciprocating rod or plunger and a packing sleeve, the combination with such sleeve, of a packing therein comprising a plurality of packing rings disposed in at least two groups spaced axially apart, said packing rings each composed of resilient wear-resistant fibers, the space between said groups forming a reservoir of diameter equal to that of said packing rings, finely divided solid lubricating material in said reservoir, and a gland follower secured in the outer end of said sleeve and arranged for applying pressure to said packing.

2. In apparatus having a reciprocating rod or plunger and a packing sleeve, the combination with such sleeve, of a packing therein comprising groups of packing rings contacting said rod, each of which consists of compressed wear-resisting fibers, said groups being spaced axially to provide a reservoir, dry comminuted graphitic material disposed in said reservoir about the plunger, and a gland follower secured in the outer end of said sleeve and arranged to apply pressure to said packing, and through the latter to said material.

3. In apparatus having a reciprocating rod or plunger and a packing sleeve, the combination with such sleeve, of a packing therein comprising intermingled groups of hard packing rings containing metal shreds and soft packing rings containing asbestos fibers, said groups being spaced in said sleeve to provide reservoirs, dry comminuted lubricant disposed to fill each of said reservoirs about the plunger, and a gland follower secured in the outer end of said sleeve for applying pressure to said packing.

4. In apparatus having a reciprocating rod or plunger and a packing sleeve, the combination with such sleeve, of a packing therein comprising a plurality of groups of packing rings of shredded resilient fibers disposed in groups spaced axially at desired intervals in said sleeve, thereby providing a plurality of spaces of diameters equal to that of said packing rings and serving as reservoirs, a mass of relatively finely divided graphite disposed in each of said reservoirs and relatively tightly packed therein, and a gland follower secured at the outer end of said sleeve for applying pressure to said packing.

5. In apparatus having a reciprocating rod or plunger and a packing sleeve, the combination with such sleeve, of a packing therein comprising a plurality of groups of adjacently disposed packing rings, a group at each end of said sleeve comprising rings, each consisting of compressed shredded metal, interposed additional groups comprising rings, each consisting of a core of asbestos fibers and a protecting sheath, said latter groups of packing rings being mutually spaced at one or more points in said sleeve to provide one or more reservoir spaces, fillings of flake graphite in each of said spaces, said fillings being tightly packed and serving as lubricant about said plunger, a gland follower disposed in the outer end of said sleeve and adapted to bear on said packing, and a securing nut engaging said sleeve and holding said follower in place and imparting thereto a desired pressure.

6. In a plunger pump having a cylinder and a plunger working therein and provided with a relatively long packing sleeve closed at its inner end and fitting snugly about the plunger which protrudes therefrom at its outer end, the combination with such sleeve, of a packing therein com-

prising a plurality of groups of adjacently disposed packing rings, a group at each end of said sleeve comprising hard rings, each consisting of compressed shredded metal, interposed additional groups comprising soft rings, each consisting of a core of soft fibers and a protecting sheath, said latter groups of packing rings being spaced at one or more points in said sleeve to provide one or more reservoir spaces, separating rings disposed against the groups of rings at each side of a space forming a reservoir and adapted to provide rigid end walls therefor, fillings of comminuted solid lubricant in the space between each set of separating rings, a gland follower disposed in the outer end of said sleeve, and a securing nut for said sleeve arranged to impart pressure thereto.

7. In apparatus having a reciprocating rod or plunger and a packing sleeve, the combination with such sleeve, of packing therein comprising packing rings contacting said rod disposed in at least two groups spaced axially apart to form an annular reservoir between adjoining groups, there being at least one such ring at each side of said reservoir, said rings being each composed of resilient wear-resistant fibers, finely divided solid lubricating material in said reservoir, and a gland follower secured in the outer end of said sleeve and arranged for applying pressure to said packing, the outer diameter of said reservoir and the arrangement being such that the said material therein is free to be compressed through pressure transmitted from said gland follower.

8. In a stuffing box having a supporting body with an opening and a rod extending outwardly therethrough, the combination of fibrous resilient wear-resistant packing ring means in said opening contacting and spaced apart along said rod and providing an annular reservoir therebetween, finely divided solid lubricating material in said reservoir, and a gland follower fitted in the outer end of said opening and arranged for applying pressure to said packing and through the packing to said finely divided solid lubricating material.

9. In a stuffing box having a supporting body with an opening and a rod extending outwardly therethrough, the combination of fibrous resilient wear-resistant packing ring means in said opening contacting said rod and spaced apart along said rod and providing an annular reservoir therebetween, there being at least one such ring at each side of said reservoir, finely divided graphite lubricating material in said reservoir, and a gland follower fitted in the outer end of said opening and arranged for applying pressure to the outer one of said packing ring means, the outer diameter of said reservoir and the arrangement being such that the pressure from said gland follower is transmitted through said outer one of said packing ring means to the said material in the reservoir.

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