

May 12, 1931.

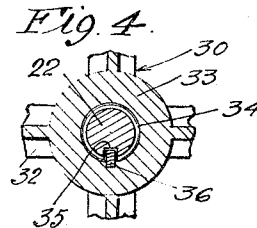
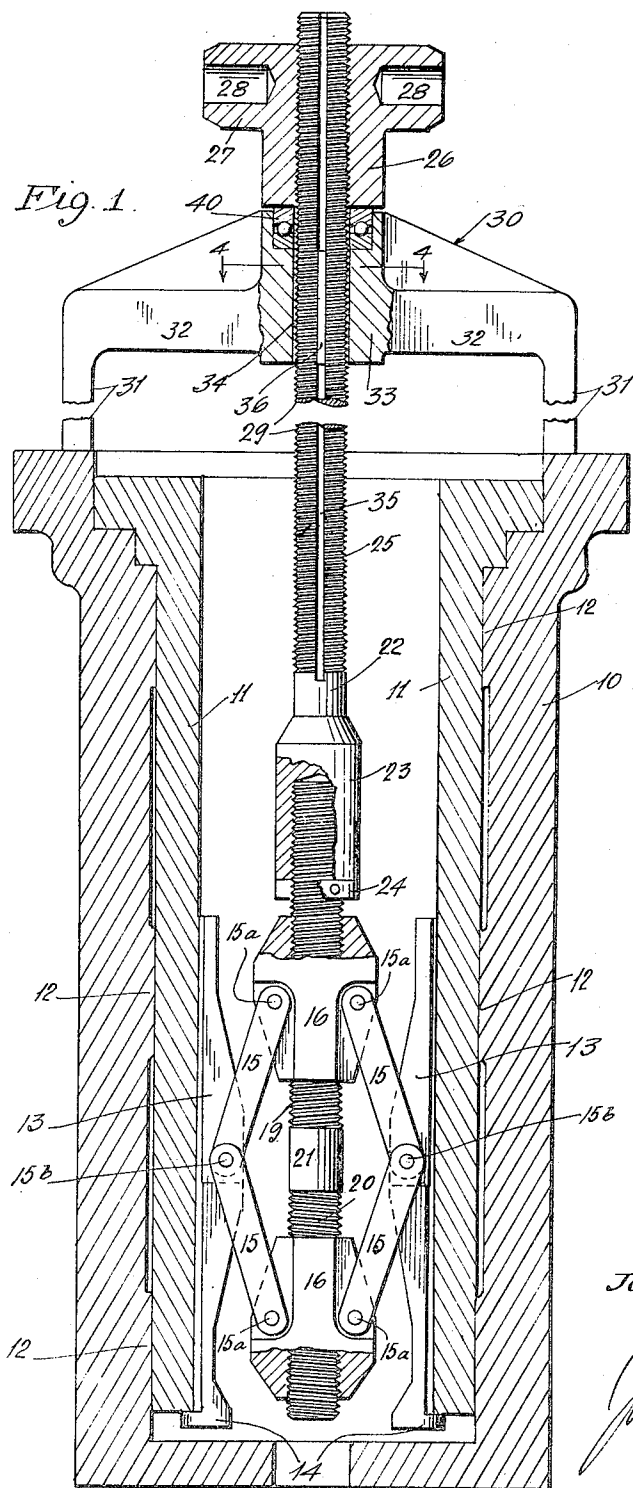
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1,804,843

LINER PULLER

Filed Dec. 14, 1929

2 Sheets-Sheet 1



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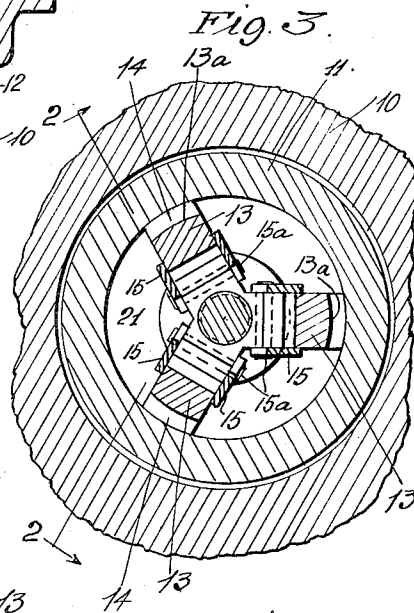
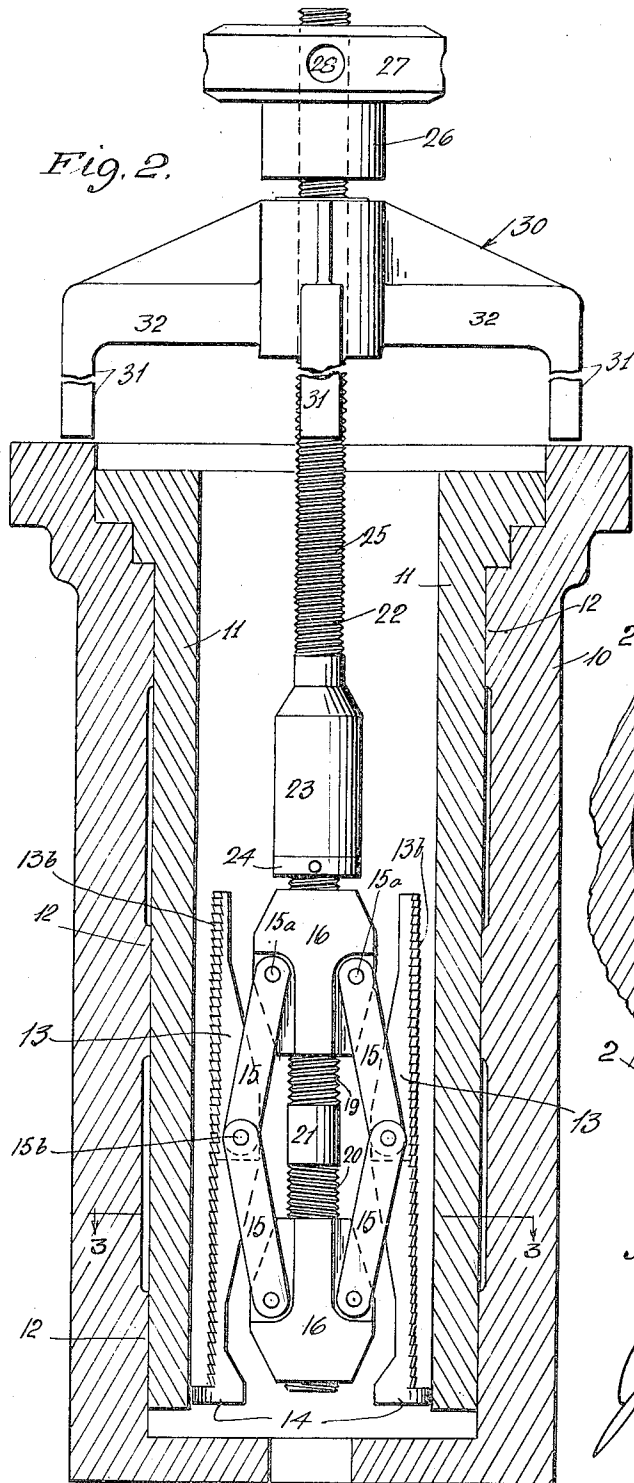
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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LINER PULLER

Application filed December 14, 1929. Serial No. 414,073.

This invention relates to tools and appliances commonly known as liner pullers and whose general function is to engage with and pull a sleeve or liner, such as the liner of a pump cylinder. Although, as will be readily understood, the invention may be used for other specific purposes, its nature and operation are best set out by description of it designed for and applied to the specific purpose of pulling pump liners.

Several difficulties are encountered in pulling pump liners, especially where they have been long in place and perhaps rusted or corroded tightly. Some such liners are comparatively thin-walled, and, if engaged at the inner end only, may tend to buckle or otherwise deform so as to render removal very difficult. And, furthermore, such liners are usually placed in a cylinder casing having a ribbed wall, so that the liner is not in contact with the cylinder casing over its whole exterior surface but is only supported by spaced ribs. If a liner puller is of such a character as to exert localized outward pressure on the inner surface of the liner, the liner may be deformed and pressed outwardly into the spaces between ribs, which again makes the removal very difficult.

It is a general object of this invention to provide a liner puller which obviates these and other difficulties; and to provide a liner puller adjustable to liners of various sizes, and which, properly adjusted and applied to the liner, supports the liner against any possible deformation or collapse and does not exert upon it any localized forces tending to deformation.

In the following detailed description, I set out a preferred and illustrative form of liner puller embodying the invention, and from this detailed description an understanding of the invention itself may be had. It will be understood that the specific form herein set out is merely illustrative of the invention and is not intended to be a limitation upon it except as the invention is definitely limited by the appended claims.

In the drawings

Figure 1 is a view showing a typical cylinder and liner in longitudinal section, and

my liner puller in elevation and section, and in the position applied to the liner ready for the pulling operation.

Fig. 2 is a similar view showing the liner puller in such a position as it assumes on being inserted to or removed from the position of Fig. 1. The longitudinal views of Figs. 1 and 2 are taken on such a line as is indicated by line 2-2 on Fig. 3;

Fig. 3 is a cross-section on line 3-3 of Fig. 2; and

Fig. 4 is a detailed cross-section on line 4-4 of Fig. 1.

In the drawings let 10 designate a typical cylinder and 11 a typical liner therein. The liner is shown supported in the cylinder on annular internal ribs 12. This spaced support of the liner in the cylinder, in some form or other, is prevalent in the use of liners.

The liner puller illustrated and described here comprises a plurality of liner engaging shoes 13, which may be of any suitable number and are here illustrated as three. These shoes are preferably elongate members having their outer liner engaging faces 13a curved to conform at least approximately, and preferably accurately, to the internal curvature of the liner to be pulled; and they are thus adapted to obtain flat pressure contact with the inner surface of the liner. Although I prefer to depend primarily upon end engagement and direct endwise pressure to remove the liner, and thus provide each shoe with an end lug 14, it is within the scope of my invention to provide the curved surfaces 13a of shoes 13 with teeth 13b, such as are illustrated in Fig. 2 only. By the use of such teeth, pulling engagement may be had with the inner surface of the liner, either to help the pulling engagement of lugs 14 or even to the complete exclusion or disuse of those lugs.

Liner engaging shoes 13 are pivotally mounted at 15b near their centers on sets of toggles 15, of which there are four for each shoe. One end of each toggle is pivoted to a shoe and the other end of each toggle is pivoted at 15a to a traveling nut 16. From an inspection of the figures it will be seen, without the necessity of protracted description,

how each shoe has two toggles which are pivotally connected with one traveling nut 16 and has two other toggles pivotally connected with the other traveling nut 16; and how, by moving the nuts 16 toward or away from each other the angular relation of the toggles may be changed to force the shoes out to the expanded positions shown in Fig. 1 or to pull them in to the contracted positions shown in Fig. 2. When the shoes are forced out to their expanded positions of Fig. 1, they are pressed flatly against the inner surface of the liner and adjust themselves to that inner surface, due to the pivotal mountings of the shoes at the pivotal points 15b.

The two traveling nuts are mounted, one on a left handed thread 20 of the longitudinal center arbor 21, and the other on a right handed thread 19 of that arbor; so that by rotation of the arbor in either one direction or the other, the nuts may be advanced toward each other or moved away from each other to expand or contract the shoes.

To the outer end of arbor 21 an operating shaft 22 is connected. This connection may be made in any suitable manner, but a convenient manner is by providing the operating shaft with an internal screw threaded socket 23 which takes the outer screw-threaded end of arbor 21, a lock nut 24 or any other suitable means being employed for locking the socket non-rotatively on the screw-threaded arbor.

Operating shaft 22 is of a suitable length for the length of the liner, or the average lengths of liners, to be pulled; and for other lengths other operating shafts may be substituted. The outer portion of the operating shaft is screw-threaded as shown at 25 and near its outer end it carries an operating nut 26 screw-threaded upon it. This nut 26 may be provided with any suitable means for facilitating powerful rotation. For instance it may have a disk or flange 27 provided with radial sockets 28 for the insertion of a capstan bar or the like.

Between the operating nut 26 and the cylinder there is a spider 30 with legs 31 adapted to bear upon the cylinder end. The legs 31 are illustrated in Fig. 1 as broken and contracted in length. In practice they are of such lengths, parallel with the axis of the tool and of the liner, that the liner may be completely pulled from the cylinder without coming into contact with the radial arms 32 of the spider.

The spider has a hub 33 with a bore 34 slidably passing the screw shaft 22, but the spider is not screw-threaded upon the shaft. The shaft has a longitudinal splineway 35 and the spider hub 33 has a spline or key 36 sliding longitudinally in the splineway—see Fig. 4. Thus, by means of rotating the spider, operating shaft 22 and arbor 21 may be ro-

tated without being given any longitudinal movement.

The operation of the device will now be easily understood from the foregoing description. When first applied the parts are in the collapsed position such as shown in Fig. 2, so that the liner engaging shoes may easily pass through the liner. The spider 32 has been set against, or substantially against, the end of the cylinder, and the other parts are pushed lengthwise into the liner by pushing inwardly on the operating shaft 22 or on the nut 26. Fig. 2 shows the parts collapsed and longitudinally inserted almost to the proper point for expansion. After the parts have been longitudinally inserted as far as is shown in Fig. 1, then, before the nut 26 is set up against the spider, the spider 30 is rotated in such a direction as to move traveling nuts 16 toward each other and thus expand the liner engaging shoes to the position shown in Fig. 1. Considerable outward pressure may be exerted by the liner engaging shoes if so desired. Then the operating nut 26 is run up against the end thrust bearing 40 which is located in the outer part of the spider, and continued forcible rotation of the operating nut then pulls outwardly on the operating shaft and arbor and shoes, and thus forcibly pulls the liner out of the cylinder. During this operation considerable longitudinal pressure, or end pressure, may have to be brought to bear upon the liner; and if the liner is thin or weak, the internal support given it by the long evenly pressing shoes will prevent its rupture or deformation.

After the liner is pulled from the cylinder, the device is easily removed from the liner by operations and reverse of those before described.

I claim:

1. A liner puller or the like comprising a plurality of liner engaging shoes, mounting means for said shoes including a rotatable arbor and means whereby rotation of the arbor in opposite directions will contract and expand the shoes, a screw-threaded operating shaft forming an extension of said arbor, a cylinder engaging spider through which said operating shaft is slidable, and an operating nut screw-threaded on the operating shaft and bearing against the spider.

2. A liner puller or the like comprising a plurality of liner engaging shoes, mounting means for said shoes including a rotatable arbor and means whereby rotation of the arbor in opposite directions will contract and expand the shoes, a screw-threaded operating shaft forming an extension of said arbor, a splined cylinder engaging spider through which said operating shaft is slidable but not rotatable, and an operating nut screw-threaded on the operating shaft and bearing against the spider.

3. A liner puller or the like comprising a plurality of liner engaging shoes, mounting means for said shoes including a rotatable arbor and means whereby rotation of the arbor in opposite directions will contract and expand the shoes, a screw-threaded operating shaft forming an extension of said arbor, a cylinder engaging spider through which the operating shaft extends, said spider being splined to the operating shaft to be non-rotating but slidable with reference thereto, and an operating nut screw-threaded upon the operating shaft and bearing against the spider.

15 4. In a liner puller or the like, a central arbor having right handed and left handed screw threads, a pair of traveling nuts screw-threadedly engaging, respectively, with the right and left handed threads, toggle links
20 pivoted together and pivoted in pairs between said traveling nuts, liner engaging shoes pivotally mounted at the inter-pivotal points of the toggle links, a screw-threaded operating shaft forming a continuation of the arbor
25 and rotatively connected thereto, a cylinder engaging spider through which the operating shaft passes, and an operating nut screw-threaded upon the operating shaft and bearing against the spider.

30 5. In a liner puller or the like, a central arbor having right handed and left handed screw threads, a pair of traveling nuts screw-threadedly engaging, respectively, with the right and left handed threads, toggle links
35 pivoted together and pivoted in pairs between said traveling nuts, liner engaging shoes pivotally mounted at the inter-pivotal points of the toggle links, a screw-threaded operating shaft forming a continuation of the arbor and rotatively connected thereto, a cylinder engaging spider through which the operating shaft passes slidably, the spider being splined to the shaft so that the spider and shaft are relatively non-rotatable, and an
40 operating nut screw-threaded upon the operating shaft and bearing against the spider.

45 6. In a liner puller or the like, a central arbor having right handed and left handed screw-threads, a pair of traveling nuts screw-threadedly engaging, respectively, with the right and left handed threads, toggle links
50 pivoted together and pivoted in pairs between said traveling nuts, liner engaging shoes pivotally mounted at the inter-pivotal points of the toggle links, a screw-threaded operating shaft forming a continuation of the arbor and rotatively connected thereto, a cylinder engaging spider through which the operating
55 shaft passes, and an operating nut screw-threaded upon the operating shaft and bearing against the spider; said liner engaging shoes being elongate in the axial direction of the arbor and having curved outer liner engaging faces.

7. In a liner puller or the like, a central arbor having right handed and left handed screw threads, a pair of traveling nuts screw-threadedly engaging, respectively, with the right and left handed threads, toggle links
70 pivoted together and pivoted in pairs between said traveling nuts, liner engaging shoes pivotally mounted at the inter-pivotal points of the toggle links, a screw-threaded operating shaft forming a continuation of the arbor and rotatively connected thereto, a cylinder engaging spider through which the operating shaft passes slidably, the spider being splined to the shaft so that the spider and shaft are relatively non-rotatable, and an operating
75 nut screw-threaded upon the operating shaft and bearing against the spider; said liner engaging shoes being elongate in the axial direction of the arbor and having curved outer liner engaging faces.

8. In a liner puller or the like, a plurality of elongate liner engaging shoes, means for pivotally supporting the shoes in their medial portions, means associated with the shoe supporting means for forcing the shoes away
85 from each other and into expanded liner engaging position, and means for exerting endwise force on the shoes supporting means for the purpose of pulling a liner engaged by the shoes.

In witness that I claim the foregoing I have hereunto subscribed my name this 9 day of December 1929.

JAMES J. SANTIAGO.