May 11, 1943. C. WHITE 2,318,980

CYLINDER LINER PULLER

Filed May 16, 1941

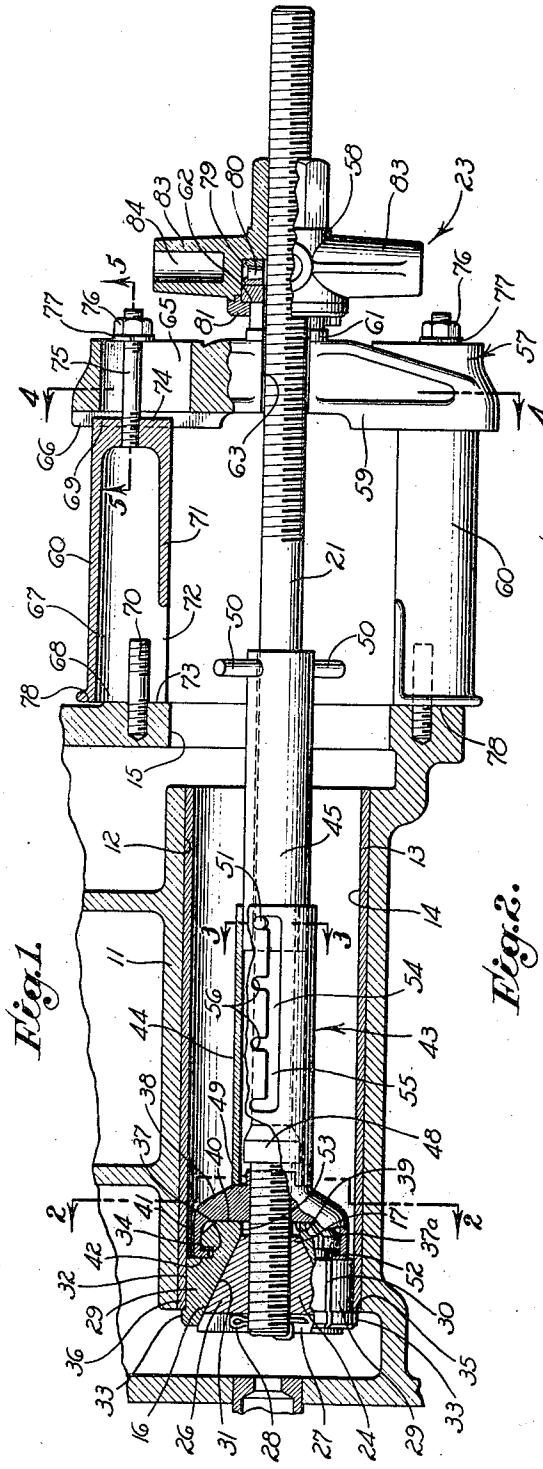

Fig. 1.

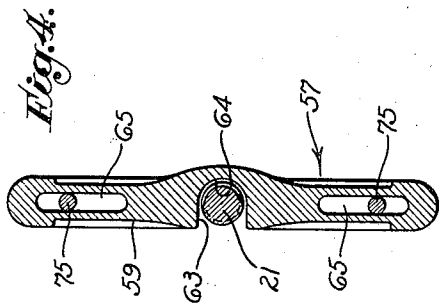

Fig. 4.

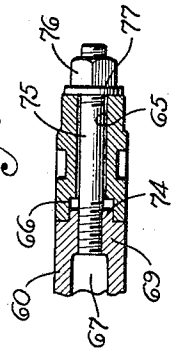

Fig. 5.

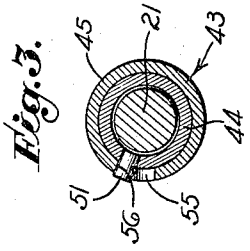

Fig. 3.

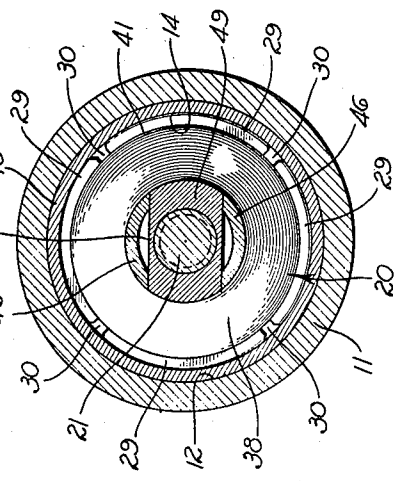

Fig. 2.

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CYLINDER LINER PULLER

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Application May 16, 1941, Serial No. 393,735

5 Claims. (Cl. 29—88.2)

This invention relates to devices for pulling an insert member from a bore. The device is especially adapted for pulling various pieces of equipment from oil well pump tubing, such as valves and liners, and for pulling the liner from the bore of a slush pump. It is in connection with the latter use that the device is illustrated in the drawing. It should be understood, however, that it is not intended that the scope of the invention be limited to use in connection with slush pumps, or for use solely in pulling liners from pumps, this embodiment being chosen for the purposes of illustration and description.

This invention is an improvement upon the pulling devices disclosed in the patent to Clarence White and Oliver B. Graham, No. 2,039,371, and in the application for patent of Clarence White and Oliver B. Graham, filed December 15, 1939, Serial No. 309,374.

It is one object of the invention to shorten the puller and thereby reduce its weight.

It is another object of the invention to provide a puller adaptable for use with cylinders of different lengths and bore diameters.

It is still another object of the invention to provide a puller which shall be readily assembled for the pulling operation.

It is another object of the invention to provide a puller capable of extracting an insert member with less manipulation of the parts of the puller than has been heretofore characteristic thereof.

These and other objects and features of the invention will be apparent from a perusal of the following descriptive specification in connection with the accompanying drawing and of the appended claims.

In the drawing, which is for illustrative purposes only:

Fig. 1 is a longitudinal, fragmentary section through a cylinder, such as the cylinder of a slush pump, and illustrates the manner in which the device embodying the features of this invention is installed for the operation of pulling a liner from a pump cylinder;

Fig. 2 is an enlarged cross section of the pulling device, taken along the line 2—2 of Figure 1;

Fig. 3 is an enlarged cross section of the pulling device, taken along the line 3—3 of Figure 1;

Fig. 4 is a sectional view of the device, taken along the line 4—4 of Figure 1; and

Fig. 5 is an enlarged fragmentary sectional view of the device, taken along the line 5—5 of Figure 1.

In Fig. 1 of the drawing, the pulling device is shown in position ready to pull the liner from a pump cylinder. A pump body 11 is formed with a cylindrical bore 12 and an outer, slightly larger, opening 15 coaxial with the bore 12. An insert liner 13 in the form of a sleeve provides a pump bore 14 within which reciprocates a pump piston (not shown). The liner 13 is inserted in and removed from the bore 12 through the opening 15.

Although the pulling device is illustrated in an operable position in a horizontal bore for illustrative purposes, the device is equally adapted for use with vertical bores. The invention comprises generally a grasping mechanism 20 carried by a puller bolt or stem 21 and a means for imparting longitudinal movement to the bolt 21, which means is generally indicated on the drawing by the numeral 23.

The several parts of the grasping mechanism and their operative relationship will be described.

A grip expanding nut 24 having a frusto-conical rim surface 16 is threaded upon the puller bolt 21 with its small end 17 facing toward the opening 15. The larger end 26 is disposed adjacent the inner end of the puller bolt 21 and is diametrally slotted at 27 to receive a cotter pin 28 which engages the bolt 21 and prevents the nut 24 from turning thereon.

A plurality of segmental expanding grips 29 are circumferentially spaced about the nut 24. Each of these grips constitutes the segment of a ring, and each two grips are separated by a radially-disposed gap 30. A bore surface 31 of each grip 29 is conically shaped to fit the conical rim surface 16 of the nut 24. Each of the grips 29 is also machined to present a segmental cylindrical rim surface 32 dimensioned to slidably fit within the bore 14 of the liner 13, a segmental cylindrical rim surface 33 of larger radius than that of the surface 32, and a segmental cylindrical rim surface 34 of smaller radius than that of the surface 32.

Between the cylindrical rim surface 33 at the inner end of each of the grips 29 and the cylindrical surface 32 is an annular shoulder 35 adapted to engage the inner end of the liner 13. Each cylindrical surface 33 is of the same, or preferably of somewhat smaller, radius than the outside rim surface of the liner 13 when the grips are expanded sufficiently to bring their cylindrical surfaces 32 in contact with the bore surface 14 of the liner 13, enabling the grips 29, when in fully expanded position, to be withdrawn through the bore of the pump body and yet have a solid and extended contactual surface engage-

ment with the bore surface 14 of the inner end 36 of the liner 13.

Between the cylindrical surfaces 32 and 34 of each grip 29 is a circumferential groove 37 with parallel side walls. A grip adjusting nut 38 has threaded engagement with the bolt 21 and is provided with an inner end face 39 for engagement with outer end faces 40 of the grips 29. The adjusting nut 38 is formed with an integral cylindrical web 41 projecting inwardly from the body of the nut 38 and disposed between the cylindrical segmental surfaces 34 and the bore 14 of the liner 13. The web 41 at its inner end is integrally connected with an annular flange 42 which extends radially inwardly from the web 41 and projects into and has annular sliding engagement with the side walls of the grooves 37. The length of the web 41 is such that the position of the flange 42 within the side walls of the grooves 37 permits an endwise thrust contact between the faces 39 and 40.

A collar 48 is rigidly secured in fixed position upon the bolt 21 at such a position therealong that it is spaced a short distance from a hub portion 49 of the nut 38. This collar 48 affords a shoulder for positively stopping movement of the nut 38 along the bolt 21. Otherwise, as the nut 38 is rotated with respect to the bolt 21 in a manner to cause it to move rightward to the end of the threaded portion of the bolt 21 the threads of the nut might become jammed on the unthreaded portion of the bolt 21 and be difficult to dislodge for a subsequent movement to the left on the bolt 21.

The radial distance between bore faces 53 of the outer or rightward end portions of the segmental grips 29 and the bolt 21 is less than the depth of that portion of the flange 42 which overlaps the outer side walls 37a of the grooves 37 of the segmental grips 29 when the latter are in operative position of engagement with the liner 13. The radial distance between the bore faces 53 and bolt 21 is somewhat greater than the depth of the shoulder 35. It follows from these relationships that, when the nut 38 is withdrawn longitudinally of the bolt 21 a sufficient distance from the nut 24 to enable the bore faces 53 of the segments 29 to be moved radially into contact with the bolt 21, the entire grasping structure 20 can be inserted within the bore 14, but that the several segments will be held in assembled relationship with respect to the bolt 21 and nuts 24 and 38 by reason of the engagement of the flange 42 with the slots 37 of the segmental grips 29. To disassemble the segments 29, the cotter pin 28 is removed, the nut 24 is unscrewed from the bolt 21, and the nut 38 is moved leftwise of the bolt 21 at least to a point at which its face 39 is flush with the left end of the bolt 21. The segments 29 can then be moved radially inwardly to clear the inner edge 52 of the flange 42.

The grip adjusting nut 38 is turned by means of a cylindrical socket wrench 43. The wrench 43 has two telescopically joined sections, an inner section 44, and an outer section 45. The inner end of the inner section 44 is formed with longitudinally projecting jaws 46 adapted to engage with flat chordal faces 47 formed on the hub portion 49 of the adjusting nut 38 (see Fig. 2).

The outer section 45 of the wrench 43 is sleeved upon the stem 21. Provision is made in handles 50 for its manual rotation.

The inner section 44 of the wrench 43 is sleeved at its outer end upon the inner end of the outer section 45. A pin 51 projecting radially from the outer section 45 of the wrench 43 engages a slot 54 formed in the cylindrical wall of the inner section 44. The slot 54 has an elongated portion 55 extending longitudinally of the section 44 and closed at its two ends. The slot 54 is also characterized by a plurality of recesses 56 communicating with the elongated portion 55 and disposed on that side of the portion 55 of the slot toward which the torque of the outer wrench section is directed when the wrench is rotated in the direction requisite for expanding the segmental grips 29. As shown in the drawing, this direction is clockwise when viewed from the right-hand side of the drawing. The engagement of the pin 51 with the slot 54 determines the extent and character of the relative movement of the two sections of the wrench both longitudinally and angularly.

When the pin 51 is at the outer end of the slot 54, the handles 50 are disposed adjacent the opening 15 in a position convenient for manual operation of the wrench 43. If the device is used for pulling liners from cylinders which are shorter than the cylinder 11 shown in the drawing, the pin 51 is seated in an inner one of the recesses 56 so that the handles 50 will assume a position relative to the outer pump body opening corresponding to that shown in Fig. 1.

This invention includes in combination with the grasping mechanism 20, the means 23 for moving the bolt 21 longitudinally of the cylinder bore 14 for movement of the grasping mechanism 20 to remove the liner 13 from the bore 12. This means 23 comprises a pressure or thrust yoke 57 and a nut 58 threaded upon the stem 21. The yoke 57 comprises a cross arm 59 and two strut members or pressure posts 60.

The cross arm 59 is provided with an outwardly projecting hub portion 61 having an outermost substantially flat pressure end surface 62. In one side of the cross arm 59 and extending through the outwardly extending hub 61 thereof is a laterally facing slot 63, an inner wall 64 of which is arcuate in transverse section, as shown in Fig. 4. The slot 63 is adapted to receive the stem 21 in the manner shown in Figs. 1 and 4, the cross arm 59 being thereby made free for lateral movement away from the stem 21 in one direction.

The cross arm 59 is formed adjacent each of its ends with a slot 65 which extends through the cross arm from its outer to its inner face, the slot being elongated longitudinally of the cross arm. The cross arm 59 is also formed on the inwardly directed face of each of its end portions with a longitudinally extending groove or guideway 66.

Each of the strut members 60 is disposed between one of the end portions of the cross arm 59 and the pump body 11. It is formed with a recess 67 extending from an inner end 68 of the strut member almost to the outer end face 69 thereof. The strut member or post 60 is thus in the form of a hollow rectangular prism open at its inner end and closed at its upper end. The recess 67 serves the double purpose of lightening and cheapening the cost of manufacture of the post and providing for the accommodation of a cylinder head stud 70. A centrally directed side wall 71 of the post 60 is cut away at its inner end to provide an opening 72, which makes it possible to move the post 60 toward the stem 21 with its inner end 68 adjacent or in sliding contact with an outer surface 73 of the pump body 11, from a position in which the wall 71 is

beyond the cylinder head stud 70 to a position in which it is between the cylinder head stud and the stem 21.

The outer end of the post 60 is formed with a tongue 74 extending outwardly from the face 69 and adapted to slidably fit within the groove or guideway 66.

A bolt 75 is threadedly seated in the outer end of the post 60 and extends through the slot 65 somewhat beyond the cross arm 59. By means of the bolt 75 and a nut 76 and washer 77 on its outer end, the post 60 is securable in any desired position of fixed relationship to the cross arm 59 within the range of travel of the bolt 75 longitudinally of the slot 65. The inner end surfaces 78 and the outer end surfaces 69 of the posts 60 are in planes perpendicular to the stem 21 and are sufficiently extended that when the cross arm 59 is pressed perpendicularly toward the cylinder body 11, each post 60 is maintained in perpendicular relationship both to the outer surface 73 of the pump body 11 and to the cross arm 59, forming with the cross arm 59 a rigidly assembled yoke 57 equivalent under such conditions to a yoke of which the cross arm and post are integrally connected, like the yoke 75 of Patent No. 2,039,371.

The nut 58, threadedly mounted on the stem 21 and adapted to pressurally engage the pressure surface 62 when the nut is threaded downwardly on the stem, is the means 23 by which an outwardly directed longitudinal force is imparted to the grasping mechanism 20. Lateral movement of the cross arm 59 relative to the stem, when such a longitudinal force is being imparted to the grasping mechanism 20, is provided to obviate slippage of the cross arm while the liner 13 is being pulled from the bore. In the form shown in the drawing, this means 23 comprises an inwardly facing annular recess 79 which accommodates a roller bearing interposed between the stem 21 and the nut 58, and an annular collar 81 secured to the nut 58 at the inner end of the recess 79. The collar 81 annularly embraces the outer end of the hub 61 of the cross arm 59. By means of the collar 81, the nut 58 and the stem 21 are held in axial alignment with the cross head 59 when the puller is in the assembled operative position shown in Fig. 1.

The nut 58 is formed with four tubular radial extensions 83. A handle bar (not shown) is inserted into a hollow socket 84 of any one of these tubular extensions 83, as may be convenient, to turn the nut 58 upon the stem 21.

The operation of extracting a liner 13 from the bore 12 of a pump body 11 will be described. The stem 21, with the grasping mechanism 20 and wrench 43 assembled upon its inner end and the nut 58 in position upon its outer end, is inserted in the liner bore 14 until the shoulders 35 are inside of the inner end 36 of the liner 13. When the stem 21 is thus being inserted in the bore 14, the grip adjusting nut 38 is backed off on the stem 21 sufficiently to enable the rim surfaces 33 of the segmental grips 29 to slide within the bore 14. The pin 51 is then placed in that one of the recesses 56 which will dispose the handles 50 just outside of the opening 15 in the pump body. As shown in Fig. 1 of the drawing, the pump bore 12 is of that length to require that the pin 51 be placed in the outermost of the bore recesses 56. By means of the handle 50, the wrench 43 is then turned in a clockwise direction as viewed from the right, causing the grip adjusting nut 38 to expand the segmental grips 29 until their rim surfaces 32 contact the bore surface 14 of the liner 13, placing the annular shoulders 35 in position to engage the inner end 36 of the liner 13 when the stem 21 is later moved outwardly.

The nut 58 is then turned on the stem 21 to a position which will allow for the disposition of the yoke 57 between the pump body and the nuts 58. With the nuts 76 loosened and the bolts 75 disposed adjacent the outer ends of the slots 65, the yoke 57 is placed in position with the walls of the slot 63 embracing the stem 21. The posts 60 are then moved centrally toward the stem 21, the centrally directed walls 71 clearing the cylinder head studs 70 by virtue of the openings 72 at the inner ends of these walls 71. When the posts 60 have been placed in the proper position with respect to the opening 15 in the pump body, the nuts 76 are tightened. The posts 60 are now held in rigid perpendicular relationship to the cross arm 59.

The nut 58 is now turned inwardly of the stem 21, the collar 81 first telescopically engaging the hub 61, and the assembled yoke 57 next being pressed tightly against the surface 73 of the pump body, with the result that the stem 21 is pulled longitudinally outwardly of the liner bore 14 until the shoulders 35 engage the inner end of the liner. Further rotation of the nut 58 slides the liner 13 outwardly from the bore 12.

When the outer section of the wrench 43 approaches the inner face of the cross arm 59, the wrench is shortened by turning its outer section 45 slightly counter-clockwise, moving the pin 51 into the elongated portion 55 of the slot 54. The wrench section 45 is then moved inwardly with respect to the wrench section 44 opposite another recess 56 and turned clockwise, permitting the nut 58 to be again rotated until the outer end of the liner 13 comes into contact with the cross arm 59. At this juncture the liner 13 has usually been sufficiently dislodged from the bore 12 to permit the completion of its removal from the pump body by means other than the pulling mechanism. If, however, this proves impossible, the nut 58 may be turned outwardly of the stem 21, the posts 60 replaced by other longer posts, and the nut 58 turned inwardly of the stem 21 to complete the removal of the liner 13.

It will be observed that the contractible wrench 43 makes it possible to dispose the wrench handles 50 initially at a position for convenient access and at the same time obviates the need for long posts on the yoke 57, whether those posts be integrally formed with the cross arm of the yoke or separably secured thereto. It will also be observed that the contractible wrench permits the initial disposition of the handles 50 in the same relative position with respect to the pump body when the puller is used with different pump cylinders having bores of different lengths.

It will also be observed that the feature of the invention by which the posts 60 are separably secured to the cross arm 59 both makes it possible to substitute longer posts during the later stage of the pulling operation, should such substitution be required, and renders the yoke 57 adaptable to cylinder body openings 15 of different diameters and to different spacings of the cylinder head studs 70. The openings 72 make it possible to assemble the posts in position with respect to the cross arm 59 and the pump body by lateral movement of the posts centrally toward the stem 21, obviating the need either for disassembling the stem 21 and nut 58 from the cross arm 59 or moving the nut and cross arm out-

wardly so that the inner ends of the posts 60 may clear the outer ends of the cylinder head studs 70.

Although there has been herein described in connection with the drawing only one embodiment of the invention, it will be understood that the invention may have other embodiments, all of which come within the scope of the appended claims.

I claim as my invention:

1. In a puller for pulling a cylinder insert member from a cylinder, the combination of: a stem adapted to be extended inwardly of the bore of said cylinder; an expansible device on the inner end of said stem adapted when expanded to engage an inwardly directed face of said insert member; an expander for said device including a nut threaded on said stem adapted when rotated in one direction to expand said device; an elongated, two-section, longitudinally extensible socket wrench for said nut rotatably mounted on said stem and extending from said nut outwardly of said bore, the two sections of said wrench being telescopically joined; and means associated with said stem for moving it longitudinally outwardly of said bore, including a thrust yoke extending outwardly from the outer end of said cylinder and spanning said bore and means for applying a thrust force to said yoke and a pulling force to said stem.

2. In a puller for pulling a cylinder insert member from a cylinder, the combination of: a stem adapted to be extended inwardly of the bore of said cylinder; an expansible device on the inner end of said stem adapted when expanded to engage an inwardly directed face of said insert member; an expander for said device including a nut threaded on said stem adapted when rotated in one direction to expand said device; an elongated, two-section, longitudinally extensible socket wrench for said nut rotatably mounted on said stem and extending from said nut outwardly of said bore, the two sections of said wrench being telescopically joined; a pin element and a slot element mating therewith upon said two sections respectively, the slot element of which comprises an elongated portion closed at each of its ends and disposed longitudinally of the wrench and further comprises laterally off-set detent recesses disposed in communication with said elongated portion and along that side of said elongated portion toward which the torque between said sections is directed when the wrench is rotated in said one direction; and means associated with said stem for moving it longitudinally outwardly of said bore, including a thrust yoke extending outwardly from the outer end of said cylinder and spanning said bore and means for applying a thrust force to said yoke and a pulling force to said stem.

3. In a puller for pulling cylinder insert members from cylinders of different lengths, the combination of: a stem adapted to be extended inwardly from the bore of said cylinder; an expansible device on the inner end of said stem adapted when expanded to engage an inwardly directed face of an insert member; an expander for said device including a nut threaded on said stem adapted when rotated in one direction to expand said device; an elongated, two-section, longitudinally extensible socket wrench for said nut rotatably mounted on said stem and extending from said nut outwardly of said bore, the two sections of said wrench being telescopically joined and said wrench when fully extended being sufficiently long to dispose the outer section of said wrench adjacent the outer end surface of the longest pump cylinder with which the puller is designed to be used; and means associated with said stem for moving it longitudinally outwardly of said bore, including a thrust yoke extending outwardly from the outer end of said cylinder and spanning said bore and means for applying a thrust force to said yoke and a pulling force to said stem.

4. In a puller for pulling a cylinder insert member from a cylinder, the combination of: a stem adapted to be extended inwardly of the bore of said cylinder; an expansible device on the inner end of said stem adapted when expanded to engage an inwardly directed face of an insert member; an expander for said device including a nut threaded on said stem adapted when rotated in one direction to expand said device; an elongated, two-section, longitudinally extensible socket wrench for said nut rotatably mounted on said stem and extending from said nut outwardly of said bore, the two sections of said wrench being telescopically joined in a manner to transmit a torque to said nut in said direction in any relative longitudinal position of said two sections; a cross arm extending across said bore and formed for lateral engagement with said stem; separable strut members disposed between the end of said cylinder and the ends of said cross arm, respectively; and a nut threaded on said stem beyond said cross arm for pressing said strut members against said cylinder end and applying a tensile stress to said stem.

5. In a puller for pulling a cylinder insert member from a cylinder, the combination of: a stem adapted to be extended into the bore of said cylinder; an expansible device on the inner end of said stem and adapted when expanded to engage an inwardly directed face of said insert member; an expander for said device, including an operating element movable in one direction relative to said stem to expand said device; an elongated, two-section, longitudinally extensible actuating member mounted on said stem and movable relative thereto to move said operating element in said one direction, said actuating member extending from said operating member outwardly from said bore, the two sections of said actuating member being telescopically joined; and means associated with said stem for moving it longitudinally outwardly through said bore, including a thrust yoke extending outwardly from the outer end of said cylinder and spanning said bore, and including means for applying a thrust force to said yoke and a pulling force to said stem.

CLARENCE WHITE.