This invention relates to a hydraulic pulling tool and particularly to a pulling tool adapted to pull wheels, gears, pistons and the like, from axles or shafts on which they are mounted.

The present invention is directed particularly to a hydraulic device adapted for operation on the impact principle for effecting removal of parts which are tightly wedged on tapered shafts.

In the oil well drilling industry, large and powerful reciprocating pumps, commonly termed "slush pumps," are conventionally employed for circulating the drilling muds through the wells during the drilling operation. The moving parts of such pumps, and particularly the pistons, are necessarily subjected to a high degree of erosive and abrasive action by the gritty fluids which they handle with the result that frequent replacement of the pistons is necessary. These pistons ordinarily include a metallic core which is securely wedged on a tapered piston rod. These pistons generally become "frozen" or so tightly wedged on the rods that they are difficult to remove. They are commonly hammered off which is usually damaging both to the rod and to the piston core which, otherwise, is often re-usable when refitted with seal rubbers.

The present invention has for its primary object the provision of a pulling tool which is particularly adapted for the removal of slush pump pistons from piston rods. A particular object is to provide a pulling tool employing hydraulic pressure generated by impact force to effect release of pump pistons from piston rods. A further object is to provide a pump piston puller employing an improved form of piston-grasping chuck. An additional object is to provide a piston pulling tool which is relatively simple in construction, easy to operate and highly efficient in its releasing action.

Other and more specific objects and advantages of the present invention will become more readily apparent from the following detailed description when read in conjunction with the accompanying drawing which illustrates a useful embodiment in accordance with this invention.

In the drawing:

Fig. 1 is a longitudinal sectional view of the pulling tool showing the chuck open and the parts in position to apply pull to the piston;

Fig. 2 is a view generally similar to Fig. 1 showing the parts in position upon completion of the pulling operation; and

Fig. 3 is a detail of the chuck locking elements of the device.

Referring to the drawing, a piston core, designated generally by the numeral 1, is shown mounted on a conventional piston rod 2 having a tapered end 2a on which the piston core has become tightly wedged and from which it is to be recovered. Piston core 1 is of a generally conventional type commonly used in oil field slush pumps and includes a tubular body 10 having a central annular flange 11 against which conventional seal rubbers (not shown) are seated. Such piston bodies will usually be provided adjacent each end with an annular groove 12 which is designed to receive locking elements (not shown) by which the seal rubbers are held in place on the piston body. The pulling tool in accordance with the present invention is especially adapted to take advantage of the grooves 12 as providing a convenient and normally present connecting element through which the pulling force may be readily and effectively applied to the piston body.

The pulling tool comprises a generally tubular body 6 having a relatively large diameter which is provided with internal threads 14 adapted to receive a hollow externally threaded nut 7 which is screwed into body 6 through one end as shown. Nut 7 has a reduced diameter neck portion 15 terminating in a head 16 provided with radial lugs 17 by which the nut may be screwed in and out of body 6. The inner end of nut 7 has an enlarged bore forming a cylinder 18 which communicates with a smaller co-axial bore 19 which extends through neck portion 15 and head 16. Slidably inserted into the inner end of cylinder 18 is a hollow piston 5 having an internal chamber 20. The outer end of piston 5 which extends into bore 19 is closed by means of a piston head 21. Packing rings 22 are mounted between the adjacent surfaces of cylinder 18 and piston 5 to form a fluid-tight seal therebetween.

A plunger 8 having an enlarged head 8a on its outer end is slidably mounted in bore 19 with its inner end extending into chamber 20 and fitted with a nut 23. A portion of bore 19 forms a stuffing box for plunger 8 and is fitted with packing 24 which forms a fluid-tight seal about the plunger.

The end of body 6 opposite that in which nut 7 is inserted is provided with a generally tubular extension 25 having an axial bore 26 communicating with bore 13. The external diameter of extension 25 is made somewhat smaller than that of body 6 and is provided with longitudinally spaced annular enlargements 27, 28.

A generally tubular chuck, designated generally by the numeral 3, is mounted on extension 25 and comprises two semi-circular segments 3a and 3b hingedly connected at one side by means of a hinge 29. Chuck 3 is made somewhat longer than extension 25 and its external diameter is made such that when closed about extension 25 it will be substantially flush with the exterior of body 6. Interiorly, the lower portion of chuck 3 is provided with a series of spaced grooves 30, 31 registering with, and generally complementary in shape to, enlargements 27, 28 on extension 25, whereby when the chuck segments are closed about extension 25 the grooves 30, 31 will receive and interlock with enlargements 27, 28. One of the chuck segments, 3a for example, is secured to extension 25 by means of one or more attaching screws 32, leaving the other chuck segment 3b to swing freely relative to segment 3a about hinge 29.

The upper portion of chuck 3 is provided internally with an annular enlargement 33 which is adapted to enter and interlock with groove 12 in piston body 10 when the chuck segments are closed about one end of the piston body.

Locking means for locking the chuck segments about extension 25 and piston body 10 comprises a tubular sleeve 4 slidably mounted on the exterior of body 6. Sleeve 4 is provided with locking pin 34 which projects interiorly of the sleeve into the interior thereof to project just below extension 25 and terminating in a lateral locking branch 36. (See Fig. 3.) With this arrangement it will be seen that when chuck segments 3a and 3b are closed about extension 25, sleeve 4 may be moved upwardly to enclose the chuck. When the sleeve has reached the upper limit of its travel as determined by the engagement of pin 34
with the upper end of slot 35, sleeve 4 may be rotated through a small angle sufficient to move pin 34 into branch 36 whereupon the sleeve will be locked in position about the chuck and will hold the chuck segments together in their closed position.

In assembling the pulling tool it will be understood that chamber 20 will be completely filled with a suitable hydraulic fluid such as oil, water or the like, the filling being made with plunger 8 in the fully retracted position.

The device is operated in the following manner: With the parts occupying the relative positions illustrated in Fig. 1, the chuck segments will be closed about the end of piston body 10 and locking sleeve 4 moved to the upper position shown in Fig. 2. Nut 7 is then screwed into body 6 until piston head 21 is firmly seated against the inserted end of piston rod 2. If piston rod 2 and piston 1 have previously been removed from the pump, as will usually be the case, these parts with the pulling tool attached, as described, will be thrown or allowed to drop on a solid surface such as a concrete floor to cause enlarged head 8a to strike thereon. The resulting impact will tend to drive plunger 8 inwardly of chamber 20. Since the fluid in chamber 20 is substantially incompressible the force of the impact will be transmitted to piston 5 which will thus be driven upwardly against the end of rod 2. The reaction forces will be exerted through the connection between the chuck and piston core 1 and the opposing forces thus created will force the rod out of the piston core. The hydraulic fluid in cylinder 20 will also act to cushion the shock of the impact thereby protecting the rod and piston surfaces against battering or other damage.

The relative areas of plunger 8 and piston 5 will usually be such that each impact will move piston 5 only a fraction of an inch but this will usually be sufficient to break the hold of piston core 1 on the tapered portion 2a of the piston rod. If not, repeated impacts may be employed to release the piston core.

When release is completed, plunger 8 can be pulled back and the device will be ready for re-use. By means of the above-described pulling tool, it will be evident that pump pistons and other bodies may be readily removed from rods or shafts. Instead of impacting the plunger against a floor or other hard base, the end of the plunger can be struck with a hammer and the same results will follow.

The form and construction of the described chuck lends itself particularly effectively to the removal of slush pump pistons from their tapered rods.

It will be understood that various alterations and changes may be made in the details of the illustrative embodiment within the scope of the appended claims but without departing from the spirit of this invention.

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

1. An impact actuated pulling device for pulling an object such as a pump piston or the like from a rod on which the object is mounted, comprising, a tubular body having an enlarged bore to receive an end of the rod carrying the object, chuck means carried by the body and comprising complementary semi-circular segments hingedly connected at one side of their longitudinal axes and adapted to be closed about the object, a retainer collar slidably mounted on the exterior of said body for movement to and from positions enclosing the chuck segments when the latter are in closed position about the object, cooperating latch means on the retainer collar and said body to releasably hold the collar in chuck-enclosing position, a sealed piston slidable in said bore to abut the inserted end of said rod, a plunger slidably mounted in said bore with one end in spaced relation to said piston and the other end projecting outside said body, seal means about said plunger to form a fluid-tight seal between the plunger and the body, and an incompressible fluid filling the bore between the piston and the plunger.

2. An impact actuated pulling device for pulling an object such as a pump piston and the like from a rod on which the object is mounted, comprising, a tubular body connectible to the object and having an enlarged bore to receive an end of the rod carrying the object, chuck means comprising semi-circular segments hingedly connected at one side of their longitudinal axis and adapted to be closed about the object, a retainer collar slidably mounted on the exterior of said body for movement to and from positions enclosing the chuck segments when the latter are in closed position about the object, a tubular nut threadedly inserted in the other end of said body, a hollow piston slidably mounted in the bore of said nut and having a head closing the outer end thereof and abuttably against the inserted end of said rod, packing means about the piston forming a fluid-tight seal between the piston and the bore wall of the nut, a plunger slidably mounted in the bore of the nut having one end extending into the interior of said piston in spaced relation to said head and having the other end projecting to the exterior of said nut, seal means about the plunger forming a fluid-tight seal between the plunger and the bore wall of the nut, and an incompressible fluid filling the interior of the nut between said fluid-tight seals.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent No.</th>
<th>Inventor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>718,306</td>
<td>Boring</td>
<td>Jan. 13, 1903</td>
</tr>
<tr>
<td>1,203,093</td>
<td>Van Woest</td>
<td>Oct. 31, 1916</td>
</tr>
<tr>
<td>1,387,674</td>
<td>Wood et al.</td>
<td>Aug. 16, 1921</td>
</tr>
<tr>
<td>1,780,888</td>
<td>Uebelhoer</td>
<td>Nov. 4, 1930</td>
</tr>
<tr>
<td>1,807,329</td>
<td>West</td>
<td>May 26, 1931</td>
</tr>
<tr>
<td>1,869,687</td>
<td>Hart</td>
<td>Aug. 2, 1932</td>
</tr>
<tr>
<td>2,551,577</td>
<td>Knudson</td>
<td>July 24, 1951</td>
</tr>
</tbody>
</table>