

[54] HYDRAULIC PULLER

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[22] Filed: **Dec. 6, 1974**

[21] Appl. No.: **530,130**

[52] U.S. Cl.:..... **29/252; 29/259**

[51] Int. Cl.²:..... **B25B 27/02; B23P 19/02**

[58] Field of Search **29/252, 259, 261; 403/388,
403/399, 400**

[56] **References Cited****UNITED STATES PATENTS**

1,045,146	11/1912	Hunter.....	29/261
1,415,451	5/1922	Jones.....	29/261
1,633,453	6/1927	Miller.....	29/261
1,777,616	10/1930	Hommel.....	29/252
1,828,252	10/1931	Lynch.....	29/252
1,889,135	11/1932	Shaffer.....	29/252
2,191,021	2/1940	Ladd.....	29/261
2,252,036	8/1941	Rummer.....	29/252
3,568,294	3/1971	Conner.....	29/259

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[57] **ABSTRACT**

A hydraulic puller. The puller comprises a double act-

ing hydraulic cylinder having a ram projecting from its front end. A piston is connected to the ram and is reciprocable within the cylinder upon the application of hydraulic pressure. A strong back of spaced limbs extends laterally from each side of the cylinder. The strong back is fixed relative to the cylinder. Notches are formed in the rear edge of each limb of the strong back and each notch is aligned with a notch on the other limb. A puller arm is positioned between the spaced limbs of the strong back on both sides of the hydraulic cylinder. Each puller arm has a plurality of holes, each hole being alignable with the notches in the strong back. There are pulling jaws at the end of the puller arms and these jaws are positioned to cooperate with the ram when the puller is in use to remove, for example, a bearing from a shaft. A clip is positioned on the upper limb of the strong back, on each side of the hydraulic cylinder. A lug formed on each clip abuts the front end of the strong back. Engagement means project from each clip. The engagement means are positioned so that when the lug on the clip abuts the front edge of the strong back, the engagement means can pass through a hole in each puller arm to engage a pair of aligned notches in the strong back. The hydraulic puller of the invention is of simple construction and, in particular, is easily adjusted for use with varying sizes of bearings and the like.

13 Claims, 5 Drawing Figures

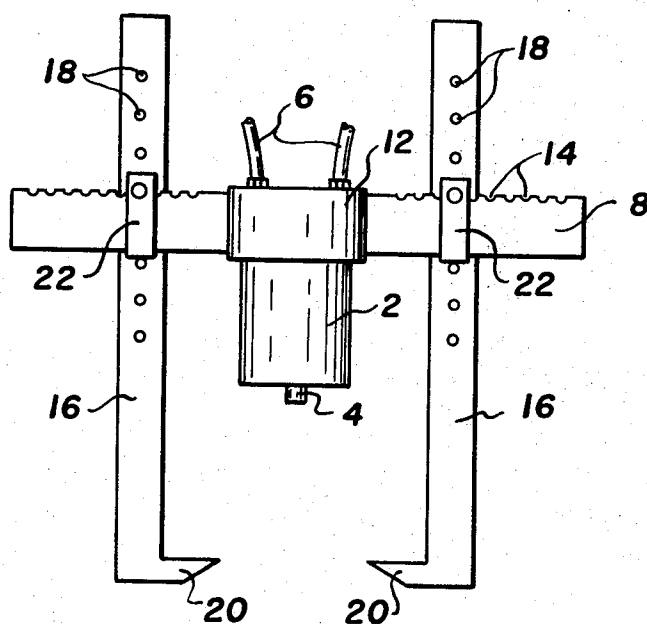


Fig. 1.

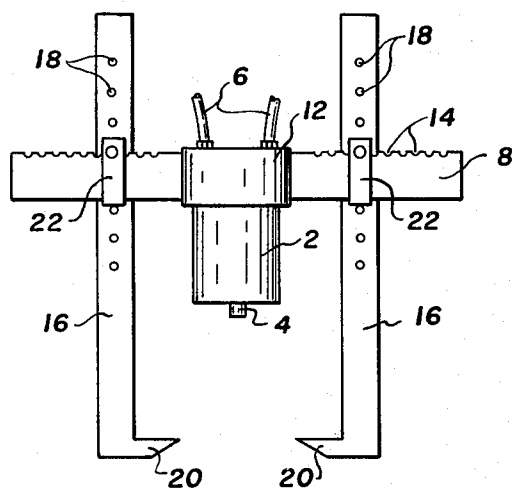


Fig. 2.

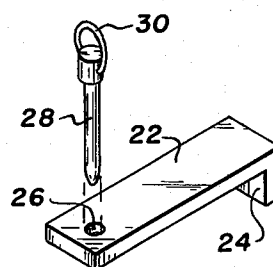
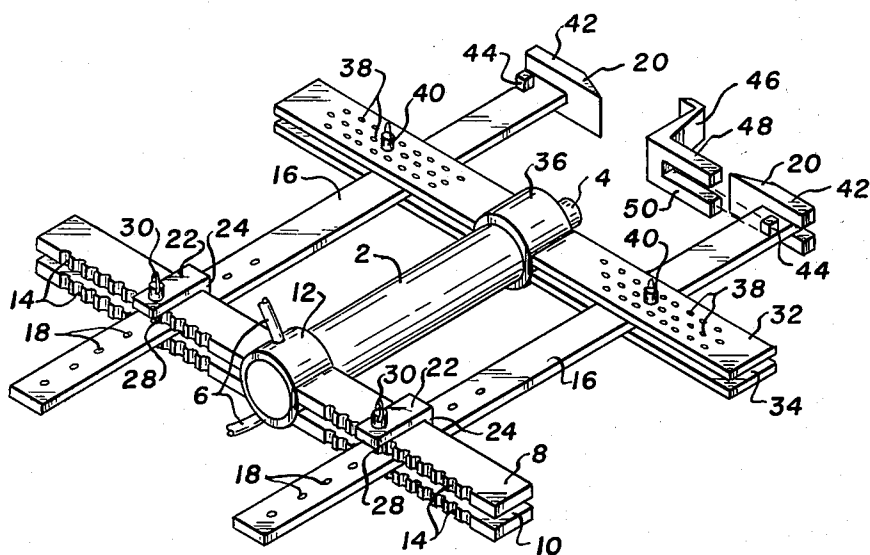
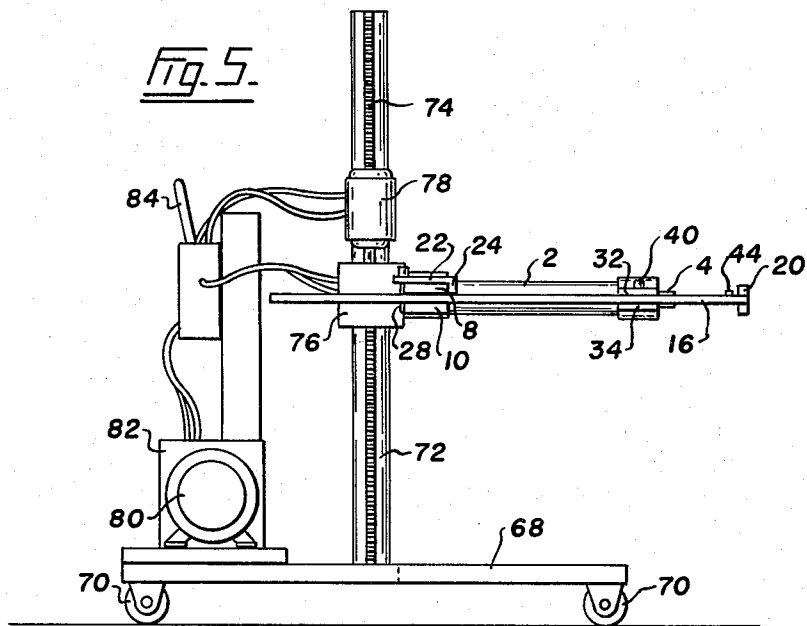
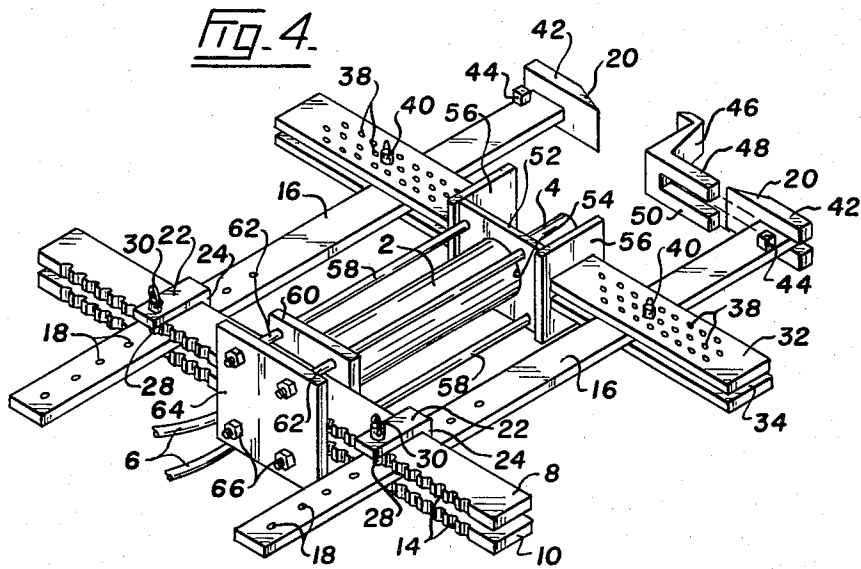


Fig. 3.





HYDRAULIC PULLER

SUMMARY OF THE INVENTION

The present invention provides a hydraulic puller in which adjustment of the pulling jaws relative to the hydraulic ram is easily and quickly carried out.

Accordingly the present invention is a hydraulic puller comprising a double acting hydraulic cylinder having a ram projecting from the front end, a piston connected to the ram and reciprocable within the cylinder and means to permit the application of hydraulic pressure to the piston. A strong back of spaced limbs extend laterally from each side of the cylinder and is fixed relative to the cylinder. Notches are formed in the rear edge of each limb of the strong back, each notch being aligned with a notch on the other limb. A puller arm is positioned between the spaced limbs of the strong back on both sides of the hydraulic cylinder. A plurality of holes through each puller arm are arranged longitudinally. Each hole is alignable with the notches in the strong back. The puller jaws at the end of the puller arms are positioned to cooperate with the ram when the puller is in use. Two clips, each dimensioned to move across the upper limb of the strong back have lugs formed on them to abut the front edge of the strong back. Engagement means project from each clip. The engagement means are positioned so that when the lug on the clip abuts the front edge of the strong back the engagement means can pass through a hole in each puller arm to engage a pair of aligned notches in the strong back.

In a preferred embodiment of the invention the puller includes retaining bars for the puller arm positioned forward of the strong back. The retaining bars comprise two pairs of spaced limbs extending laterally from each side of the cylinder and fixed relative to the cylinder. The puller arms are each positioned between each pair of spaced limbs of the retaining bars. In this preferred embodiment, the retaining bars are preferably formed with aligned holes to permit insertion of a pin through the two limbs of the pair at varying, preselected positions. Each inserted pin then abuts the outer edge of each puller arm and defines an outer position for the arm.

In another preferred embodiment of the invention the puller arms are each formed with spaced projections at their ends. The projections on each arm define a channel between them, able to receive a jaw adaptor.

If needed, the puller may be mounted on a wheeled trolley to permit easy movement of the puller. Such a trolley, if desired, may also contain means to enable the puller to be moved up and down vertically. A primary motor, preferably an electric motor, is on the trolley. A hydraulic pump may be on the trolley to actuate the hydraulic cylinder of the puller. This pump is driven by the primary motor. The trolley should also contain valve means to control the flow of hydraulic fluid. Arrangements of primary motors, hydraulic pumps and valves to direct hydraulic fluid from the pump, are, of course, well known.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a simple embodiment of the hydraulic puller according to the invention;

FIG. 2 is a perspective view of a clip useful in the pullers illustrated in the remaining drawings;

FIG. 3 is a perspective view of a hydraulic puller according to the invention;

FIG. 4 is a perspective view of a further embodiment of a hydraulic puller according to the invention; and

FIG. 5 is a schematic view showing a hydraulic puller according to the invention mounted on a trolley.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows a hydraulic puller comprising a double acting hydraulic cylinder 2 having a ram 4 projecting from its front end. The hydraulic cylinder 2 contains a piston (not shown) connected to the ram 4 and reciprocable within the cylinder. The hydraulic cylinder 2 is provided with hydraulic pipes 6 which permit the application of hydraulic pressure to the piston. A strong back comprises an upper limb 8 and a lower limb 10 (not shown in FIG. 1, but as in FIG. 3) spaced from the limb 8. The limbs 8 and 10 extend laterally from each side of the cylinder 2 and are fixed relative to cylinder 2 by being attached to a ring 12 attached to the cylinder 2. The ring 12 may also be formed integral with cylinder 2.

There are notches 14 formed in the rear edge of each limb 8 and 10 of the strong back. Each notch 14 on the limb 8 is aligned with a notch on the limb 10.

Puller arms 16 are positioned between the limbs 8 and 10 of the strong back. The puller arms 16 are on either side of the hydraulic cylinder 2. Each puller arm 16 has a plurality of holes 18 arranged longitudinally. Each hole 18 is alignable with notches in the spaced limbs 8 and 10. Each puller arm 16 has a pulling jaw 20 at each end. The puller arms 16 are arranged beside the hydraulic ram 4 in such a manner that the jaws 20 can easily cooperate with the ram 4 when the puller is in use. Clips 22 lie across the upper limb 8 of the strong back. As shown most clearly in FIG. 2, each clip 22 is formed with a lug 24 to abut the front edge of the strong back. There is a hole 26 in each clip positioned adjacent the end of the clip away from the lug 24 so that when the lug 24 on the clip 22 abuts the front edge of the upper limb 8 of the strong back, holes 26 are sufficiently aligned with a pair of notches 14 in the rear edge of the strong back to permit insertion of a pin 28 through the hole 26, through a notch 14 in the upper limb 8 of the strong back, through a hole 18 in the puller arm 16 and through a notch 14 in the lower limb 10 of the strong back to secure the clip 22 in position on the upper limb 8 of the strong back. Thus the pin 28 comprises an engagement means projecting from the clip 22 through the hole 26.

To facilitate moving the pin 28 it is provided with a ring 30 which can be gripped by the fingers.

The double acting hydraulic cylinder 2 provides the necessary force to remove a bearing or the like when the puller is in use. In normal use the ram 4 abuts the shaft on one side of the bearing, the pulling jaws 20 abut the other side of the bearing. The puller arms 16 permit a wide range of locations for the pulling jaws 20. The lugs 24 abut the front edge of the strong back and thus prevent the arms 16 moving backwardly relative to the strong back. The pin 28 engages the hole 26 in the clip 22, the notches 14 in the strong back limbs 8 and 10 and a hole 18 in the puller arm 16. By engagement in the notches 14, the pins 28 prevent the puller arms 16 moving forward relative to the cylinder 2.

The hydraulic fluid is supplied to the double acting hydraulic cylinder 2 through pipes 6, as well known in the art.

To use the puller shown in FIG. 1 the pins 28 are first removed at least from the holes 18 in the puller arms 16. The puller is brought near to the shaft having the bearing mounted on it and the ram 4 placed on or close to the shaft. The jaws 20 are brought against the rear of the bearing and the pin 28 is inserted through the hole 26 in the clip 22, through a notch 14 in the upper limb 8 of the strong back through a hole 18 in each of the pulling arms 16 and through a notch 14 in the lower limb 10 of the strong back. Hydraulic pressure may then be applied to the ram 4 to make it move outwardly from the hydraulic cylinder 2. The effect of this outward movement against a fixed shaft is to move the jaws 20 towards the end of the shaft and thus remove the bearing.

The embodiment of the invention illustrated in FIG. 3 shows a number of preferred aspects of the present invention. And in contrast to the embodiment illustrated in FIG. 1, FIG. 3 illustrates an embodiment in which the strong back comprises two pairs of spaced limbs. In each pair the upper limb is 8 and the lower limb 10. Each pair of limbs 8 and 10 extends laterally from each side of the cylinder 2 and is fixed relative to the cylinder.

FIG. 3 shows retaining bars positioned forward of the strong back. Each retaining bar comprises a pair of upper limbs 32 and a pair of lower limbs 34. Each pair of limbs 32 and 34 extend laterally from the side of the cylinder 2 and are fixed relative to the cylinder 2 by the ring 36 attached to the cylinder 2. The limbs 32 and 34 are welded or otherwise attached to the ring 36. The puller arms 16 are positioned between each pair of spaced limbs 32 and 34 of the retaining bars.

In the illustrated embodiment of FIG. 3 each limb 32 and 34 is provided with holes 38. Each hole 38 in the upper limb 32 is aligned with a similar hole 38 in the lower limb 34 of the pair. These aligned holes 38 permit insertion of a pin 40 through the limbs 32 and 34 at varying, preselected positions. The inserted pins 40 abut the outer edge of each puller arm 16 and thus define an outer position for the arm 16.

In FIG. 3 the puller jaws 20 are formed separately from the puller arms 16 and then welded to the arms 16. This is both for convenience and economy of manufacturing, but, principally, to define a projection 42. The arms 16 are formed with projections 44, each spaced from a projection 42. The spaced projections 42 and 44 define a channel between them able to receive a jaw adaptor 46, only one of which is shown. The adaptor 46 is formed with limbs 48 and 50 which go around the puller arm 16. The upper limb 48 goes in the channel between the projections 42 and 44 and is able to withstand force applied by the hydraulic ram 4 without being removed from the channel or from the arm 16.

The embodiment of FIG. 3 is used in the same manner as in the embodiment of FIG. 1 subject to adjustment of the pins 40 in the limbs 32 and 34. The pins 40 are conveniently moved from the holes 38 while the puller is adjusted as described above for the FIG. 1 embodiment. When this adjustment is complete the pins 40 are inserted through holes 38 to abut the outer edges of arms 16. Holes 38 are positioned to enable a wide variety of positions for the arms 16. Further, if

necessary, small wedges can be inserted between the pins 40 and the outer edges of arms 16 to take up any slack that may be considered undesirable. Of course removal of the pins 40 may not be necessary. If the bearing to be removed is smaller than the bearing previously removed then the arms 16 are moved inwardly and the pins 40 moved only after the new position for arms 16 has been established. The FIG. 3 embodiment has the advantage that it may be useful where the embodiment of FIG. 1 can not be useful. In particular the use of pin 40 to control the outer positions for the arm 16 means that the puller arm 16 can diverge at a substantial angle and yet there will be no risk of the jaws 20 springing loose from the bearing when force is applied to the shaft by the hydraulic ram 4. The pins 40 prevent the arm 16 moving sideways beyond a predetermined position. If the puller arms 16 diverge at a considerable angle it may be necessary to use an adaptor arm 46 engaged in the channel between the projections 42 and 44. The adaptor 46 used will generally be shaped to ensure that the force exerted on the bearing is parallel to the axis of the bearing rather than being in a direction parallel to the divergent puller arms. The adaptors will be angled in such a way as to compensate for the angle of divergence of the puller arms 16.

The embodiment of FIG. 4 resembles that of FIG. 3 but differs in that the hydraulic cylinder 2 is positioned in a cradle and, as indicated above, in having a strong back made up of one pair of spaced limbs. All parts of FIG. 4 also shown in FIGS. 1 and 3 have the same numbers in FIG. 4. The cradle illustrated in FIG. 4 comprises a front plate 52 fixedly connected to the front of the cylinder 2. Hole 54 in the front plate 52 permits the front part of the hydraulic cylinder and, in particular, the hydraulic ram 4, to project through plate 52. Side plates 56 are attached to the ends of the front plate 52. The limbs 32 and 34 of the retaining bars are attached to the side plates 56 and extend from them. Four bracing arms 58 are attached to the front plate 52. The bracing arms 58 extend rearwardly from the front plate 52. A back plate 60 is attached to the bracing arms 58 and also abuts the rear of the hydraulic cylinder 2. There are further bracing arms 62 extending rearwardly of the back plate 60. Conveniently these bracing arms 62 may be the same bracing arms 58 that extend between the front plate 52 and the back plate 60. There is a retaining plate 64 attached to the bracing arm 62 by the bolt 66. The passage between the back plate 60 and the retaining plate 64 receives the strong back composed of limbs 8 and 10 and fixes the strong back relative to the cylinder 2.

As illustrated in FIG. 5 the puller of the present invention may be mounted on a wheeled trolley comprising a chassis 68 with four wheels 70. The chassis 68 has an upstanding shaft 72 with gear teeth 74 formed on the shaft. There is a worm drive and gear box 76 that engages with the teeth 74 on the shaft 72. An electric motor 78 provides a means to rotate the gears in the gear box 76 and thus move the puller up or down the shaft 72. An electric motor 80 is mounted on the chassis 68 as a primary motor. A hydraulic pump 82 is driven by the primary motor to generate the necessary hydraulic pressure to operate cylinder 2. There are valve means, indicated by a reference to the control lever 84, to control the flow of hydraulic liquid from the hydraulic pump 82 through the hydraulic pipes 6 of the hydraulic cylinder 2. The valve 84 is conventional

and simply directs hydraulic fluid either to drive the hydraulic ram 4 outwardly or inwardly, as desired.

In use the wheeled trolley can be moved simply by pushing to the required location. An electric lead from the motor 80 can be plugged into an outlet. The wheeled trolley may be provided with a switch box and switch. Once the trolley has been moved into position the electric motor 78 can be operated to move the puller to the appropriate level. The ram 4 and the jaws 20 of the puller are then moved into the appropriate position relative to the bearing, as described above. Once the height of the puller has been adjusted to the desired level and the ram and jaws moved to approximately the correct position relative to the bearing, electric motor 80 is started to generate the necessary hydraulic pressure. By operation of the valves 84 the ram is moved to operate the puller and remove the bearing. Once the bearing has been removed, the electric motor 80 is switched off and the trolley moved away to a convenient storage position.

The motor 80 need not be electric. It can be any type of primary motor, for example a gasoline or diesel motor. The electric motor 78 can be a hydraulic motor. The means for moving the puller to the appropriate level, illustrated as worm drive and gear box 76, can also be varied widely by the man skilled in the art.

The illustrated embodiments of the puller of the invention can be varied in a number of ways. The ram 4 can be threaded and thus engaged in a thread in an article to be removed from a shaft. Furthermore, the threading of the ram 4 means that a number of other tools can be screwed onto the ram 4, for example, gripping and hooking tools that can be used to attach to something to be shaped. An important variation is the configuration of the clips 22. It will be appreciated that the pins 28 may be attached, for example welded, in position in holes 26. This reduces the risk of losing the pins 28. Furthermore the clip 22 and pin 28 may be in one piece. That is the pin 28 may be replaced by an integral pin extending from the underside of clip 22. The rings 30 are not necessary in the illustrated embodiments, nor in the above variations. The rings 30 do, however, facilitate movement of the pins or, in the variations, the clips 22 with attached or integral pins.

As indicated, the puller can be used to remove bearings from shafts. It can also be used to remove gears, couplings, wheels and indeed any article mounted on a shaft, depending upon the overall size of the article to be removed compared with the size of the puller. The puller can also be used to shape bars, tubing etc. simply by locating the article to be shaped in the channel between the projections 42 and 44 and pushing against the unsupported part of the article to be shaped with the ram 4.

What I claim is:

1. A hydraulic puller comprising:

- a double acting hydraulic cylinder having a ram projecting from its front end, a piston connected to the ram and reciprocable within the cylinder and means to permit the application of hydraulic pressure to the piston;
- a strong back of spaced limbs extending laterally from each side of the cylinder and fixed relative to the cylinder;
- notches formed in the rear edge of each limb of the strong back, each notch being aligned with a notch on the other limb;

a puller arm positioned between the spaced limbs of the strong back on both sides of the hydraulic cylinder;

a plurality of holes through each puller arm arranged longitudinally, each hole alignable with the notches in the strong back;

pulling jaws at the end of the puller arms positioned to cooperate with the ram when the puller is in use; two clips, each dimensioned to lie across the upper limb of the strong back;

a lug formed on each clip to abut the front edge of the strong back;

engagement means projecting from each clip and positioned so that when the lug on the clip abuts said front edge, the engagement means can pass through a hole in each puller arm to engage a pair of aligned notches in the strong back.

2. A puller as claimed in claim 1 in which the engagement means projecting from each clip comprises a pin, the clip being provided with a hole positioned so that when the lug on the clip abuts said front edge the hole is substantially aligned with a pair of notches in the strong back and the pin can thus be inserted through the hole in the clip and through a hole in a puller arm to engage a pair of aligned notches in the strong back.

3. A puller as claimed in claim 2 in which the pin is attached in position in the hole in the clip.

4. A puller as claimed in claim 1 in which the strong back comprises two pair of spaced limbs, each pair extending laterally from each side of the cylinder, and fixed relative to the cylinder.

5. A puller as claimed in claim 1 including retaining bars for the puller arm positioned forward of the strong back and comprising two pairs of spaced limbs extending laterally from each side of the cylinder and fixed relative to the cylinder, the puller arms each being positioned between each pair of spaced limbs of the retaining bars.

6. A puller as claimed in claim 3 in which each pair of spaced limbs of the retaining bar is formed with aligned holes to permit insertion of a pin through the two limbs of the pair at varying, preselected positions, each inserted pin abutting the outer edge of each puller arm to define an outer position for the arm.

7. A puller as claimed in claim 1 able to receive jaw adaptors by having spaced projections formed at the end of each puller arm. The projections on each arm defining a channel between them able to receive a jaw adaptor.

8. A puller as claimed in claim 1 in which each pin is formed with a finger grip.

9. A puller as claimed in claim 5 in which the hydraulic cylinder is positioned in a cradle comprising a front plate fixedly connected to the front of the cylinder;

a hole in the front plate to permit at least the ram to project;

side plates attached to the ends of the front plate and having the retaining bars attached to them and extending from them;

a plurality of bracing arms attached to the front plate and extending rearwardly;

a back plate attached to the bracing arms and abutting the rear of the hydraulic cylinder;

a plurality of bracing arms extending rearwardly of the back plate;

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a retaining plate attached to the bracing arms extending rearwardly of the back plate to form a passage to receive the strong back.

10. A puller as claimed in claim 5 in which the hydraulic cylinder is formed with encircling rings adjacent the front and the rear of the cylinder and the strong back comprises two pairs of spaced limbs, each pair extending laterally from each side of the cylinder and attached to the encircling ring adjacent the rear of the cylinder and in which the retaining bars for the puller arms extend laterally from each side of the front encircling rings.

11. A puller as claimed in claim 1 on a wheeled trolley to permit easy movement of the puller, the trolley comprising a chassis having an upstanding shaft with gear teeth formed on it;

gear means engageable with the gear teeth in the shaft attached to the hydraulic cylinder;
means to rotate the gear means and thus selectively move the puller up or down the shaft;
a primary motor on the trolley;
a hydraulic pump driven by the primary motor;
valve means to control the supply of hydraulic liquid from the hydraulic pump to the means to permit the application of hydraulic pressure to the piston of the hydraulic cylinder.

12. A puller as claimed in claim 11 in which the primary motor is an electric motor and in which the trolley includes a switch box.

13. A puller as claimed in claim 11 in which the means to rotate the gear means is an electric motor.

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