Sept. 22, 1964 C. V. ADAMS 3,149,851

PULLING ADAPTER

Filed Dec. 29, 1960 2 Sheets-Sheet 1

Fig. 1

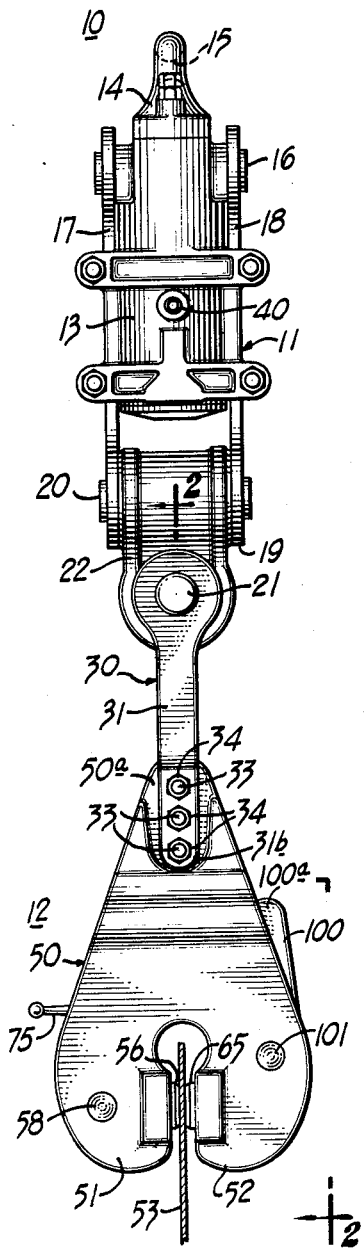


Fig. 2

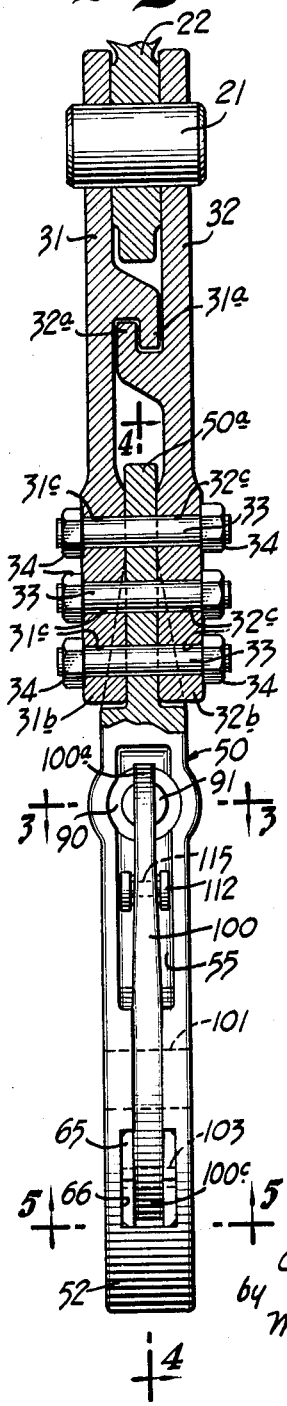
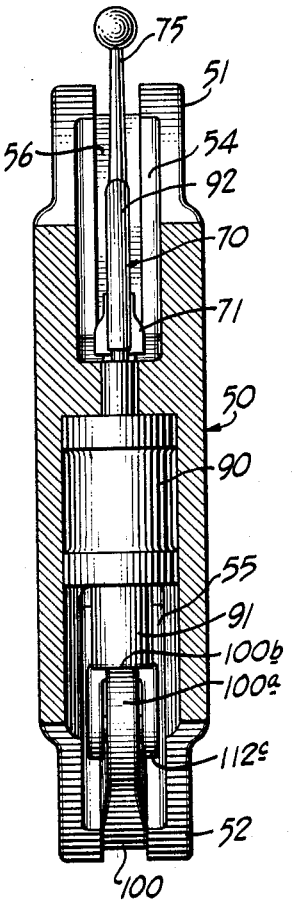


Fig. 3



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Filed Dec. 29, 1960 2 Sheets-Sheet 2

Fig. 4

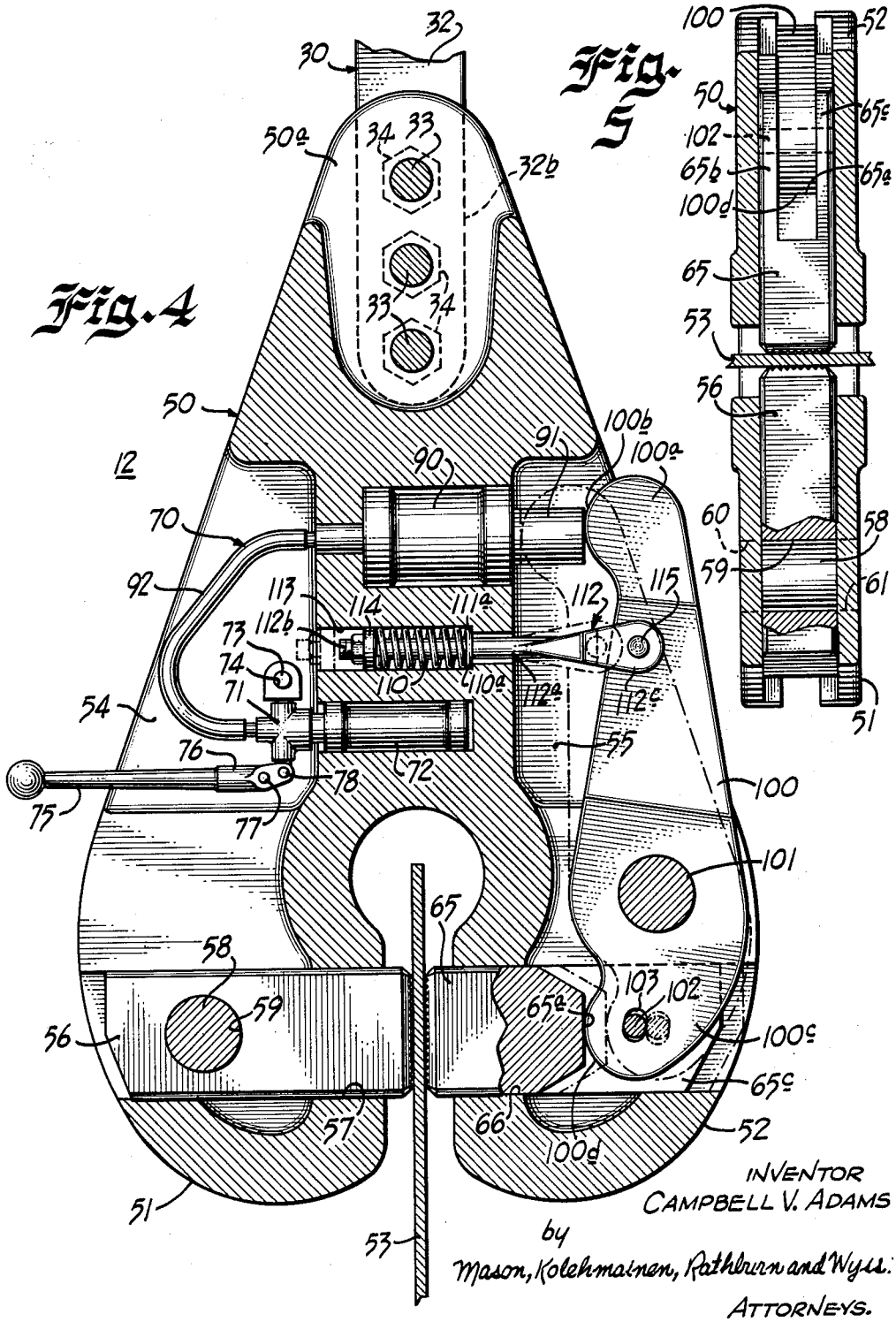

Fig. 5

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PULLING ADAPTER

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This invention relates to pile pulling, and, more specifically, to an improved pulling adapter for pulling piles, and particularly adapted for use with a pile extractor.

Pile clamps or adapters for extractors of the type adapted for pulling steel, wood, concrete, H-beams, pipe and like piles are well known. One common method of pulling piles includes a means for exerting pull upon the pile by means of a crane or like device. While it is known to apply a constant pull to the pile, such a method is very slow and a tremendous force is required thereby necessitating a large crane and associated apparatus at a substantial cost. It is therefore well known to superimpose an extracting hammering force to the pile. This is readily accomplished by applying the pulling force through a pile extractor which is operable from a source of fluid energy to actuate a ram to produce pile extracting blows superimposed on the pulling force.

In a typical installation the pile extractor is hung on the crane pull line so that the pulling force is transmitted through the extractor to a pile clamp or pulling adapter secured to the extractor and adapted to be secured to the pile. The pulling adapter may engage the pile in various ways, such as, for example, it may be bolted thereto. Pulling adapters are known to comprise means for clamping the adapter to the pile; however, such pulling adapters generally use the pulling force to clamp the adapter to the pile. While such an arrangement may be satisfactory where a constant pulling force is applied, in the above-described ram type of pile extractors the pulling load applied to the pile through the pulling adapter does not remain constant and difficulty has been experienced in that the variations in the pulling force do not permit the clamping means to be held uniformly and tightly against the pile. Moreover, even though the above-described prior known adapter is employed with a constant pulling device, as the pile is withdrawn the pulling force on the pile decreases so that the clamping force on the adapter will continuously vary. Therefore, while the present invention is particularly advantageously used with pile extractors, it is equally applicable to pile pulling with a constant pulling load.

Therefore, it is desirable to provide an improved pulling adapter with means for clamping the adapter to the pile independent of the pulling force.

A further object of the present invention is to provide a pile extractor having an improved pulling adapter for connection to a pile.

A further object of the present invention is to provide an improved pulling adapter for use with a pile extractor.

A still further object of the present invention is to provide an improved pulling adapter for use with a power extractor wherein there is provided a clamping force independent of the pulling force applied to the adaptor.

Further objects and advantages of the invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Briefly stated, in accordance with the invention, a pulling adapter for applying a pulling force to a pile is adapted to transmit the pulling force to the pile and is provided with means for clamping the adapter to the pile. A clamping force is provided to the clamping means which is independent of the pulling force. The pulling adapter, according to the instant invention, is particularly advantageously applied to a pile extractor of the type including a fluid operated ram which is operable to provide pile extracting blows transmitted to the pulling adapter and superimposed upon the pulling force.

The nature of the invention will best be understood when described in connection with the accompanying drawings, in which:

FIG. 1 is an elevational view illustrating a pile extractor containing the improved pulling adapter according to the present invention;

FIG. 2 is an elevational partial side sectional view taken along plane 2—2 of FIG. 1;

FIG. 3 is a cross sectional view of the improved pulling adapter taken along section 3—3 of FIG. 2;

FIG. 4 is a sectional elevational view of the improved pulling adapter taken along plane 4—4 of FIG. 2; and

FIG. 5 is a cross sectional view of the improved pulling adapter taken along plane 5—5 of FIG. 2.

Referring to FIG. 1, a pile extractor 10 for applying a pulling force to a pile includes a fluid operated ram shown generally at 11 and a pulling adapter according to the present invention shown generally at 12. The fluid operated ram 11 is of a known type and need not be fully herein described; one suitable pile extracting ram is described in U.S. Patent No. 1,736,104. However, briefly, the fluid operated ram 11 includes a cylinder assembly 13 containing the operating parts of the ram. A lifting cap 14 having an eyelet opening 15 is provided at the top of the cylinder assembly 13. The lifting cap 14 is adapted to be connected to the crane pull line, as heretofore described so that a pulling force may be applied to the pile extractor. Near the top of the top of the cylinder assembly is an anvil 16 supporting a pair of side bars 17, 18. A crosshead assembly 19 is connected to the other end of the side bars 17, 18. The crosshead assembly 19 includes a pair of pins 20, 21 and a crosshead member 22. The first pin 20 passes through the crosshead member 22 and is secured to the side bars 17 and 18. The second pin 21 passes through the crosshead member 22 axially displaced from the pin 20 and at a right angle thereto. The crosshead assembly 19 thereby constitutes a universal joint which has the advantages that the pile may be laid down flat while the extractor remains hanging in a vertical position so as to facilitate disengagement of the extractor from the extracted pile. Also connected to the lower pin 21 is a connecting link assembly 30 including the connecting links 31 and 32 (FIG. 2). The connecting link 31 contains a downwardly projecting tongue 31*a*; the connecting link 32 contains an upwardly projecting tongue 32*a* which cooperates with the downwardly projecting tongue 31*a* to form a tongue and groove type of connection and to hold the connecting links 31 and 32 in spaced relation. The lower ends of the connecting links 31 and 32 each contain an enlarged portion 31*b*, 32*b*, respectively, which together form a pair of spaced projections on the connecting link assembly 30 adapted for securing the pulling adapter 12. The projections 31*b*, 32*b* each contain a plurality of aligned openings 31*c*, 32*c*, respectively, through which pass a plurality of connecting link pins 33. Each end of these connecting link pins 33 is threaded for receiving a locking member or nut 34. The fluid operated ram 11 contains means such as a threaded aperture 40 for supplying operating fluid such as compressed air or steam to the cylinder assembly 13 of the ram 11 thereby to actuate the ram 11 to exert pile extracting blows against the anvil 16. Such blows are superimposed upon the pulling load which is applied to the ram 11 through the eyelet 15 and are transmitted to the pulling adapter 12 through the connecting link assembly 30, crosshead assembly 19, and side bars 17 and 18.

Referring now specifically to the pulling adapter 12,

and particularly to FIG. 4, the pulling adapter 12 includes a jaw-shaped frame or yoke 50 having a tang portion 50*a* secured to the connecting link assembly 30 by means of the connecting link pin 33. The yoke 50 contains a pair of spaced jaw members 51 and 52 adapted to be freely positioned around a pile 53 to be pulled with cored-out or hollow portion 54, 55 above each jaw member 51, 52 respectively. One of the spaced jaw members 51 contains a fixed gripping jaw 56 extending through a longitudinal aperture 57 in the jaw member 51 and held in fixed position by a jaw pin 58 passing through an opening 59 in the gripping jaw 56 and through a pair of transverse openings 60 and 61 in the sides of the wall of the jaw member 51. The pin 58, however, is readily removable and the gripping jaw 56 is thereby readily replaceable or interchangeable so that the gripping jaw 56 may be of various lengths, thereby permitting the centering of the pile 53 in the yoke 50 regardless of the thickness or diameter of the pile 53.

For the purpose of clamping the pile 53 between the jaw members 51 and 52, the second jaw member 52 is provided with a movable gripping jaw 65 slidably positioned in a longitudinal aperture 66 in the jaw member 52. The gripping jaws 65 and 56 are relatively movable; the movable gripping jaw 65 being movable toward or away from the fixed gripping jaw 56 to thereby clamp or release the pile 53. It is to be understood that although only one of the jaws 56, 65 has been illustrated as movable for purposes of clarity, obviously both of the jaws 56, 65 could be made movable if desired.

For the purpose of applying a clamping force on the movable gripping jaw 65 independent of the pulling force, there is provided a fluid assembly 70 such as, for example, a hydraulic assembly. The assembly 70 includes a hydraulic pump and reservoir assembly 71 inserted in a longitudinal hole 72 in the yoke 50 and held by a pin 73 passing through an aperture 74 in the bottom of the assembly 71, thereby removably securing the pump and reservoir assembly 71 in the yoke 50. In this manner the pump and reservoir assembly 71 may be removed for purposes of servicing. Moreover, the pump and reservoir assembly 71 may be located at some distant point from the jaw frame 50 so that, if desired, the pump may be automatically actuated rather than manually actuated. With the pump and reservoir assembly 71 located in the yoke 50, as shown, it is convenient to have the pump manually operable through a removable handle 75 which is removably insertable in a bore in a pump actuator 76. Removal of the handle 75 during the pulling operation prevents possible damage thereto. The pump actuator 76 is pivotally mounted about a pin 77 to actuate the pump piston and connecting rod assembly 78. A hydraulic cylinder and piston assembly 90 is provided for transferring the hydraulic pressure created by the pump and cylinder assembly 50 to the movable gripping jaw 65. Although the cylinder and piston assembly 90 has been illustrated as single-acting, it is obvious that it could be made double-acting if both of the jaws 56, 65 were movable. The cylinder and piston assembly 90 has a piston rod 91 extending from one end thereof. A hydraulic conduit 92 interconnects the pump and cylinder assembly 70 and the cylinder and piston assembly 90. The pump and cylinder assembly 70 is provided with a hydraulic release valve incorporated therein and actionable by the movement of handle 75 for releasing the hydraulic pressure in the hydraulic cylinder and piston assembly 90 thereby to release the grip of the jaws 56 and 65 on the pile 53.

To transfer the clamping force developed by the cylinder and piston assembly 90 to the movable jaw 65, there is provided a rocker arm 100 pivotally mounted in the opening 55 of the jaw member 52 by a transverse pin 101. The piston rod 91 engages one end 100*a* by engagement with the cam surface 100*b* thereof. The other end 100*c* of the rocker arm 100 is cooperable with a cam surface 65*a* of the movable jaw 65 so that the clamping force exerted by the piston rod 91 is transferred to the movable jaw 65. The pivot pin 101 is located along the rocker arm 100 closer to its end 100*c* engaging the movable arm 65 than to its end 100*a* engaging the piston rod 91. In this manner a mechanical advantage is developed by the rocker arm 100 so that a substantially greater clamping force is developed by the movable jaw 65 than is exerted by the piston rod 91. Moreover, the rocker arm 100 is secured to the movable jaw 65 by engagement of a pin 102 secured to a pair of spaced wall extensions 65*b* and 65*c* of the movable jaw 65, the pin 102 passing through a slot 103 in the rocker arm 100. The engagement of pin 102 with the sides of the slot 103 permits clamping loads to be transferred between the rocker arm 100 and the movable jaw 65 through surfaces 100*b* and 65*a* and at the same time minimize the lost motion between the rocker arm 100 and the movable jaw 65 upon release of the clamping force.

In order to release the clamping force of the jaws 56 and 65 when the hydraulic pressure in the hydraulic cylinder and piston assembly 90 is released, there is provided biasing means to return the rocker arm 100 and movable jaw 65 to a released position. The biasing means includes a compression spring 110 positioned in a bore 111 in the yoke 50 and having one end 110*a* thereof against a shoulder 111*a* of the bore 111. Passing through the bore 111 and compressing the spring 110 is an eye-bolt 112 having a shank 112*a* threaded at one end 112*b* and containing a fastening member such as a nut 113 and a washer 114. The eyebolt 112 is provided with an eye end 112*c* pivotally connected to the rocker arm 100 through pin 115. The spring 110 is in compression between the shoulder 111*a* and washer 114 secured on the shank 112*a* of the eyebolt 112; the compression spring 110 thereby always biases the rocker arm 100 and movable jaw 65 toward a released position.

Having thus described the pulling adapter 50, its operation will now be explained. The pile extractor 10 including the pulling adapter 12 is lowered over a pile 53 with removable jaw 65 in a retracted position. The fixed jaw 56 has been pre-selected of proper length so that the thickness or diameter of the pile 53 has been accounted for and the pile 53 will geometrically be located in the center of the pulling adapter 12 when it is gripped by the jaws 56 and 65 thereof. With the spaced jaw members 51 and 52 around the pile 53, but not engaging the pile 53, the movable jaw 65 is moved toward the fixed jaw 56 so as to securely clamp the pulling adapter 12 to the pile 53. The clamping force is applied to the movable jaw 65 by actuation of the pump and cylinder assembly 70, and, specifically, manually by the operation of the handle 75. It is to be understood, however, that the pump may be actuated automatically from a power take-off of the crane or otherwise. The hydraulic pressure is transmitted through the conduit 92 to the cylinder and piston assembly 90. The released position is illustrated in phantom in FIG. 4. The hydraulic pressure in the cylinder and piston assembly 90, however, moves the piston 91 to the right, as viewed in FIG. 4, rotating the rocker arm 100 clockwise about the pivot pin 101. The camming surface 100*d* then engages the camming surface 65*a* of the movable jaw 65 to bring the jaws 56 and 65 securely into clamping engagement with the pile 53. It may be desirable, but not necessary, that the jaws 56 and 65 have serrated or deformed surfaces so as to better grip the pile 53.

With the pulling adapter 12 securely clamped to the pile 53, a pulling force can now be applied to the pile 53. The pull cable of a crane or like device is secured to the eyelet opening 15 of the lifting cap 14 of the fluid operated ram 11 and this force is transmitted through the side bars 17 and 18, crosshead assembly 19, connecting link assembly 30, and pulling adapter 12 to the pile 53. A source of fluid energy such as the aforementioned com-

pressed air or steam is connected to the threaded aperture 40. As is well known, the fluid operates the ram 11 to produce pile extracting blows against the anvil 16. The force of these blows is transmitted to the pile 53 and superimposed upon the pile pulling force through the side bars 17 and 18, the crosshead assembly 19, connecting link assembly 30 and pulling adapter 12 to the pile 53. In certain extremely difficult cases where a very large pulling force is required, it may be desirable to apply some of the pile pulling force directly to the pile rather than through the pile extractor 10.

Once the pile 53 has been withdrawn, it may be readily released from the pulling adapter 12. The pile 53 may be laid down and, due to the action of the universal operating crosshead assembly 19, the fluid operated ram 11 may be held vertically by the crane cable while the pulling adapter 12 lies with the pile 53. Release of the pressure in the cylinder assembly 90 causes the piston 91, rocker arm 100, and movable jaw 65 to be biased from the position shown in solid in FIG. 4 to the position shown in phantom in FIG. 4 through the action of the compressed spring 110 and eyebolt 112. Movable jaw 65 is withdrawn from engagement with the pile 53 through the engagement of the pin 102 with the side of the slot 103 of the rocker arm 100. The pile extractor including the pulling adapter 12 may now be removed from the pile and is ready for application to another pile.

As is readily appreciated, the improved pulling adapter provides for a clamping force independent of the pulling force applied to the pile, thereby producing the aforementioned advantageous results. The improved pulling adapter constantly clamps the pile 53 independently of the pulling force exerted thereon. Moreover, the jaws 56 and 65 are readily adaptable to engage piles 53 of various thicknesses or diameter.

While certain preferred embodiments of the invention have been described by way of illustrations, many modifications will occur to those skilled in the art. It is therefore understood that it is intended in the appended claims to cover such modifications as fall within the true spirit and scope of the invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A pulling adapter for applying a force to a pile comprising a yoke having a pair of spaced jaw supporting members adapted to be freely positioned around the pile, a fixed gripping jaw positioned in one of said jaw supporting members, another gripping jaw relatively movable with reference to the first-mentioned jaw and positioned in the other of said jaw-supporting members, means mounted on said yoke for moving said jaws relative to each other to securely grip said pile including fluid operated means, and means connected to said fluid operated means for applying said force to said other gripping jaw.

2. The pulling adapter of claim 1 wherein said means for moving said jaws relative to each other includes means for producing a fluid pressure, piston means mounted on said yoke movable by said pressure to produce a clamping force, and a rocker arm pivotally mounted on said yoke having one end engaging said piston means and having the other end in engagement with said other gripping jaw for transferring the clamping force to the jaw.

3. A pulling adapter as set forth in claim 2 wherein said means for producing a fluid pressure comprises a manually operable hydraulic pump and reservoir assembly within said yoke.

4. A pulling adapter as set forth in claim 2 and additionally including biasing means biasing said jaws into a released position.

5. A pulling adapter for applying a force to a pile comprising a yoke having a pair of spaced jaw supporting members adapted to be freely positioned around the pile, said yoke having hollow means above each jaw-supporting member and provided with a pair of aligned jaw-carrying apertures in said jaw supporting members communicating with said hollow means, a fixedly positioned gripping jaw positioned in one of said jaw-carrying apertures, a movable gripping jaw relatively movable with reference to the first-mentioned jaw and slidably positioned in the other of said jaw-supporting members, hydraulic cylinder means mounted within said hollow means and including a piston rod, means for applying hydraulic loads to said cylinder means to hydraulically control movement of said piston rod, a rocker arm within said hollow means between said piston rod and said movable gripping jaw and pivotally mounted to said yoke intermediate its length at a point closer to said movable jaw than to said piston rod, each end of said rocker arm being provided with a cam surface, one of said cam surfaces being engageable by said piston rod and the other being engageable with said movable jaw whereby movement of said piston rod is effective to apply a gripping force to said movable jaw through said rocker arm.

6. A pulling adapter as set forth in claim 5 wherein there is provided a pin secured to spaced wall extensions of said movable jaw and extending through a slot in said rocker arm.

7. A pulling adapter as set forth in claim 6 including biasing means biasing said jaws into retracted position.

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