

IMPROVEMENTS IN AND RELATING TO APPARATUS FOR PILE DRIVING

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The present invention relates to improvements in and relating to apparatus for pile driving and in particular to improvements to pile driving apparatus where hydraulic means are employed to drive piles.

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Apparatus for driving piles have been in existence for a long time. Hydraulically powered pile driving apparatus is also known to the art. In one prior art apparatus there is disclosed a pile driving apparatus which includes a slidable drive head mounted across the vertical frame and the outer side of the drive head is adapted to receive pile structure and/or a dolly. The inner side of the drive head is adapted to receive an end of a hydraulic ram wherein the drive head is driven by hydraulic means mounted beneath the drive head to drive a pile into the ground. The apparatus includes only one hydraulic ram.

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In pile driving apparatus where only one hydraulic ram is included suffer disadvantages. As the pile driving apparatus is generally mounted onto a base frame, it is often necessary to use a dolly to drive the pile further down into the ground before another pile structure is placed above the first pile structure and is then driven into the ground. Thus as every pile is driven into the ground, a dolly has to be used. This method is slow and time-consuming and involves a lot unproductive labour in positioning the dolly onto the frame and thereafter removing the dolly.

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Therefore, it is a primary aim of the present invention to provide a pile driving apparatus to eliminate or substantially eliminate the use of dollies in driving more than one pile at a given pile point.

It is another aim of the present invention to provide a pile driving apparatus wherein the pile structure can be driven continuously.

To achieve the above mentioned aims there is provided an apparatus for pile driving which includes a vertical framework mounted onto a base framework. The vertical framework includes at least two vertical guide members jointly to receive and enable a drive head to move vertically upwards and downwards along the guide members. At least two hydraulic units are secured to the opposite terminal ends of the drive head and at least one third hydraulic unit is secured to the mid portion of the drive head with the ram of the third hydraulic unit extending through an aperture in the drive head. The invention further includes a guide means to receive and enable the hydraulic unit to move vertically upwards and downwards. This guide means can preferably be the same set of guide members as for the drive head or alternatively can be an independant unit or set of guide members.

The terminal ends of the rams of the first and second hydraulic units are mounted beneath the drive head and the mouth region of the cylinder of the third hydraulic unit is mounted above and secured to the drive head.

According to this invention, a pile is introduced into the ground by the downward force of the drive head caused by the retracting the rams of the first and second hydraulic units. The now partially driven pile is further introduced into the ground by extending the ram of the third hydraulic unit.

The hydraulic units are operated by conventional means known to the art.

Other and further aims of the present invention will be apparent from the following description and claims taken in conjunction with the accompanying drawings which by way of illustration show preferred embodiments of the present invention and the principles thereof and what are now considered to be the best modes contemplated for applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention as defined by the appended claims.

The invention will be described by reference to the following drawings wherein :-

Fig. 1 is a front diagrammatic view of a pile driving apparatus according to the present invention;

Fig. 2 is a diagrammatic view of the side of the pile driving apparatus of Fig.1, details of the base frame and cantilever having been omitted, wherein the third hydraulic ram is in a non-operative position;

Fig. 3 is a diagrammatic view of the side of the pile driving apparatus in Fig.2, wherein the third hydraulic ram is at a ready to operate position;

Fig. 4, is a diagrammatic view of the side of the pile driving apparatus of Fig. 2, wherein the third hydraulic ram is at an extended position;

Fig. 5 is a section across line A-A of the embodiment shown in Fig. 1; and

Fig. 6 shows a diagrammatic view of an alternative embodiment of the invention which includes a separate pair of guide means for the third hydraulic means.

- 5 The apparatus for pile driving (1) (Fig. 1) has a vertical frame (2) mounted onto a base frame (4). The base frame (4) comprises of a horizontal platform (6) to receive a weight means (8), preferably cement blocks, to bias against the driving force applied at the vertical frame. The base frame is preferably movably mounted onto wheels (10) or other suitable moveable mounting means.
- 10 The base frame also advantageously includes means to position the base frame at a required angle, such means to include hydraulically powered jack means connecting the vertical frame (2) and the base frame.

- The vertical frame (2) includes at least two guide members (2a, 2b). Each
- 15 guide member includes a longitudinal slit (14) preferably at the mid portion of the guide member to accommodate a drive head (16). The drive head consists of one longitudinal member extending between the longitudinal slits of both the guide members (2a, 2b). To strengthen the vertical frame, the top portion and the lower portion of the frame is joined together by suitable
- 20 means preferably a cross bar member (17) secured by welding. Each guide member (2a, 2b) is preferably of "I" shaped rigid material, preferably of steel, with a slit opening (14) at the centre of the vertical limb. This provides a steady and rigid configuration and prevents buckling under increased compression forces.

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Each guide member (2a, 2b) includes two chambers (18, 32) with a longitudinal slit along the mid portion of the guide member (2). The drive head (16) includes a vertical plate (36) mounted across the slit (14). On

either side of the vertical plate are fixed at right angles two horizontal plates, one of which is secured to a hydraulic ram (24a). The other horizontal plate (38a, 38b) is secured to the third hydraulic chamber (46). Advantageously frictional plates (34) are securely fastened on either side of the vertical limb (28). These frictional plates can be mild steel plates.

In the chamber (40), formed by the "L" plates (30a, 30b, 30c, 30d) and the vertical limb (28), is included a vertical plate (42) for further securely positioning and guiding the vertical plate (36) in the vertical frame (2).

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To fasten more securely the vertical frame (2) to the base frame (4), support beams can be attached between the vertical frame and the base frame.

15 Two hydraulic drive means, preferably including telescopic plunger means, an hydraulic pump and control valve means are mounted immediately adjacent to the back of the vertical frame (2). The free end of the hydraulic ram (24a, 24b) is fastened to the horizontal plate (38) of the drive head (16). It is preferred that the hydraulic ram (24a, 24b) be positioned inside the chamber
20 (32).

A third hydraulic drive means (46) preferably including telescopic plunger means, hydraulic pump and control valve means is mounted in the opposite direction to the first two hydraulic rams. The basal region of the third
25 hydraulic means (46) is secured, preferably by nut and bolt means to the drive head member (16). The details of the hydraulic pump and control valve means are not illustrated as they are quite obvious. At least two pairs of support brackets (48,50) are secured to hydraulic chamber, one pair at

the upper region and another pair at the lower region of the hydraulic chamber. The terminal ends of each pair of brackets are designed and structured to fit into the longitudinal slit (14) in the vertical frame (2) so as to be slidable along the slits. As stated earlier the lower portion of the third hydraulic drive means (46) is securely fastened to the drive head member (16). A annular bore (52) is included in the mid-portion of the drive head. The head of the third hydraulic ram (25) is introduced through the annular bore (52) and in a position vertically above the pile structure to be driven.

The working of the invention will now be described. The apparatus is positioned at the place where the pile is to be driven. If necessary, the position being registered at the spot by immobilising the wheels on the base frame (4). The drive head is lifted to a position above the upper end of the pile structure (20) by extending the hydraulic rams (24a, 24b). The pile (20) is then placed below the ram (25) of the third hydraulic means. The drive head (16) is then moved downwards by actuating the hydraulic rams (24a, 24b). The downward movement of the hydraulic rams (24a, 24b) pulls the drive head downwards, thereby moving the pile (20) downwards into the ground. The third hydraulic drive means (46) is passively pulled downwards by the drive head (16). As the hydraulic drive means (46) is secured to support brackets (48,50) the hydraulic drive means (46) is moved slidingly along the vertical frame.

When the first and second hydraulic ram are completely withdrawn into the hydraulic cylinders, the third hydraulic means (46) is actuated (Fig 3), thus driving the pile (20) further into the ground. Once the hydraulic ram of the third hydraulic drive means (46) is completely extended to drive the pile further down, it is then retracted. The hydraulic rams (24a, 24b) are then

extended to the starting position. It will be noted that the third hydraulic drive means is moved upwards to its starting position (see Fig. 2) when the drive head (16) is moved upwards.

5 The next pile to be driven into the ground at the same spot as the first pile is placed in position. That is that once the first pile is driven into the ground, a second pile can be placed on the first pile and be driven into the ground by repeating the process described as before. Advantageously the ends of sections can be securely fastened together by conventional means,
10 e.g. welding the steel end plates of the piles together. It will be obvious that piles of ranging lengths can be driven.

After the required number of piles are driven at a given point, it may be necessary to use a dolly to drive the portion of the last pile above the
15 ground. After the last pile is driven into the ground, the hydraulic ram of the third hydraulic drives means (46) is retracted, the drive head is moved to the starting position by extending the hydraulic rams (24a, 24b). A dolly of appropriate length is then placed above the protruding pile. The drive head is moved down to a desired height and the hydraulic ram of third
20 hydraulic derive means (46) is actuated and is driven into the ground to the designed depth.

The hydraulic cylinder of the third hydraulic drive means (46) can be locked in position along the vertical frame (2) by suitable locking means, when hydraulic ram is actuated. This will eliminate or reduce the tendency for this drive head (16) to pull up the hydraulic rams (24a, 24b).

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The pile apparatus (1) is then moved along the rails to another position at which it is desired to drive a pile or piles.

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From the foregoing description it is clear that piles can be driven continuously into the ground, without the need to use a dolly until the last pile at a given point is to be driven.

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Although the pile apparatus described and illustrated includes two hydraulic drive means to pull the drive head down and one hydraulic drive means to push the pile structure down, the invention can be modified further. For example there can be additional hydraulic drive means to pull the drive means down and advantageously additional hydraulic drive means to push the pile structure down. For example, there can be two pairs of hydraulic drive means to pull the drive head down and another pair of hydraulic drive means to push the pile down thereafter. Furthermore, there could be a pair of guide means for the first and second hydraulic means and another separate pair of guide means for the third hydraulic means, as shown in Figure 6.

It will of course be understood that the present invention is described above purely by way of example, and that modifications of detail can be made within the scope of the invention.

CLAIMS

1. An apparatus for pile driving comprising a vertical framework mounted on a base framework, characterised in that the vertical framework includes at least two vertical guide
5 members jointly to receive and enable a drive head to move vertically upwards and downwards along the guide members; at least two hydraulic units are secured to opposite ends of the drive head; at least one third hydraulic unit is secured to a mid portion of the drive head with the ram of
10 the third hydraulic unit intending through an aperture in the drive head; a guide means is provided to receive and enable the third hydraulic unit to move vertically upwards and downwards; the terminal ends of the rams of the first and second hydraulic units are mounted beneath the drive
15 head and the mouth region of the cylinder of the third hydraulic unit is mounted above and secured to the drive head; wherein a pile can be introduced into the ground by a downward force of the drive head, caused by retracting the rams of the first and second hydraulic units, and the
20 partially driven pile can be further introduced in to the ground by extending the ram of the third hydraulic unit.
2. An apparatus as claimed in Claim 1, wherein locking means are provided for locking the third hydraulic unit in position when the rams of the first and second hydraulic
25 units have been retracted.
3. An apparatus as claimed in Claim 1 or Claim 2, wherein the two vertical guide members for the drive head act also as the guide means for the third hydraulic unit.
4. An apparatus as claimed in any preceding claim, wherein
30 four hydraulic units are secured to the terminal ends of the drive head and two hydraulic units are secured to the mid portion of the drive head.
5. An apparatus for pile driving substantially as hereinbefore described with reference to and as shown in
35 Figures 1 to 5 or Figure 6 of the accompanying drawings.



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