A method for pile-driving and a ram head for fixation of a hammer assembly in relation to a pile.

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References cited:
WO-A-88/05844
GB-A-26073
US-A-2931186
US-A-4653595
DE-C-659274
GB-A-1409188
US-A-4479552

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Description

The present invention relates to a method for pile-driving and to a ram head for fixation of a hammer assembly in relation to a pile to be driven by means of the hammer assembly.

Pile-driving is a well-known technique for placing many different forms of foundations in the ground. Piles are today often made of concrete and are often produced under industrial conditions in a factory, and very effective machinery for pile-driving is available nowadays, so that the driving can be carried out quickly and effectively on site. Modern pile-drivers are provided with a hammer assembly, or ram, and a slide guide, called the loader, which is arranged along the pile driving direction, for example vertically or almost vertically. A modern and very effective hammer assembly comprises an elongate unit being placed on top of the pile in extension of the axis thereof, which unit by means of hydraulically supplied power throws an internal weight upwards and allows it to drop in order to perform the ramming. The hammer assembly follows the pile downwards during the ramming, so that the drop height and frequency of the weight need not be dependent on the actual driving depth of the pile. The pile top must, of course, be guided in relation to the hammer assembly, so that the pile is hit squarely on the top, and this is suitably achieved by means of a sort of holding mechanism arranged in the form of a so-called ram head. Normally, an intermediate plate or impact piece is placed between the hammer mechanism and the pile top, said intermediate plate or impact piece being of a material such as for example wood or plastic which may, to some degree, cushion the blows.

In the case of piles made of a material of some friability, such as concrete, there is a risk of impact damages on the top which will disfigure the appearance of the pile, although it is normally possible to hit the piles so gently that the damages will be of no importance for the load-bearing capacity or strength of the pile. For this reason, driving of concrete piles is at present not very often used at places where the pile top will remain visible, and if, nevertheless, this technique is used, it is anticipated that there will be a need for a refinishing of the pile top.

US patent no. 2,931,186 discloses a ram head which may be adapted for the driving of different kinds of piles. This ram head is in the form of a cap or a cup turned so that the opening is oriented downwards. In order to adapt this ram head for the driving of concrete piles, a filler pad is placed inside the cup so as to provide a planar, smooth lower surface inside the cup and a cushion pad is interposed between the filler pad and the pile top. The edge of the cup projects downwards so as to enclose the filler and cushion pads and part of the pile top. Practical experience with ram heads of kinds similar to that of US patent no. 2,931,186 has revealed that in cases of heavy hammering through this type of ram head onto a large pile made of a material of some friability, such as concrete, damage to the pile top edges is generally unavoidable. The reason for the damage to the pile top edges is believed to be the comparatively lower structural strength of the pile top surface in regions near the edges combined with the fact that the impact piece is severely deformed or completely mashed, expanding transversely and adapting to any non-planeties of the surfaces enclosing it, so that, regardless of its initial size and shape, it will end up covering the entire area of the pile top surface distributing the impact force from further hammer blows evenly all over the pile top surface including the above-mentioned regions of lower strength.

WO-A-8805844 discloses a silencer for pile rammers comprising a drop load, an impact piece and a guide cylinder for maintaining the alignment of the drop load relative to the impact piece. The document is silent regarding how to maintain the alignment of the impact piece relative to the pile. Nor does this document mention anything about the relative sizes of the surfaces of contact between the impact piece and the pile top surface.

DE-C-659274 discloses a hammer assembly for pile ramming with leaf springs for connecting the hammer assembly to the pile. The leaf springs have pivots in both ends, and the connection to the pile is established by pivotable fittings connected to a tensioning bolt extending across the pile through a transverse bore. The document does not mention anything about the relative sizes of the surfaces of contact between the hammer assembly and the pile top surface. The leaf springs are adapted to exert a tensioning force biasing the hammer assembly towards the pile top surface, while they can hardly be believed to be able to resist a transverse displacement, and the leaf springs can, therefore, not be expected to be effective in maintaining the alignment of the hammer assembly relative to the axis of the pile.

The invention provides a ram head adapted for receiving impact pulses produced by a hammer assembly and for transmitting the impact pulses through an impact piece and into the top surface of a pile with the purpose of driving said pile into the ground or into a similar substance, said ram head comprising guiding means with surfaces adapted for facing side faces of the pile over contact areas on the pile sides in a distance from the top edges of the pile, said ram head comprising a bottom plate provided with a collar projecting axially from said bottom plate in the direction towards the in-
tended position of the pile, said collar receiving a deformable impact piece for confining it within a defined area, said guiding means being adapted for maintaining the alignment of said ram head relative to the axis of the pile, said ram head being characterized in that said collar is enclosing the impact piece and is arranged in a manner, with relation to said guiding means, so that the impact piece is kept away from the edge zones of the pile top surface, when the pile is held by said guiding means.

Hereby, the impact pulses act only upon a defined area of the pile top surface not extending to the edges, while the edge zones are kept free from the action of the hammer. The result is that piles of a relatively friable material, such as concrete, can be driven without any damages to the top edges of the pile.

According to an advantageous embodiment of the invention, a ram head is provided as stated in Claim 2. It is hereby achieved that such a pile can be driven without damage to the side edges, even if the pile material is relatively friable.

It should be mentioned that there are limits to the accuracy with which piles maybe placed so that certain disadvantages have to be accepted, such as slight displacements and angular deviations of the piles. Also, in the case of piles with longitudinal edges, f. ex. piles of rectangular shape, there is a risk of turning the pile during driving.

The risk of displacement, angular deviation or turning furthermore has the effect that driven piles cannot readily be used for masts which must be positioned very accurately. If they were to be used for this purpose there would be a need for the possibility of adjusting or levelling by fastening of the mast which entails a further complication. The simplest way of mounting a mast in an adjustable manner is to provide the pile with upwardly projecting fixation elements, such as bolts, whereby the mast may be adjustably fastened. It is very difficult, however, to drive a pile if it is provided with bolts projecting from its top. There is an immediate risk of deforming or otherwise damaging the bolts. Experiments as to providing the ram head and impact piece with openings for projecting elements such as bolts, have for various reasons not been successful. One important reason is that the impact piece during ramming is severely deformed or crushed to such an extent that the impact piece must be renewed after each pile driven. It is, therefore, useless to provide openings in the impact piece as the latter is normally completely mashed, and thereby in practice forged onto the bolts, so that the ram head after ramming is stuck in the pile. It should be remarked that normally the ram head is of a relatively simple configuration, f. ex. having a plane impact surface and sides fitting around the pile top. As by more sophisticated configurations there will be a substantial risk that the ram head will crack or be broken during ramming.

According to a preferred embodiment of the invention, a ram head is provided for use in connection with a pile having elements projecting from its top as stated in Claim 3. It is hereby achieved that such a pile may be driven without any risk of damaging the projecting elements and without any problems in connection with releasing the ram head from the pile top after driving.

According to another preferred embodiment of the invention, a ram head is provided as stated in Claim 4. It is hereby achieved that a pile of f. ex. quadrangular cross section may be placed in a selected one among different angular orientations about its vertical axis and be driven under control of the orientation. This is suitable where there is a strong exigency of a very accurate pile orientation, such as for example by foundations for masts which must have a specific orientation and where the site for placing the pile driver cannot be freely chosen. This ram head is particularly suitable for pile drivers moving along and working from their position on rails.

According to an advantageous embodiment the ram head is made of steel of low hardness and low strength. Practical experiments have surprisingly shown that ram heads of such material in practice are more durable than ram heads of high strength steel having a tendency to crack during hammering. The reason herefor is not quite clear but is assumed that it may be due to the fact that low strength steel is relatively vibration-absorbent.

The invention further provides a method as stated in Claim 7. It is hereby achieved that a pile may be driven without damages to the top edges, even when the pile material is relatively friable, and with the use of only a very simple and cheap impact piece.

According to an advantageous embodiment of the invention, a method is provided for driving a pile having at least partially plane side faces and longitudinal edges as stated in Claim 9. It is hereby achieved that such a pile may be driven without any risk of damaging the side edges.

The invention is more fully explained in the following with reference to preferred embodiments shown in the drawings, wherein

FIG. 1 shows a vertical section through a pile top with a schematic view of a ram head according to the prior art,

FIG. 2 shows a horizontal section through a pile top and the bottom part of the ram head according to Fig. 1,

FIG. 3 shows a vertical section through a portion of a ram head according to the invention placed in position above a pile top,
FIG. 4 shows a horizontal section through a pile top with elements of a ram head according to the invention, 
FIG. 5 shows a side view of a ram head according to another embodiment of the invention, 
FIG. 6 shows a side view corresponding to Fig. 5, but in direction perpendicular thereto, 
FIG. 7 shows a horizontal section through the top part of a ram head according to the invention, and 
FIG. 8 shows a horizontal section corresponding to Fig. 7, but at a lower position.

Initially, the principle used in the prior art ram heads will be explained, reference being made to Figures 1 and 2. The ram head 106 is shown embracing a rectangular pile top, and it appears that the ram head has the form of a box with a bottom or hammer surface 107 lying above the pile and with side faces 108 extending downwardly along the pile sides for fixation of the pile. A usual impact piece or intermediate plate 100 is interposed between the hammer surface 107 and the pile top 101. Although it does not appear from Fig. 1, the intermediate plate is practically so dimensioned that it may be hammered in position in the ram head 106 and may stick thereto without falling out, while the pile and the ram head are hoisted in position and are brought together. With a ram head of this type the pile can be driven quickly and effectively, but in practice it has been found that in piles of a material of some brittleness or friability, such as concrete, there will be damages on the top edge 103 of the pile and on the longitudinal edges 104. From a cosmetic point of view these damages are very adverse, and upwardly open cracks may be formed which outdoors may give rise to problems, as water may seep down and cause frost bursting of the foundation.

In the following, various embodiments of the invention will be discussed with reference to Fig. 3 and the following Figures.

Fig. 3 shows a vertical sectional view of part of a ram head 110 according to an embodiment of the invention and in position above a pile 2 having upwardly projecting elements 105, f. ex. in the form of embedded bolts. This ram-head part has a bottom plate 125 facing an impact piece 100 placed between said bottom plate 125 and the pile top 101, said impact piece 100 being of f. ex. wood, preferably oak, or synthetic material, preferably nylon. According to the invention the bottom plate is provided with a downwardly extending collar 126 enclosing the impact piece 100. This collar serves the purpose not only of holding the intermediate plate in its undeformed shape, but also of holding the impact piece 100 within its limits, even in the case of a severe deformation thereof. It is hereby achieved that the impact impulses are only acting on the central area of the pile top, and not near the top edges 103. Experiments have shown that hereby the pile may be driven without any damage of the top edges, if only the impact piece is of a suitable thickness and the length of the collar is adapted thereto, for example half the thickness of the impact piece. The collar may have the form of any closed, or substantially closed, outline, but preferably it is rectangular or circular.

Furthermore, the bottom plate 125 is provided with openings 127 leaving free space around the bolts 105. The hammer assembly acts on the impact plate 121 being firmly mounted on top of the horizontal top section 120 which transmits the impact impulse to the bottom plate 125 through the body 122 being in the form of a cylindrical tube.

In the following, a practical embodiment of the ram head according to the invention is explained with reference to Figures 4, 5, 6, 7, and 8 of the drawings. Those parts of the ram head of Figure 3 which are also found in the present embodiment are provided with the same reference numerals.

As clearly apparent from Figures 5 and 6, this ram head is provided with guiding beams 128 mounted on the body 122 of said ram head and strengthened by welding to the bottom plate 125, extending downwardly around the pile which is secured by the contact pieces 129, as clearly apparent from Figure 4. These lateral guides secure the pile so that it can neither be displaced laterally nor rotate about its longitudinal axis, said lateral guides acting on contact faces on the pile sides 102 in distance from the side edges of the pile and in distance from the top edges of the pile. Practical experiments have shown extremely good results with this construction, as damaging of the pile edges and the pile as a whole can be avoided during driving. The contact pieces 129 are secured to the guide beams 128 by means of simple bolts 130, so that the contact pieces may be removed and for example be replaced by contact pieces of other dimensions, so that the guide may be adjusted to different pile dimensions.

The ram head of this embodiment is made in two parts, i.e. a stationary part 111 (see Figure 6) and a part 112 being rotatable about the vertical, central axis. The stationary part 111 is firmly secured in relation to the hammer assembly (not shown) by appropriate securing of a projecting collar 113. The stationary part continues from the collar 113 downwards into a cylindrical body 116 having a supporting plate 114 mounted below. The entire stationary part is constructed in such a manner that it is dividable in a plane containing the longitudinal axis for ease of mounting and dismantling, and the two parts are held together by means of fish-plates 115. The rotatable part 112 is guided by sliding rings 119 and is supported by the sup-
porting plate 114. As mentioned in connection with the embodiment of Figure 3, the rotatable part also here comprises a top section 120 with an impact plate 121 on which the hammer acts. The top section is welded to the cylindrical body part 122.

Just below the top section 120 a number of radially projecting fins 124 are provided (see Figure 7) and below these fins a horizontal supporting flange 123 is mounted by means of which the rotatable part is supported on the supporting plate 114. The fins which are welded to the top section 120 and to the supporting flange 123 serve the purpose of partly supporting these parts and partly fixing the rotary orientation of the rotatable part in relation to the stationary part 111. As shown in Figure 7, eight fins define between themselves seven grooves having equal intervals, shown here with a pitch of 15° between them. In the stationary part two bushings 117 are provided at a mutual positional distance of 22,5°. In these bushings a guide pin 118 with conical point may optionally be inserted and secured, said pin fitting into the interval between the fins. As appears from Figure 7, the rotatable part may thus by means of the two bushings 117 alternately be turned and fixed in a total of fourteen positions at intervals of each 7,5°, over an angular region of totally 105°. Of course, a further possibility of rotation can be achieved by raising the ram head from the pile and turn the rotatable part 90° in relation to the pile top and lower it again. The arrangement has in practice been found to be able to perfectly endure the impact actions, which is supposed to be due to the possibility of longitudinal displacement of the rotatable part in relation to the stationary part, so that the impact impulse is not transferred to the guide pin 118 or to the fins.

The ram head is suitably made of steel of low hardness and preferably of steel type 37-2 according to DIN 17100 or ISO 630.

Claims

1. A ram head adapted for receiving impact pulses produced by a hammer assembly and for transmitting the impact pulses through an impact piece and into the top surface (101) of a pile with the purpose of driving said pile into the ground or into a similar substance, said ram head comprising guiding means (128,129) with surfaces adapted for facing side faces of the pile over contact areas on the pile sides in a distance frog the top edges of the pile, said ram head comprising a bottom plate (125) provided with a collar (126) projecting axially from said bottom plate in the direction towards the intended position of the pile, said collar receiving a deformable impact piece (100) for continu-

2. A ram head according to Claim 1, CHARACTERIZED in that the surfaces of said guiding means are arranged to face the side faces of a pile having at least partially plane side surfaces and longitudinal edges (104), the surfaces of said guiding means being adapted to hold said pile by contacting the plane side surfaces of the pile at positions in a distance from the longitudinal edges.

3. A ram head according to Claim 1 or Claim 2, adapted for use in connection with a pile comprising elements (105) projecting upwardly and above the pile top surface, CHARACTERIZED in that the ram head is provided with openings (127) in the underside to allow free space around said elements, and that the axially projecting collar (126) is arranged to keep the impact piece (100) clear of the upwardly projecting elements, also while the impact piece is being deformed by the impacts from the hammer assembly.

4. A ram head according to Claim 2 or Claim 3 for the driving of a pile into the ground or into a similar substance, while maintaining a selected rotary orientation about the longitudinal axis of the pile, CHARACTERIZED in that the ram head is divided into a first and a second part, said first part (111) being arranged above said second part (112) in the operating position, said parts being mutually rotatable about an axis extending parallel to the intended axis of driving the pile and through the middle of the second part and being adapted so that a mutually rotational orientation may be selected and fixed by the first part being provided with a removable and insertable guide pin (118), which may be arrested in the inserted position, an end portion of said guide pin being adapted so that it may fit into anyone among a number of longitudinal grooves defined between radially projecting fins (124) in the second part when the guide pin is in the inserted position, so that the engagement between the pin and the selected groove may fix a rotational orientation, while allowing mutual displacement of
said parts in axial direction.

5. A ram head according to Claim 4, CHARACTERIZED in that said second part is provided with seven grooves at angular spacings or intervals about the longitudinal axis of 15°, and in that said first part is adapted with a possibility of inserting and fixing the guide pin at either of two positions. said positions being arranged with an angular spacing of 22.5° about the longitudinal axis so as to achieve a total of fourteen possibilities of mutual orientation at angular intervals of 7.5°.

6. A ram head according to any of the Claims 1-5, CHARACTERIZED in that it is made of steel of low hardness and low carbon content, such as steel type 37-2 according to DIN std. 17100 or ISO std. 630.

7. A method for the driving of a pile (2) into the ground or into a similar substance, said pile having a top surface disposed substantially at right angles to its longitudinal axis, and side faces extending substantially parallel to its longitudinal axis, wherein a hammer assembly constricted to move in the direction of the longitudinal axis of the pile is used to drive the pile downwards by hammering onto a ram head (110) which transmits the hammer blows into the top surface of the pile, said ram head comprising guiding means (128, 129) with surfaces adapted for facing side faces of the pile over contact areas on the pile sides in a distance from the top edges of the pile, said ram head comprising a bottom plate (125) provided with a collar (126) projecting axially from said bottom plate in the direction towards the intended position of the pile, said collar receiving a deformable impact piece (100) for confining it within a defined area, said guiding means being adapted for maintaining the alignment of said ram head relative to the axis of the pile, CHARACTERIZED in that said collar enclosing the impact piece and is arranged in a manner, with relation to said guiding means, so that the impact piece is kept away from the edge zones of the pile top surface (101), when the pile is held by said guiding means.

8. A method according to Claim 7, CHARACTERIZED in that said impact piece is made of a material adapted to cushion the hammer blows, at least to some degree.

9. A method according to Claim 7 or 8 for the driving of a pile into the ground or into a similar substance, said pile having side faces being at least partially plane and with longitudinal side edges, CHARACTERIZED in that the pile is secured in relation to the hammer assembly by being held over contact areas of the side faces, said areas terminating short of the side edges and short of the upper edges, while the zones adjacent these edges are kept free.

**Patentansprüche**

1. Rammkopf zur Aufnahme der von einer Hammerstoßkraft erzeugte Schlagimpulse und zur Übertragung der Schlagimpulse durch ein Schlagelement in die Oberseite (101) eines Pfähles, um den Pfahl in den Boden oder eine entsprechende Substanz zu treiben, wobei der Rammkopf (110) mit Flächen, die Seitenflächen des Pfähles über Kontaktbereiche an den Pfahlseiten in einem Abstand von den oberen Rändern des Pfähles gegenüberliegen können, und eine Bodenplatte (125) aufweist, die mit einer Einfassung (126) versehen ist, die axial von der Bodenplatte in der Richtung zur beabsichtigten Position des Pfähles hin vorsteht und ein zylinderförmiges Schlagelement (100) aufnimmt, um dieses innerhalb eines definierten Bereiches einzugrenzen, und wobei die Führungseinrichtungen die Ausrichtung des Rammkopfes relativ zur Pfahlachse aufrechterhalten können, dadurch gekennzeichnet, daß die Einfassung (126) das Schlagelement (100) umgibt und relativ zu den Führungseinrichtungen derart angeordnet ist, daß das Schlagelement von den Randzonen der Oberseite (101) des Pfähles weggehalten wird, wenn der Pfahl von den Führungseinrichtungen gehalten wird.

2. Rammkopf nach Anspruch 1, dadurch gekennzeichnet, daß die Flächen der Führungseinrichtungen so angeordnet sind, daß sie die Seitenflächen eines Pfähles gegenüberliegen, der mindestens teilweise ebene Seitenflächen und Längskanten (104) besitzt, wobei die Flächen der Führungseinrichtungen durch Kontaktieren der ebenen Seitenflächen des Pfähles an Stellen in einem Abstand von den Längskanten den Pfahl halten können.

3. Rammkopf nach Anspruch 1 oder 2, der zusammen mit einem Pfahl verwendbar ist, welcher Elemente (105) aufweist, die nach oben und über die Oberseite des Pfähles hinaus vorstehen, dadurch gekennzeichnet, daß der Rammkopf mit Öffnungen (127) in der Unterseite versehen ist, um einen Freiraum um die Elemente herum vorzusehen, und daß die axial vorstehende Einfassung (126) das Schlagele-
Verfahren zum Eintreiben eines Pfahles (2) in den Boden oder in eine entsprechende Substanz, wobei der Pfahl eine Oberseite, die im wesentlichen rechtwinklig zu seiner Längsachse angeordnet ist, und Seitenflächen besitzt, die sich im wesentlichen parallel zu seiner Längsachse erstrecken, wobei eine Hammereinheit, die eine Zwangsbewegung in Richtung der Längsachse des Pfahles durchführt, zum Eintreiben des Pfahles durch Hämern auf einen Rammkopf (110) verwendet wird, der die Hammerschläge in die Oberseite des Pfahles überträgt, und wobei der Rammkopf Führungseinzugsstellen (128, 129) mit Flächen aufweist, die den Seitenflächen des Pfahles über Kontaktbereiche an den Pfahlsiten in einem Abstand von den Oberkanten des Pfahles gegenüberliegen können, wobei der Rammkopf ferner eine Bodenplatte (125) umfaßt, die mit einer Einfassung (126) versehen ist, welche axial von der Bodenplatte in einer Richtung zur beabsichtigten Position des Pfahles hin vorsteht und ein verformbares Schlagemittel (100) aufnimmt, um dieses innerhalb eines definierten Bereiches einzugrenzen, wobei die Führungseinzugsstellen die Ausrichtung des Rammkopfes relativ zur Achse des Pfahles aufrechterhalten können, dadurch gekennzeichnet, daß die Einfassung (126) das Schlagemittel umgibt und relativen zum Führungseinzugsstellen derart angeordnet ist, daß das Schlagemittel von den Randzonen der Oberseite (101) des Pfahles entfernt gehalten wird, wenn der Pfahl von den Führungseinzugsstellen gehalten wird.

Verfahren nach Anspruch 7, dadurch gekennzeichnet, daß das Schlagemittel aus einem Material besteht, mit dem die Hammerschläge zumindest etwas gedämpft werden können.

Verfahren nach Anspruch 7 oder 8 zum Eintreiben eines Pfahles in den Boden oder in eine entsprechende Substanz, wobei der Pfahl Seitenflächen, die zumindest teilweise eben sind, und Längsseitenkanten aufweist, dadurch gekennzeichnet, daß der Pfahl relativ zur Hammereinheit dadurch gesichert wird, daß er über Kontaktabweichungen der Seitenflächen gehalten wird, die kurz vor den Seitenkanten und kurz vor den oberen Kanten enden, während die Zonen benachbart zu diesen Kanten freigehalten werden.

Revendications

1. Tête de battage conçue pour recevoir des impulsions d’impact produites par un ensemble de marteau et pour transmettre les impulsions d’impact à travers un élément d’impact et dans la surface supérieure (101) d’une pile dans le but d’enfoncer ladite pile dans le sol...
ou dans une substance similaire, ladite tête de battage comprenant des moyens de guidage (128, 129) avec des surfaces conçues pour faire face aux faces latérales de la pile sur des zones de contact sur les côtés de la pile à une distance des arêtes supérieures de la pile, ladite tête de battage comprenant un plateau de fond (125) muni d'un collet (126) dépassant axialement dudit plateau de fond dans la direction de la position prévue de la pile, ledit collet recevant un élément d'impact déformable (100) pour le confiner à l'intérieur d'une zone déterminée, lesdits moyens de guidage étant conçus pour conserver l'alignement de ladite tête de battage par rapport à l'axe de la pile, caractérisée en ce que ledit collet (126) enferme l'élément d'impact (100) et est disposé de telle façon, par rapport auxdits moyens de guidage, que l'élément d'impact est tenu éloigné des zones de contact de la surface supérieure de la pile (101), quand la pile est tenue par lesdits moyens de guidage.

2. Tête de battage selon la revendication 1, caractérisée en ce que les surfaces desdits moyens de guidage sont disposées pour faire face aux faces latérales d'une pile ayant des arêtes longitudinales (104) et des surfaces latérales au moins partiellement planes, les surfaces desdits moyens de guidage étant prévues pour tenir ladite pile en venant en contact avec les surfaces latérales planes de la pile à des endroits à une distance des arêtes longitudinales.

3. Tête de battage selon la revendication 1 ou la revendication 2, prévue pour être utilisée en relation avec une pile comprenant des éléments (105) dépassant vers le haut et au-dessus de la surface supérieure de la pile, caractérisée en ce que la tête de battage est munie d'ouvertures (127) sur le côté inférieur pour laisser un espace libre autour desdits éléments, et en ce que le collet (126) dépassant axialement est disposé pour maintenir l'élément d'impact (100) à l'abri des éléments dépassant vers le haut, aussi pendant que l'élément d'impact est déformé par les impacts provenant de l'ensemble de marteau.

4. Tête de battage selon la revendication 2 ou la revendication 3, pour l'enfoncement d'une pile dans le sol ou dans une substance similaire, tout en maintenant un sens de rotation choisi sur l'axe longitudinal de la pile, caractérisée en ce que la tête de battage est divisée en une première et une deuxième parties, ladite première partie (111) étant disposée au-dessus de ladite deuxième partie (112) dans la position de fonctionnement, lesdites parties pouvant pivoter mutuellement sur un axe s'étendant parallèlement à l'axe prévu pour enfoncer la pile et à travers le milieu de la deuxième partie et étant conçu de façon qu'un sens de rotation mutuel puisse être choisi et fixé par la première partie, laquelle est munie d'une goupille de guidage (118) pouvant être insérée et retirée, qui peut être bloquée dans la position insérée, une partie d'extrémité de ladite goupille de guidage étant conçu de façon qu'elle peut être placée dans l'une quelconque parmi plusieurs gorges longitudinales définies entre des ailettes en saillie radiale (124) dans la deuxième partie quand la goupille de guidage est dans la position insérée, de sorte que l'engagement entre la goupille et la gorge choisie peut fixer un sens de rotation, tout en permettant un déplacement mutuel desdites pièces dans la direction axiale.

5. Tête de battage selon la revendication 4, caractérisée en ce que ladite deuxième partie est munie de sept gorges à des intervalles ou espacements angulaires sur l'axe longitudinal de 15°, et en ce que ladite première partie est dotée d'une possibilité d'insertion et de fixation de la goupille de guidage à l'un de deux emplacements, lesdits emplacements étant disposés avec un espacement angulaire de 22,5° sur l'axe longitudinal de façon à obtenir un total de quatorze possibilités de rotation mutuelle à des intervalles angulaires de 7,5°.

6. Tête de battage selon l'une quelconque des revendications 1 à 5, caractérisée en ce qu'elle est constituée d'acier de faible dureté et à faible contenu en carbone, tel que le type d'acier 37-2 conformément à la norme DIN 17100 ou la norme ISO 630.

7. Procédé pour l'enfoncement d'une pile (2) dans le sol ou dans une substance similaire, ladite pile ayant une surface supérieure disposée sensiblement à angles droits par rapport à son axe longitudinal, et des faces latérales s'étendant sensiblement parallèlement à son axe longitudinal, dans lequel un ensemble de marteau contraint de se déplacer dans la direction de l'axe longitudinal de la pile est utilisé pour enfoncer la pile vers le bas en frappant au moyen d'un marteau une tête de battage (110) qui transmet les coups de marteau dans la surface supérieure de la pile, ladite tête de battage comprenant des moyens de guidage (128, 129) avec des surfaces conçues pour faire face aux faces latérales de la pile.
sur des zones de contact sur les côtés de la pile à une distance des arêtes supérieures de la pile, ladite tête de battage comprenant un plateau de fond (125) muni d’un collet dépassant axialement dudit plateau de fond dans la direction de la position prévue de la pile, ledit collet recevant un élément d’impact déformable (100) pour le confiner à l’intérieur d’une zone déterminée, lesdits moyens de guidage étant conçus pour conserver l’alignement de ladite tête de battage par rapport à l’axe de la pile, caractérisée en ce que ledit collet (126) enferme l’élément d’impact (100) et est disposé de telle façon, par rapport auxdits moyens de guidage, que l’élément d’impact est tenu éloigné des zones de contact de la surface supérieure de la pile (101), quand la pile est tenue par lesdits moyens de guidage.

8. Procédé selon la revendication 7, caractérisé en ce que ledit élément d’impact est réalisé dans un matériau conçu pour amortir les coups de marteau, au moins dans une certaine mesure.

9. Procédé selon la revendication 7 ou 8, pour l’enfoncement d’une pile dans le sol ou dans une substance similaire, ladite pile ayant des faces latérales au moins partiellement planes et avec des arêtes latérales longitudinales, caractérisé en ce que la pile est fixée par rapport à l’ensemble de marteau en étant maintenue sur des zones de contact des faces latérales, lesdites zones se terminant près des arêtes latérales et près des arêtes supérieures, tandis que les zones voisines de ces arêtes sont laissées libres.