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(54) **Removable anchor block**

(57) Removable anchor block (1) for insertion into the ground for anchoring an object, comprising a plate-shaped element (2) having two or more fixing points (3) for fixing pulling cables on the plate-shaped element (2). The anchor block (1) is characterized in that at least two of the two or more fixing points (3) are provided substantially evenly distributed around the circumference of the plate-shaped element (2), and in that the two or more

fixing points (3) are designed to be connected directly or indirectly by means of the pulling cables to the object to be anchored.

Method for inserting such a plate-shaped anchor block into the ground as well as a method for removing such an anchor block.

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Description

[0001] The present invention relates to a removable anchor block which is suitable for insertion into the ground and is used for absorbing tensile forces which occur, for example, during the stabilization of temporary structures such as sheet pile walls.

[0002] The invention also relates to a method for inserting such an anchor block into the ground as well as a method for removing such an anchor block from the ground.

[0003] Anchor blocks are generally known and are used to stabilize certain structures such as sheet pile walls, in which process in particular lateral forces are absorbed, or partially absorbed, by the anchor block. The anchor blocks currently in general use are difficult or impossible to remove after insertion into the ground, which is undesirable.

[0004] EP 444 667 discloses an anchor block which can be removed from the ground, comprising a plate-shaped element with two fixing points and two pulling cables. The first pulling cable is fixed in the centre of the plate-shaped element and serves to absorb the tensile force exerted by the object to be anchored. The other, second pulling cable is fixed in a corner of the plate-shaped element and serves to make removal of the anchor block possible.

[0005] A disadvantage of the anchor block known from EP 444 667 is that it is difficult to insert in a desired position.

[0006] The object of the invention is to provide a removable anchor block which is easy to insert into the ground in the desired position.

[0007] The object is achieved with an anchor block according to claim 1.

[0008] The phrase distributed around the circumference should be understood to mean that at least two of the two or more fixing points are provided on either side of a centre point or centre line of the surface of the plate-shaped element. This means that if one of the two pulling cables is pulled, the plate-shaped element will tilt in a first direction while, if one or more of the other pulling cables is pulled, the plate-shaped element will tilt in an opposite direction.

[0009] The advantage of such an anchor block is that during pulling of the pulling cables fixed on the plate-shaped element the position of the plate-shaped element is easy to determine because the length of the cables is known. Since the position of the plate-shaped element is known and the position of the plate-shaped element can be controlled by the two cables, it is easy to bring the plate-shaped element into the correct position.

[0010] The two or more fixing points are preferably provided near an edge of the plate-shaped element. Placing the fixing points near the edge means that it is easy to take the plate-shaped element into its desired position. A fixing point placed at the edge makes it easier here to remove the plate-shaped element from the ground. Since

in the case of two fixing points they are both placed at the edge, it is furthermore not important which of the two cables has to be pulled in order to remove the plate-shaped element from the ground.

[0011] The phrase near the edge should generally be understood to mean away from the centre point of the surface of the plate-shaped element. The closer the fixing points are to the edge, however, the better the above-mentioned effect will be achieved.

[0012] The edge of the plate-shaped element is advantageously at least partially bevelled or sharpened in order to make it easier to insert the plate-shaped element into the ground and/or pull it out of the ground.

[0013] The anchor block preferably comprises a connecting part which is suitable for connecting to an elongated pushing element, in particular a pushing tube, by means of which the plate-shaped element can be pushed into the ground in a direction substantially parallel to the surface of the plate-shaped element. With such a connecting part it is ensured that during the insertion of the plate-shaped element into the ground said plate-shaped element remains in the correct position.

[0014] The anchor block preferably comprises two or more pulling cables, each of which is permanently or detachably connected to one of the two or more fixing points, it being furthermore preferable for the two or more pulling cables to be of the same length.

[0015] The desired position of the anchor block according to the invention after it has been inserted into the ground is such that the surface of the plate-shaped element is substantially perpendicular relative to the direction in which it has been inserted into the ground. Said desired position is easy to achieve, for example by using pulling cables of the same length. By making the pulling cables of the same length converge in one pulling point, for example by connecting them to a single pulling hook, it is easy, by pulling these cables until all cables are taut, to determine that the plate-shaped element is in the desired position.

[0016] However, since the length of the cables is known, the position and orientation of the plate-shaped element can be determined by means of each set of two pulling cables during pulling of these pulling cables.

[0017] In one embodiment the pulling cables are pivotally fixed in the fixing points, the pivoting being possible only about an axis lying in the plane of the plate-shaped element. During the insertion of the plate-shaped element into the ground, the axis preferably also lies perpendicular to the direction of insertion.

[0018] In one embodiment the pulling cables are in the form of chains. Chains have been found very suitable as pulling cables for the plate-shaped anchor, since with a small diameter they are relatively strong.

[0019] The invention furthermore provides a method, described in claim 16, for inserting an anchor block into the ground according to one or more of claims 1 - 15, which method is characterized by the following steps:

- connecting the plate-shaped element to an elongated pushing element, in particular a pushing tube,
- pushing the plate-shaped element into the ground,
- disconnecting the anchor block and removing the pushing element from the ground,
- bringing the anchor block into a desired position by pulling the two or more pulling cables connected to the plate-shaped element in such a way that the plate-shaped element tilts into the desired position, and
- connecting to the pulling cables the object which is to be anchored by the anchor block.

[0020] The invention furthermore provides a method for removing an anchor block according to one or more of claims 1 - 15, which method is described in claim 20 and is characterized by pulling one of the two or more pulling cables in such a way that the plate-shaped element tilts and can be pulled out of the ground in a direction substantially parallel to the surface of the plate-shaped element.

[0021] The invention will be explained in greater detail below with reference to a number of exemplary embodiments, in which reference is made to the drawing. In the drawing:

Figure 1 shows a top view of a first embodiment of an anchor block according to the invention,

Figure 2 shows a top view of a second embodiment of an anchor block according to the invention,

Figures 3a - 3c show a number of the steps of a method according to the invention,

Figures 4a and 4b show a top view and an elevational view respectively of a cross section of a third embodiment of an anchor block according to the invention, and

Figure 5 shows a top view of a possible application of an anchor block according to the invention.

[0022] Figure 1 shows a first embodiment of an anchor block indicated in its entirety by reference numeral 1. The anchor block 1 comprises a plate-shaped element 2, which is provided with two fixing points 3 for fixing a pulling cable on each of the fixing points 3, detachably or otherwise. The fixing points can be in the form of, for example, eyes welded on the plate-shaped element 2, through which eyes the cables to be fixed are inserted, or they can be in the form of holes made in the plate-shaped element 2, in which holes the fixing cables are fixed.

[0023] The plate-shaped element 2 can be made of, for example, a suitable type of metal, for example steel.

[0024] The fixing points 3 are substantially distributed around the circumference of the plate-shaped element,

i.e. in this case the two fixing points are fixed on either side of the centre point A of the surface of the plate-shaped element 2.

[0025] The fixing points 3 are provided near the edge 2a of the plate-shaped element, in order to make it easily possible to bring the plate-shaped element 2 into the desired position when it is being inserted into the ground.

[0026] The anchor block 1 furthermore comprises a connecting part 4, which is suitable for connecting to an elongated pushing element 5, only the end of which is shown in Figure 1, and by means of which the plate-shaped element 2 can be pushed into the ground in a direction substantially parallel to the surface of the plate-shaped element 2.

[0027] The connecting part 4 is in the form of a part projecting from the plate-shaped element 2, which part is complementary to an end of the elongated pushing element 5. The end of the pushing element 5 in fact comprises a hollow part which can be placed around the projecting part of the plate-shaped element 2, so that the pushing element keeps the orientation of the plate-shaped element 2 the same relative to the pushing element 5 during the insertion of the plate-shaped element 2 into the ground.

[0028] The edge 2a of the plate-shaped element 2 is at least partially bevelled or sharpened in order to make it easier to insert the plate-shaped element 2 into and/or pull it out of the ground. In particular, the plate-shaped element is bevelled or sharpened on the side facing away from the connecting part. This will make it easier to insert the plate-shaped element 2 into the ground during pushing of the plate-shaped element 2 by means of the pushing element 5.

[0029] The dimensions of the plate-shaped element 2 are, for example, 0.3 by 0.5 metre. In general, the dimensions are preferably in the region between 0.2 and 2.0 metres, more preferably in the region of 0.4 to 1.0 metre. A plate-shaped element with these dimensions is, on the one hand, easy to manoeuvre in a large number of types of ground, while at the same time it has sufficient surface area to be able to absorb a great tensile force.

[0030] Figure 2 shows a second embodiment of an anchor block 1. The same parts are indicated by the same reference numerals in Figure 2.

[0031] In this second embodiment the anchor block 1 comprises a plate-shaped element 2 which is in circular form. The plate-shaped element 2 comprises three fixing points 3 which are distributed around the circumference of the plate-shaped element 2 and near the edge 2a of the plate-shaped element 2. Distributed around the circumference means here that the fixing points are provided at 0, 120 and 240 degrees of the circular plate-shaped element relative to the centre point A of the circular plate-shaped element 2.

[0032] A connecting part 4 comprising a drilled hole 6 with internal screw thread is provided on the plate-shaped element 2. A projecting part 5a with an external screw thread is provided on the pushing tube 5, which

external screw thread is complementary to the internal screw thread in the drilled hole 6. The pushing tube 5 and the plate-shaped element 2 can be connected to each other by means of the screw threads, in which case it is ensured that the orientation of the plate-shaped element 2 relative to the pushing element 5 is maintained during the insertion of the plate-shaped element 2 into the ground.

[0033] In this embodiment of the plate-shaped element 2 also, the three fixing points 3 are provided near the edge of the plate-shaped element, in order to make manoeuvring under the ground easier.

[0034] In this embodiment also, the edge 2a of the plate-shaped element, in particular on the side of the plate-shaped element 2 facing away from the connecting part 4, can be bevelled or sharpened in another way in order to make it easier to insert the plate-shaped element 2 into the ground.

[0035] The diameter of the plate-shaped element 2 is approximately 0.6 metre. In general, the diameter of a plate-shaped element 2 in circular form lies between 0.2 and 2.0 metres, more preferably between 0.4 and 1.0 metre. A plate-shaped element with these dimensions is, on the one hand, easy to manoeuvre in a large number of types of ground, while at the same time it has sufficient surface area to be able to absorb a great tensile force.

[0036] The method for inserting an anchor block into the desired position into the ground and removing it again after use will now be explained with reference to Figures 3a - 3c.

[0037] Figures 3a - 3c show diagrammatically an elevational view of a cross section of a foundation pit 10. For excavation of the foundation pit a sheet pile wall 11 is provided on the side of said foundation pit. Through the presence of the ground 12 on the side of the sheet pile wall 11 away from the foundation pit 10, pressure is exerted upon the sheet pile wall 11, with the result that the latter is pushed in the direction of the foundation pit 10. In order to prevent movement of the sheet pile wall in this direction, use is made of one or more anchor blocks, by means of which the sheet pile wall 11 is anchored to the ground 12.

[0038] The insertion of the anchor block 1 into the ground is shown in Figure 3a. The anchor block 1 is substantially designed as described in Figure 2. The plate-shaped element 2 is connected by means of the connecting part 4 to an elongated pushing element, in particular a pushing tube 5. By way of the pushing tube 5, the plate-shaped element 2 is inserted into the ground in a direction substantially parallel to the surface of the plate-shaped element. The pushing tube can be pushed in a manner known per se, for example by means of a pile-driving device or a suitable vibrating device (not shown).

[0039] Three pulling cables 7 are connected to the three fixing points 3 of the plate-shaped element 2 of the anchor block 1. During the insertion of the anchor block 1 into the ground 12 by means of the pushing tube 5, the pulling cables 7 do not yet have any specific function.

[0040] After the plate-shaped element 2 has been inserted to the desired depth, for example in a sand layer which gives sufficient strength for anchoring of the sheet pile wall 11, the pushing tube 5 is disconnected from the plate-shaped element 2 and removed from the ground 12.

[0041] After the pushing tube 5 has been removed from the ground 12, the plate-shaped element 2 can be tilted to the desired position in the ground 12. In general, the desired position is the position in which the surface of the plate-shaped element 2 is substantially perpendicular to the direction in which the tensile forces of the object to be anchored, in this case the sheet pile wall 11, are exerted.

[0042] Pulling the three pulling cables 7 enables the plate-shaped element 2 to be tilted, so that it moves to the desired position. Since the length of the pulling cables 7 is known, it is possible while taking the plate-shaped element 2 to the desired position to determine the position of the plate-shaped element 2 on the basis of the lengths of the pulling cables 7 which are situated in the ground 12. It is therefore possible to control the plate-shaped element 2 in such a way that it moves to the desired position.

[0043] All three of the three pulling cables 7 are advantageously of the same length, and the pulling cables 7 are preferably pulled from one pulling point, as shown in Figure 3b. One pulling point here means, for example, the hook of a crane. The pulling cables 7 can advantageously be provided with a loop-shaped end, which can be placed in a simple manner on the hook of the crane.

[0044] When pulling cables 7 of equal length are used, it is clear that when all three of the pulling cables 7 are taut, the plate-shaped element 2 is in the desired position. If one or two of the pulling cables 7 is/are slack, the side of the plate-shaped element 2 that is connected by way of the fixing points 3 to said pulling cable 7 or pulling cables 7 is too close to the sheet pile wall 11 compared with the other side of the plate-shaped element 2.

[0045] Figure 3b shows how the three pulling cables 7 are pulled simultaneously by a crane hook 13, so that the plate-shaped element 2 goes into the desired position. By means of a plate 14, the three pulling cables 7 are connected to the sheet pile wall 11 to be anchored. After direct or indirect connection of the pulling cables 7 to the sheet pile wall to be anchored, the anchor block 1 gives resistance to the movement of the sheet pile wall 11 in the direction of the foundation pit 10.

[0046] The anchor block shown, with a diameter of approximately 0.6 metre in suitable ground can absorb a force of 40 - 70 tonnes, which is ample for the purpose described.

[0047] If the foundation pit 10 is no longer needed and the sheet pile wall 11 can therefore be removed, the anchor block 1 is no longer needed. It is generally desirable to remove the anchor block 1 from the ground after use, in particular if the anchor block 1 has been inserted into the ground of a person who is not the owner of the ground

where the building has been carried out.

[0048] Figure 3c shows how the anchor block 1 can be removed easily from the ground 12 after use. After the pulling cables have been disconnected from the object to be anchored, in this case the sheet pile wall 11, one of the pulling cables 7 can be pulled, for example by connecting one of the pulling cables 7 to the hook 13 of a crane.

[0049] Since said pulling cable 7 is fixed to a fixing point 3 which is not in the centre of the surface of the plate-shaped element 2, the plate-shaped element will leave the desired position and tilt to a position in which the surface of the plate-shaped element 2 is lying substantially parallel to the direction in which the pulling cable 7 being pulled is running. As a result, the resistance exerted by the ground upon the plate-shaped element 2 will decrease, and it will be possible to pull the plate-shaped element out of the ground with a relatively low force.

[0050] The remaining pulling cables 7 can hang loose during the pulling and can be pulled slowly with the other cable or can be pulled out of the ground after the plate-shaped element 2 has been removed from the ground.

[0051] The pulling force required for pulling an anchor block of the type shown in Figures 3a - 3c with a diameter of approximately 0.6 metre out of the ground can lie in the region of 5 - 10 tonnes.

[0052] After the removal of the anchor block, it can be reused for anchoring a particular object. Depending on the ground where the anchor block 1 is being used and the force which the anchor block is intended to absorb, certain dimensions of the anchor block can be selected. The user advantageously has anchors with different dimensions at his disposal.

[0053] Any cables which have sufficient strength for absorbing the forces occurring can be used as the pulling cables 7. Steel cables or chains are preferably used.

[0054] Figures 4a and 4b show a removable anchor block according to the invention which is particularly suitable for chains, indicated in its entirety by the reference numeral 10. The anchor block 10 comprises a plate-shaped element 11, which is substantially rectangular. The plate-shaped element 11 comprises two fixing points which are formed by two pins 12, which are welded onto the plate-shaped element 11. The pins 12 are provided above two slits 14 which are provided on the central longitudinal axis of the plate-shaped element 11. Furthermore, the plate-shaped element 11 comprises a part 16 for making it easier to insert the anchor block into the ground.

[0055] A link 15 of a chain is placed around each of the pins 12. The links 15 fall partially into the slit 14. The thickness of the link is almost the same size as the width of said slit, so that the link can rotate only in the plane perpendicular to the pin 12.

[0056] The link 15 can form part of a chain which as a whole forms the pulling cable. It is also possible to provide one link or a pair of links, in which case a pulling cable of a different type, for example a steel cable, can be fixed

on the then arising "short" chain on the end lying away from the plate-shaped element.

[0057] One of the slits 14 advantageously runs to the edge of the plate-shaped element 11 (in the drawing slit 14 on the left-hand side). This makes it possible for the chain lying on this side to lie substantially in the plane of the plate-shaped element 11 (dotted line in the drawing). As a result, during the pulling out of the anchor block 10 the chain and the plate-shaped element 11 will be substantially in line with each other, with the result that the cross section of the combination of plate-shaped element 11 and link 15 in the direction of pulling out becomes smaller. Furthermore, the plate-shaped element does not have the tendency to rotate during the pulling, and the tension in the link 15 and the force exerted upon the pin 14 will be lower.

[0058] In the embodiment shown the pins 12 are provided on the side of the plate-shaped element 11 where the pulling cables also extend. It is also possible to provide the pins 12 on the other side of the plate-shaped element or in the plane of the plate-shaped element. Instead of welding, it is also possible to connect the pins 12 to the plate-shaped element 11 by use of a suitable method.

[0059] The anchor block 10 can be designed and/or used in the way described in the remainder of this patent application.

[0060] Figure 5 shows an anchor block 20 according to the invention, which is used to anchor a sheet pile wall 21. The sheet pile wall 21 comprises a number of sheet pile wall planks 22, which form a sheet pile wall in the known manner. The anchor block is inserted into the ground in the manner described earlier in the application and comprises a plate-shaped element 23 and two pulling cables 24.

[0061] The pulling points/fixing points 25 by means of which the pulling cables are fixed on the sheet pile wall 21 are advantageously placed at a greater distance from each other than the dimension of the plate-shaped element 23, in other words the pulling cables 24 diverge in the direction away from the plate-shaped element 23. An advantage of fixing the pulling cables 24 on the pulling points 25 in this way is that a number of sheet pile wall planks 22 can be fixed with a single anchor block. It is possibly not necessary here to use a waling, since the anchorage gives sufficient support for the - in this case three - sheet pile wall planks.

[0062] Another advantage of the method shown in Figure 5 for fixing the pulling cables 24 on the sheet pile wall 21 is that, since the pulling cable 24 lies outside the surface, or projected surface, of the plate-shaped element 23, i.e. not on a line perpendicular to the plate-shaped element 23, when the pulling cable 24 is pulled the tilting of the plate-shaped element and subsequent removal of it from the ground will be made even easier. The two pulling points/fixing points 25 in this case advantageously lie outside the surface, or projected surface, of the plate-shaped element 23, so that it is easily possible to pull out

the plate-shaped element 23 with one of the two pulling cables 24.

[0063] In an alternative embodiment it is also possible to leave more than one sheet pile wall plank 22 between the sheet pile wall planks 22 on which the pulling cables are fixed. It is then possible to span an even greater distance with a single anchor block. If desired, a waling may be provided between the two sheet pile wall planks 22, on which the pulling cables 24 are fixed in order to strengthen the anchorage even further.

[0064] For the sake of completeness, it is pointed out that the removable anchor block according to the invention can be used both for temporary anchorage of an object (for a short period) and permanent anchorage of an object (for a long to very long time). Even in the case of permanent anchorage of an object it may in fact be desirable for the anchor ultimately to be removed from the ground. It is therefore advantageous to use the removable anchor block according to the invention. Furthermore, said anchor block is quick and easy to insert into the ground, so that in both cases it is advantageous to use it.

Claims

1. Removable anchor block for insertion into the ground for anchoring an object, comprising a plate-shaped element having two or more fixing points for fixing pulling cables on the plate-shaped element, **characterized in that** at least two of the two or more fixing points are provided substantially evenly distributed around the circumference of the plate-shaped element, and **in that** the two or more fixing points are designed to be connected directly or indirectly by means of the pulling cables to the object to be anchored.
2. Anchor block according to claim 1, in which the plate-shaped element has two fixing points.
3. Anchor block according to claim 1 or 2, in which the plate-shaped element has three fixing points.
4. Anchor block according to one or more of claims 1 - 3, in which at least two of the two or more fixing points are provided near an edge of the plate-shaped element.
5. Anchor block according to one or more of claims 1 - 4, in which an edge of the plate-shaped element is at least partially bevelled or sharpened in order to make it easier to insert the plate-shaped element into the ground and/or pull it out of the ground.
6. Anchor block according to one or more of claims 1 - 5, in which the anchor block comprises a connecting part which is suitable for connecting to an elongated

pushing element, in particular a pushing tube, by means of which the plate-shaped element can be pushed into the ground in a direction substantially parallel to the surface of the plate-shaped element.

7. Anchor block according to one or more of claims 1 - 6, in which the connecting part is a projecting part of the plate-shaped element, which projecting part is complementary to an end of the elongated pushing element.
8. Anchor block according to one or more of claims 1 - 7, in which the plate-shaped element is substantially circular.
9. Anchor block according to one or more of claims 1 - 8, in which the plate-shaped element is substantially rectangular, in particular square.
10. Anchor block according to one or more of claims 1 - 9, in which the dimensions of the side or the diameter of the plate-shaped element lie in the region of 0.2 to 2.0 metres, preferably in the region of 0.4 to 1.0 metre.
11. Anchor block according to one or more of claims 1 - 10, in which the anchor block comprises two or more pulling cables, each of which is permanently or detachably connected to one of the two or more fixing points.
12. Anchor block according to claim 11, in which the two or more pulling cables are of the same length.
13. Anchor block according to claim 12, in which the pulling cable is substantially in the form of a chain.
14. Anchor block according to claim 13, in which a link of the chain is pivotably mounted in a fixing point, which fixing point is in the form of a pin around which the link is placed.
15. Anchor block according to one or more of claims 1 - 14, in which the two or more pulling cables are pivotably fixed on the two or more fixing points in such a way that the pivoting is possible only about an axis which is parallel to the plane of the plate-shaped element.
16. Method for inserting a plate-shaped anchor block into the ground according to one or more of claims 1 - 15, **characterized by** the following steps:
 - connecting the plate-shaped element to an elongated pushing element, in particular a pushing tube,
 - pushing the plate-shaped element into the ground,

- disconnecting the anchor block and removing the pushing element from the ground,
- bringing the anchor block into a desired position by pulling the two or more pulling cables connected to the plate-shaped element in such a way that the plate-shaped element tilts into the desired position, and
- connecting to the pulling cables the object which is to be anchored by the anchor block.

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17. Method according to claim 16, in which the two or more pulling cables are of the same length, and in which the pulling of the two or more pulling cables is performed from one pulling point, for example a hook.

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18. Method according to claim 16, in which the two or more pulling cables are pulled in two pulling points, the distance between the pulling points being greater than the dimension of the plate-shaped element.

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19. Method according to claim 16, in which the object to be anchored is a sheet pile wall made up of two or more sheet pile wall planks, each of the two or more pulling cables being fixed on a separate sheet pile wall.

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20. Method for removing an anchor block according to one or more of claims 1 - 15, **characterized by** pulling one of the two or more pulling cables in such a way that the plate-shaped element tilts and can be pulled out of the ground in a direction substantially parallel to the surface of the plate-shaped element.

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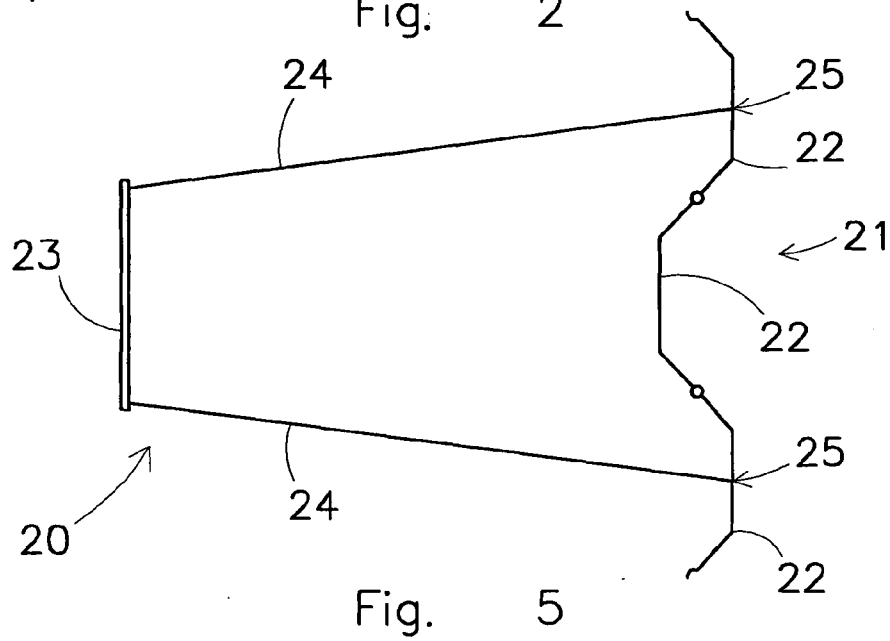
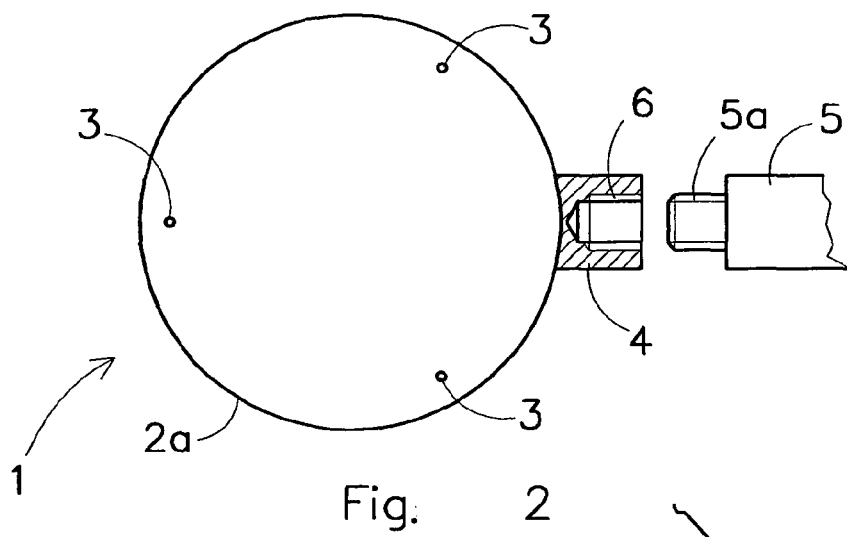
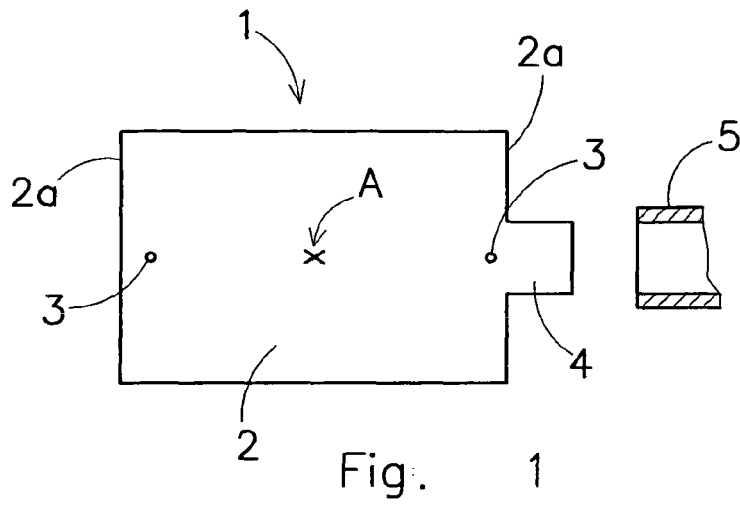
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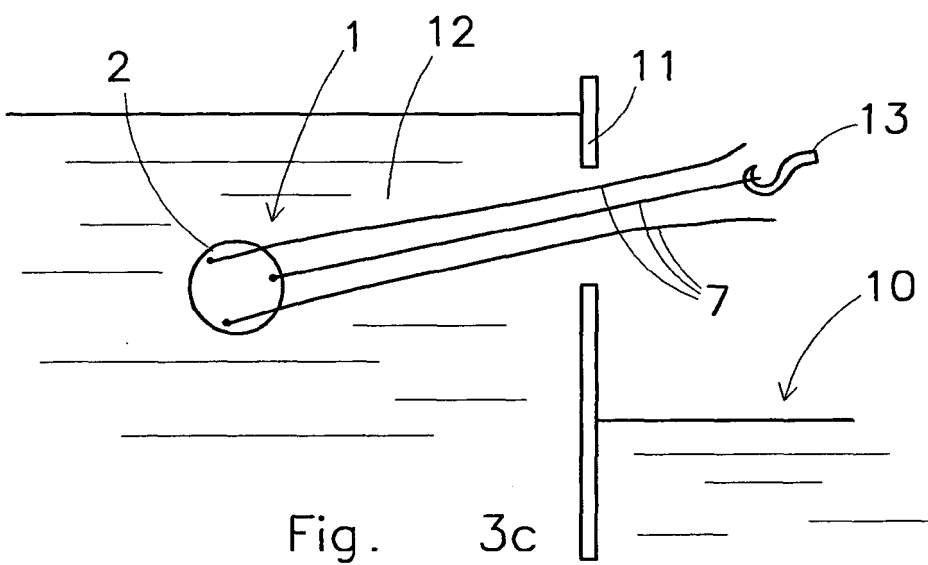
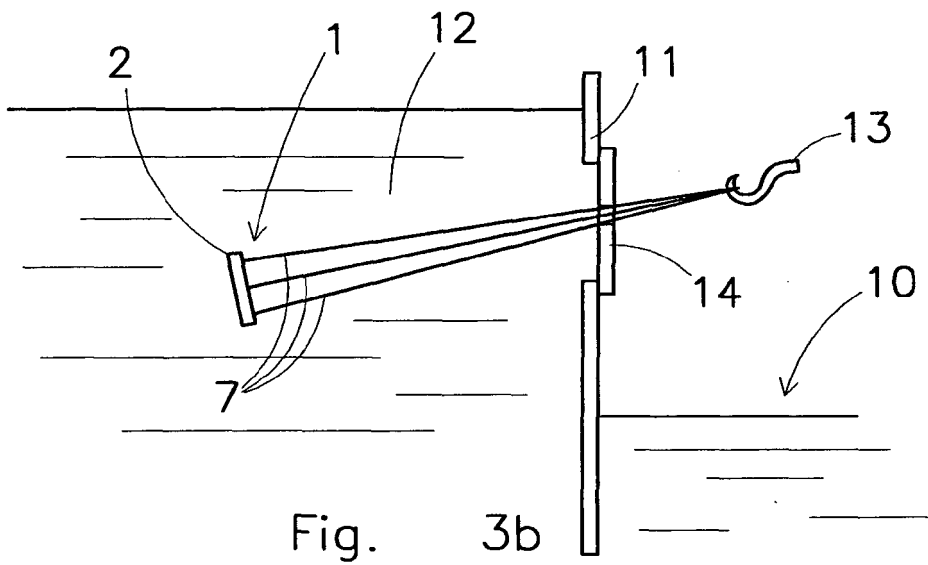
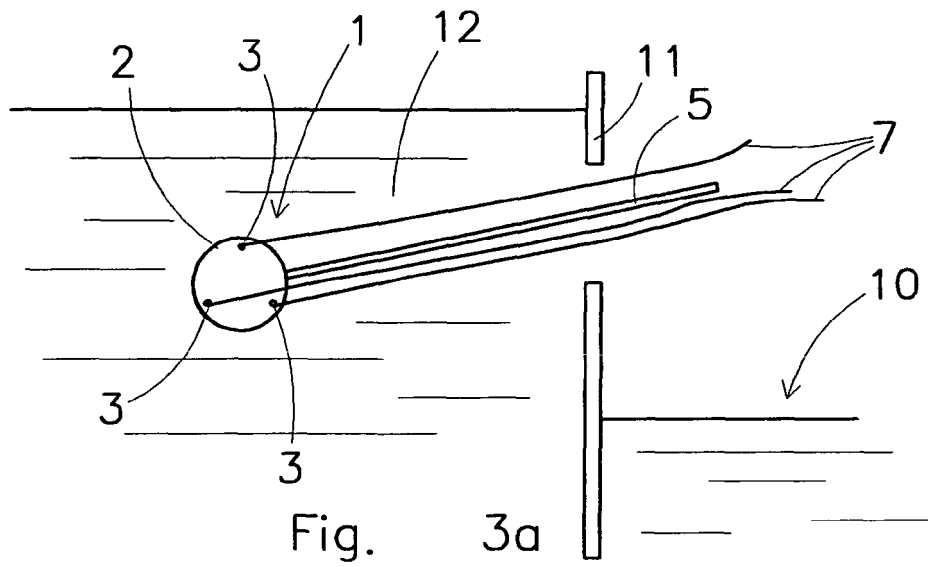
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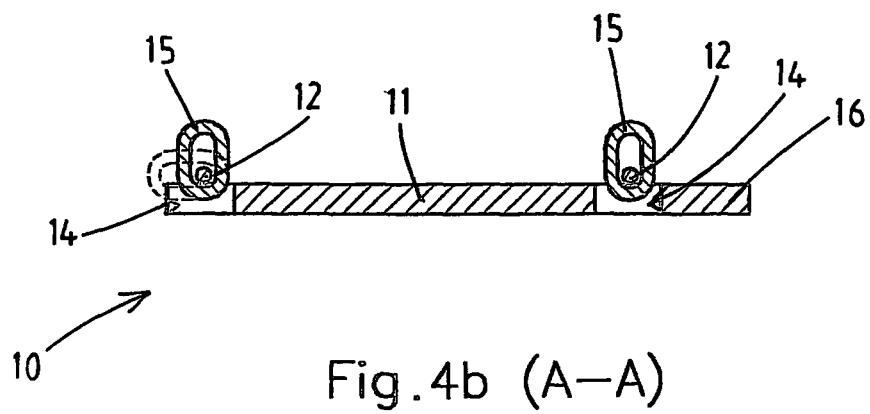
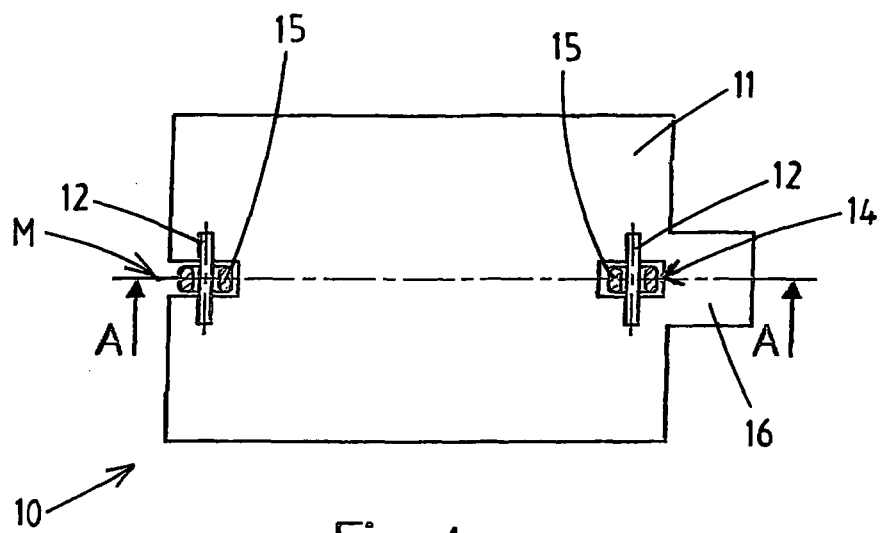
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REFERENCES CITED IN THE DESCRIPTION

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