(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 504 506 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **91302328.9**

(22) Date of filing: **18.03.91**

(51) Int. Cl.5: **E02D 7/16**, E02D 7/26

(43) Date of publication of application:
23.09.92 Bulletin 92/39

(84) Designated Contracting States:
DE FR GB IT SE

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(54) Hydraulic pressure pile driver.

(57) A hydraulic movable base frame pressure--pile driver which can be used in foundational work for hanging hammer to pile or holding a pile to press, its special feature is that it includes a hydraulic movable based frame 1, a gate-type head tree 6 that is equipped a box-type pile-holder 7 and a guide rod 2 which can be used for handing the hammer when piling or for lifting a pile into the head tree when pressing the pile, has equipped an oil motor 13 for driving the guide rod for installing and lifting the pile.

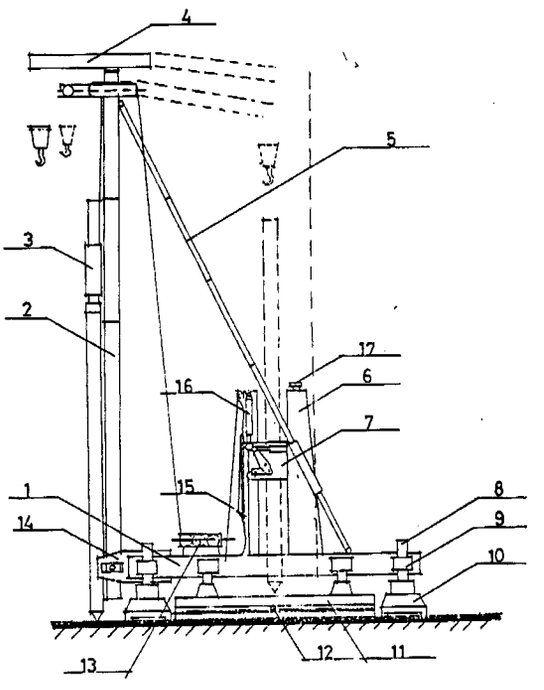

FIGURE 1

EP 0 504 506 A1

THE SUMMARY OF THE INTRODUCTION

This inventation is a movable Base Frame Pressure-Pile Driver that can be used for hanging the hammer when hitting piles or for holding piles when pressing piles. Its main character is that the base frame of the equipment is installed on the hydraulic movable structure that can move in the longitudinal or transversal direction. A gate-type head tree with a box-type pile-holder is installed on the base frame. A guide rod that is used for hanging the hammer when hitting piles or for lifting piles into the head tree and an oil motor for driving is also installed on the base frame.

Using the Pressure-Pile Driver for hitting or pressing piles the base frame is stable. When clamping and pressing piles, the para-position is accurate, the clamping force is great and the direction's guide is fine. The equipment is convenient to move and easy to adjust. It is suitable to use in different construction condition.

THE INSTRUCTION TO THE HYDRRAULIC MOVABLE BASE FRAME PRESSURE-PILE DRIVER

1: This inventation involves a basic pole driving equipment in foundation construction. It is a pressure-pile driver which drives base piles by pressing or hitting.

2: Having intrieved World Patents Index and other information, we didn't find the same subject related to the inventation. The existing equipment of driving the construction's base piles -- pile driver, is a crawler diesel pile driver. It consists of a diesel hammer, a guide rod, a diagnal brace, an A-type support frame, a hoist, a base frame, a movable structure and an operating control system. The guide rod is installed in the front end of the base frame and it is located by the diagnal brace wiht a hydraulic oil cylinder. The diesal hammer is installed around the guide rod. The hammer can move up or down on the rod when it is driven by the hoist on the base frame. The A-type support frame in the center of the base frame is used for driving the guide rod when installing it. The base frame can revolution the crawler moving structure. The pile-driver produces a loud noise, a great vibration and a serious environmental pollution in construting,especially when it is used in residential area and high rise building district for pile driving, it will influence the buildings around. And this will also affect the residents' living condition. Because the height of the guide rod and hammer's hanging is increased along with the pile's length, this will lead to the unstability of the base frame and affect the safety of operating. In order to overcome the shortcomings of this hitting type of pile driver, there already has been a pressure-pile driver. It consists of a movable box-type base frame, a head tree, a pile-holder that can hold and press piles, and a hydraulic equipment system. The head tree is formed by four channal steel piles in the base frame. Each channal steel pile equips a guide track for the pile-holder's moving up and down. And at the top of the steel piles installs hydraulic oil cylinders which they are equipped mutually perpendicularly. The oil cylinders' piston bars are connected with the pile-holder. The pile holder consists of four pieces of interindependant clamping plates and four interindependant chuck bodies, hydraulic oil cylinders and roller device. They are respectively set up on the guide tracks of the four channal steel piles. That is to say, the four chuck bodies equipped clamping plates are seperately connected with the hydraulic oil cylinder's pistons, which they drive the chuck bodies moving horizonly or vertically. The base frame is installed on the movable mechanism by the support brackets and the circular channel revolution mechanism. The movable machanism has two groups of boatboots touching the grounel. The one group boatboots is installed in the transversal ends of the base frame, it is called to be the longideinal movable boatboots. The other group boatboots are installed in the longitudinal ends of base frame, they are called to be the transversal movable boatboots. The base frame is connected with the boatboots by the support brackets hinged in the base frame and the support legs that are installed in the brackets and controlled by the oil cylinders. This kind of pressure pile driver's weakness is that when clamping a pile, it must apply the force from the four direction. On the one hand, the displacements from the four directions are difficult to adjust uniformly as clamping a pile, that is to say, it is difficult to adjust the center's position. And more, the direction's guide when pressing piles depends on the four channal steel piles. If they are not uniform, this will affect the force of pressing pile. On the other hand, the resultant clamping forces from four directions that the chuck bodies clamp the pile is equal to the force of one oil cylinder's driving. So the force of clamping piles is hard to increase substantially. This kind of pressure pile driver's brackets are equipped on the base frame by hinge construction, so when supporting the base frame, it must be operated by people and fixed by overarm support. Thus the labor intensive of operating is great, and more, the supporting distance limited by the head tree in pressing piles. A traction guide rod and an oil motor for lifting piles are installed on the base

frame. The gate-type head tree is formed by two channel piles. And it is in the center of the base frame. At the top ot the head tree installs a hydraulic rise-falling oil cylinder equipment that the cylinders are equipped inter perpendicularly. The box-type pile-holder is installed on the guide track of the head tree. The rise-falling oil cylinders' piston bars are connected with the pile holder. A pulley mechanism is installed at the top surface of the head tree for passing wire ropes to lift and equip the guide rod. The guide rod is installed with the guider abutment at the end of the base frame and is hinged with the hydraulic diagnal brace that is in two ends of the head tree on the base frame. On the top of the guide rod there equips a turning crane. It is used for lifting piles into the head tree. The hydraulic elongate-shortening brackets are installed under two side of the base frame. The brackets are equipped with supporting legs. The supporting legs in two ends of the base frame are built in the longitudinal movable boatboots, the central supporting legs are built in the transversal movable boatboots. The box-type pile holder in the inventation includes four pieces of clamping plates, two chuck bodies, box and two groups of all cylinders. The two chuck bodies are installed in the box. Each chuck body has been equipped with two inter perpendicular-installed clamping plates. The oil cylinders' piston bars are connected with the chuck bodies. For this pile holder, the piston bars will pull or push the chuck bodies moving the box when the hydraulic oil cylinders are switched on. Thus the two chuck bodies will draw closely or separately and there by clamp or loose the pile in the center. The piston bar will lift up or put down the pile holder when switching on the hydraulic rise-falling oil cylinder on the head tree. That the piston bars lift up the pile-holder is clamping the pile in upper position of the pile. That the piston bars put down the pile holder is pressing the pile.

In order to make the invented pile holder have greater clamping force, we can equip a multiplying power lever between the hydraulic oil cylinder and the chuck body. And the two chuck bodies in the box is differently designed be a fixed chuck body and a living chuck body. This is to say that one chuck body is fixed to install on one side of the box. The other chuck body is installed on the other side of the box by the axle of force application through the two sidewalls of the box in the form of the sliding fit.The multiplying power levers are symmetrically hinged in the two sidewalls of the box. The hydraulic oil cylinders are symmetrically equipped out of the two sidewalls of the box. The piston bars of the oil cylinders are hinged with the ends of force application of the multiplying power levers. The force outlet end of the multiplying power lever is hinged with the axle of force application of the moving chuck body. This kind of the pile-holder with the multiplying power make a greater clamping force between the clamping plates of the chuck bodies when the oil cylinders are switched on.

Considering to construct in different conditions, there may be different geometry piles. In order that the clamping plates of the pile holder have a fine conduct with the different geometry piles and make the clamping surface of the pile bear the force uniformly. We can connect the four clamping plates with the chuck bodies by axle pins and make the clamping plates have self-modulation ability in pressing piles.

In order to make the part of the elongate-shortening of the brackets longer, the two brackets which is symmetrically in the two sides of the base frame can be installed in the same sliding groove and be connected with a pair of brakets by a group of horizonally elongate-shortening bi-head hydraulic oil cylinders. This shortens equipment position than the one head oil cylinder. So it will increase the length of the brackets relatively. The bi-head oil cylinder and the two symmetric brackets are installed in the sliding groove in the base frame. The oil cylinder is installed by the hinge in its central part and the cardan shaft hinge fork connected with the hinge axle in the cardan shaft hinge case that is fixed on the base frame. The piston bars of the oil cylinders are articulated with the elongate-shortening brackets. To this elongate-shortening brackets, the piston bar drive the brackets to elongate or shorten when the bi-head oil cylinder is switched on. The two brackets can be controlled to elongate or shorten symmetrically or asymmetrically.

The following is the working orders of the invented pressure-pile driver. When preparing to use the equipment for hitting piles, operate the hydraulic oil cylinder control system to drive the equipment to the piling position. Using the oil motor, the diagnal brace and the pulley structure on the gate type head tree, hinge the quick rod and hang the hammer, and so begin to pile. After having accomplished the first pile, operate the movable structure to arrive at the second pile's driving position, and begin to pile. When preparing to use the equipment for pressing piles, after the equipment has arrived at the pile's pressing position. At first, switch on the oil motor, lift up the pile by the turning crane on the top of the guide rod, and adjust the diagnal brace to make the guide rod incline to the gate-type head tree in order to put the pile into the clamping plates of the pile-holder on the head tree. Then operate the rise-falling oil cylinder on the head tree to make the pile holder

rise to the full. Now, operate the oil cylinder equipment of the head tree to drive the pile holder fall down to the lowest limit. Thus the pile has been pressed into the soil layer. When adjusting the base frame's position. It only need adjust the movable structure's locating condition.

Thus it can be seen, the invention possesses two functions for hitting and pressing piles. When the invented piled driver is used for driving piles, its base frame is stable;When it is used for pressing piles, it can put into the piles by itself. When clamping and pressing piles, the para-position is accurate, the clamping force is great and the direction's guide is fine. The designed movable base frame make the equipment is convenient to move and easy to adjust. Adjusting the length of the elongate-shortening brackets can increase the span of the base frame and improve the stability, when hitting piles. Shorting the length of the brackets can satisfy to press the border piles when pressing piles.

INSTRUCTION TO FIGURES

Figure 1 is a structure abridged general view of this invention.

Figure 2 is a vertical view of the pile holder in the inventation

Figure 3 is a front view of the pile holder shown in Figure 2.

Figure 4 is a longitudinal sectional view of the part of the base frame in Figure 1 near the elongate-shortening brackets. It indicates the bracket's elongate-shortening structure.

Figure 5 is a structure abridged general view of the transversal movable boatboots in Figure 1.

Figure 6 is the state abridged general view of the base frame's revoluting in the inventation.

Now, we illustrate the inventation farther combined with Figures.

According to the Figure 1, the base frame 1 of the pressure-pile driver is installed above the longitadinal movement boatboots 10 and transversal movable boatboots 11 by the elongate-shortening brackets 9 and the rise-falling suppout leg 8. The transversal movable boatboots is a double-skin-construction. The two layers are hinged with the different revolution hinge 12. The guide rod abutment 14 is in the left end of the base frame. The guide rod 2 is installed in it and can swing around its support axle. The upper part of the guide rods is hinged with the diagnal brace with a hydraulic oil cylinder. The diagnal brace 5 have fixed the guide rod 2 on the base frame. At the top of the guide rod 2 also equip the turning crane 4 for lifting piles. The hammer for pile driving is hung on the guide rod 2.The gate-type head tree 6 is fixed to install in the center of the base frame 1 and is formed by two channel vertical posts. The pulley mechanism 17 is equippped at the top surface of the two vertical posts. The hydraulic rise-falling oil cylinder 16 is installed at the top of the head tree. The guide track 15 is equipped in the inner wall and the pile holder 7 is equipped in the inner cavity. The pile holder is set up on the guide tracks 15 of the post by the roller mechanism at the top of the head tree, and is hinged with the piston bar of the rise-falling oil-cylinder 16. Therefore, the elongating or shortening of the piston bar can driver the pile holder 7 move down or up along with the guide track 15. Seen from the figure, on the base frame 1, there equips the oil motor 13 for lifting the guide rod 2, the hammer 3 and the piles.

Figure 2 and 3 have shown that there is a pile holder for clamping and pressing piles on the guide track 15 of the vertical post of the gate type head tree. Shown in the figure, the pile-holder includes the box 18, the movable chuck body 21, the fixed chuck body 24, the clamping plates 23 and 25, the hydraulic oil cylinder 26 and 30, the multiplying power lever 36. The two chuck body 21 and 24 are installed in the box 18, and the fixed chuck body 24 is fixed to equip in the right side of the box. The movable chuck body 24 is set up in the left side of the box 18 in the form of sliding fit, and is connected with the box by the axle of force application 29 on it. The chuck body 21 and 24 have each equipped two perpendicular clamping plates. The two pieces of clamping plates 23 is hinged on the movable chuck body 21 by axle pin 22. The other two pieces of the clamping plates 25 is hinged on the fixed chuck body 24 by axle pin 22. At the two ends 29 and 33 of the box 18 installs a roller mechanism to roll on the guide track of the gate-type head tree. The axle of the roller is fixed in the box 18. The roller 28 is equiper on it. Out of the two sidewalls 27 and 31 of the box, a multiplying power lever 36 including a multiplying power arm 35 and a track rod 40 is symmetricaly equipped by axle pin 39. At the end of the longer arm 34 of the multiplying power arm has hinged the gydraulic oil cylinder 26 and 30 which they are horizonally installed. The piston bar 20 and 32 is hinged with the longer arm 34 of the multiplying power arm. The bottoms of the oil cylinder 26 and 30 are hinged with the roller axle of the box body. One end of the track bar 40 is hinged with the shorter part of the multiplying power arm 35 of the multiplying power lever 36. The other end is hinged with the axle of force application 19 of the movable chuck body 21. To this kind of pile holder, the piston 20 and 32 will drive the multiplying power arm to swing when switching on the oil cylinder out of the box. If the piston bar elongates, the track bar 40 of the multiplying power lever 36 draws the axle of force application 19 to drive the movable chuck body 21

moving toward the central position which is confined by the two sidewalls of the box 18 (This is moving toward the fixed chuck body), The clamping plates 23 and 25 will clamp the pile; If the piston bar shortens, the direction of the acting force is opposite to the above, the clamping plates will loosen the clamped pile. In Figure 3, the elavator ball-seating 41 is fixed and equipped in the two ends of the box 18. The ball head of the piston bar 37 of the hydraulic rise-falling oil cylinder on the head tree is built in the ball-seating. The piston bar's rising or falling will drive the pile holder up or down.

Figure 4 has clearly shown the connection structure of the two elongate-shortening brackets which locate on the same vertical section of the base frame in the base frame's moving structure. Seen from the figure, the two brackets 44 and 48 is symmetricly installed in the sliding groove 43 on the base frame 1 and also can elongate or shorten in it. Each end of the brackets has perpendicularly set up the supporting legs oil cylinder 42 and 50. On the base frame 1 with the sliding groove 43 equips a cardan shaft hinge case 52. It makes that the bi-head oil cylinder. 45 of the bracket 44 and 48 is installed in the cardan shaft hinge case 52 by the axle hinge 46 in its center and the cardan shaft hinge fork 47 articulate with the axle hinge. The two piston bars of the bi-head oil cylinder 45 are hinged with the end of the two brackets by locating axle 49 and 53. The 51 and 54 in the figure are the piston bars of the supporting legs' oil cylinder 42 and 50. Their ends are built in the movable boatboots.

Shown in the Figure 5, the transversal movable boatboots is double-skin construction. It is formed by the boots body 56 and the boots bottom 55. The boots bottom 55 equips a central revolution axle seat 64 and four groups of revoluting ball block 63 that they are arranged in an, arc type. The boots body 56 is installed on the revolution axle seat 64. In the body 56 equip supporting vehicle 57 and 62 and a hydraulic oil cylinder 58. The vehicle can roll on the guide track 59 in the boots body. The supporting legs' ball block 61 is installed on the top of the two vehicles. The ball gead 60 of the supporting leg equipped in the brackets is built in it. This is to say that the base frame 1 in this inventation is installed on the vehicles in the boatboots by the bracket 44, 48 and the supporting legs' ball head 64. The one vehicle 57 of two vehicles is hinged with the piston bar of the oil cylinder 58.The root of the oil cylinder is hinged with the boots body located in one side of the other vehicle 62. To this transversal movable boatboots' structure, when the piston bar of the oil cylinder 58 elongates, the piston bar drives the vehicle 57 drive the base frame 1 moving toward the left. At same time, the base frame 1 draws the vehicle 62 rolling toward the left and the base frame keep to the left. It must indicate that the transversal movable boatboots 11 now is hanging in the air and that the longitadinal movable boatboots touch the ground and supports the whole weight of the equipment. So when the piston of the oil cylinder 58 shortens into the oil cylinder, as the weight on the vehicle is greater than on the boatboots, the oil cylinder push the transversal boatboots to the left by the hinge axle at the root of the oil cylinder, until the right side of the vehicle 62 in the boots body 56 roll to the right side of the boots body. This also can be said that the vehicle 57 and 62 both stop and the boatboots moves toward the left relatively until the right side vehicle closes to the right end of the boatboots. So a working process of the oil cylinder 58 (an elongating and a shortening) drives the movable boatboots stepping a pace toward the left (about 1.5m). On the contrary, it is similar.

Figure 6 indicates the state that the base frame has revolved once in the former position around the transversal movable boatboots 11. When the base frame 1 is in the normal state (The longitudinal movable boatboots is perpendicular to the transversal movable boatboots), drive the longitudinal movable boatboots departing from the ground and the transversal movable boatboots supporting the weight. And switch on the oil cylinder 581 and 582 at the same time. Thus make the piston bar of the 581 elongate and the piston bar of the 582 shorten. And the vehicle 571 connected with the 581 drives the base frame 1 displacing toward the left, but the vehicle 572 connected with the 582 drives the base frame 1 displacing toward the right. So the base frame 1 is produced an anti-clock wise moment of force and make the boots body 561 and 562 revolution axle seat 641 and 642 in the anti-clock wise direction related to the boots bottom 551 and 552. Therefore the base frame 1 can revolve an angle in the anti-clock wise direction too. Moving oppositing to the above, it also can drive the base frame 1 revolved in the clockwise direction. When the base frame 1 has revolved an angle, make the longitudinal movable boatboots be hanging and drive the boots bottom 551 and 552, the boots body 561 and 562 to be paralled differently. If make the longitudinal movable boatboots 10 be hanging in the air, and the transversal movable boatboots 11 support the weight again, repeat the above operation, the base frame 1 can revolve an angle again. The base frame revolve to 360 degrees. The maximum angle of once revolering is up to 20 degrees.

Claims

1. A hydraulic movable base frame pressure--pile

driver which can be used in foundational work for hanging hammer to pile or holding a pile to press, its special feature is that it includes a hydraulic movable based frame 1, a gate-type head tree 6 that is equipped a box-type pile-holder 7 and a guide rod 2 which can be used for handing the hammer when piling or for lifting a pile into the head tree when pressing the pile, has equipped an oil motor 13 for driving the guide rod for installing and lifting the pile.

In addition:

a) A hydraulic elongate -- shortening brackets is installed in two sides of the base frame 1. Supporting legs are equipped at the ends of the brackets. These supporting legs are built in the movable boatboots. Among them, the supporting legs at two ends of the base frame are built in the longitudinal movable boatboots, the central supporting legs are built in transversal movable boatboots.

b) The gate-type head tree 6 which is constituted by two channel vertical post is installed in the center of the base frame. On the top surface of the head tree 6 there is a pulley mechanism 17. The hydraulic rise-falling oil cylinder 16 are equipped vertically downward at the top of the head tree. The guide track 15 is equipped in the inner wall of the head tree and the box-type pile-holder 7 is equipped in its inner cavity. The pile holder 7 is set up on the guide track 15 through the roller mechanism above the pile holder's box body and is hinged with the piston bar of the rise-falling oil cylinder 16.

c) The guide rod 2 is set up at the abutment at the end of the base frame 1 and hinged with the hydraulic diagonal brace 5 near the head tree. On the tope of the guide rod there equips a rotating crane boom.

2. According to the right Claim 1, the pressure-pile driver's special feature is the box-type pile holder 7. It is formed by four pieces of clamping plates 23 and 25, two clamping body 21 and 24, box 18 and two groups of hydraulic oil cylinder 26 and 30. The two chuck body 21 and 24 are equipped in the 18. Each clamping body is allocated to pieces of clamping plates that are equipped mutually perpendicularly. Among the clamping plates, the two pieces of clamping plates 23 are installed on the chuck body 21, the other two pieces of clamping plates 25 are installed on the chuck body 24. The piston bars of the oil cylinders 26, 30 are connected with the chuck body 21 passing through the axle of force application 19 of the chuck body 21.

3. According to the right Claim 2, the pressure-pile driver's special feature is that there are two groups of multiplying power levers 36 which are formed by multiplying power arms 35 and track rods 40 among the hydraulic oil cylinder equipments 26, 30 and the chuck body 21. And the chuck body 24 is fixed on the side of the box 18. The chuck body 21 is installed at the other side of the box 18 by the form of sliding fit. The two groups of multiplying power levers 36 are articulated on the two sidewalls of the box symmetrically. The piston bar 20 and 32 of the hydraulic oil cylinder 26 and 30 are hinged with the longer arm 34 of the multiplying power arm 35 of the multiplying power lever. The end of the track bar 40 of the multiplying power lever is hinged with the shorter arm of the multiplying power arm 35, the other end is articulated with the axle of force application 19.

4. According to the right Claim 2 and 3, the pressure-pile driver's special feature is that the four pieces of clamping plates 23 and 25 are joined on the clamping body 21 and 24 by axle pin.

5. According to the right Claim 1, the pressure-pile driver's special feature is that the two elongate-shortening brackets 44 and 48 on the same longitudinal section of the base frame are equipped symmetrically into the sliding groove 43 on the base frame 1. And they are hinged with the two piston bars of the bi-head oil cylinder 45. The piston bars are articulated at the ends of the elongate-shortening brackets 44 and 48.

6. According to the right Claim 1, the pressure-pile driver's special feature is that the transversal movable boatboots is two-skin-structure, it is formed by the boot's body 56 and the boot's bottom 55. On the boot's bottom 55, there equips the central revolution axle seat 64 and four groups of revolution ball-block 63 that they are arrange in an arc type. The boot's body 56 is set up on the revolution axle seat 64.

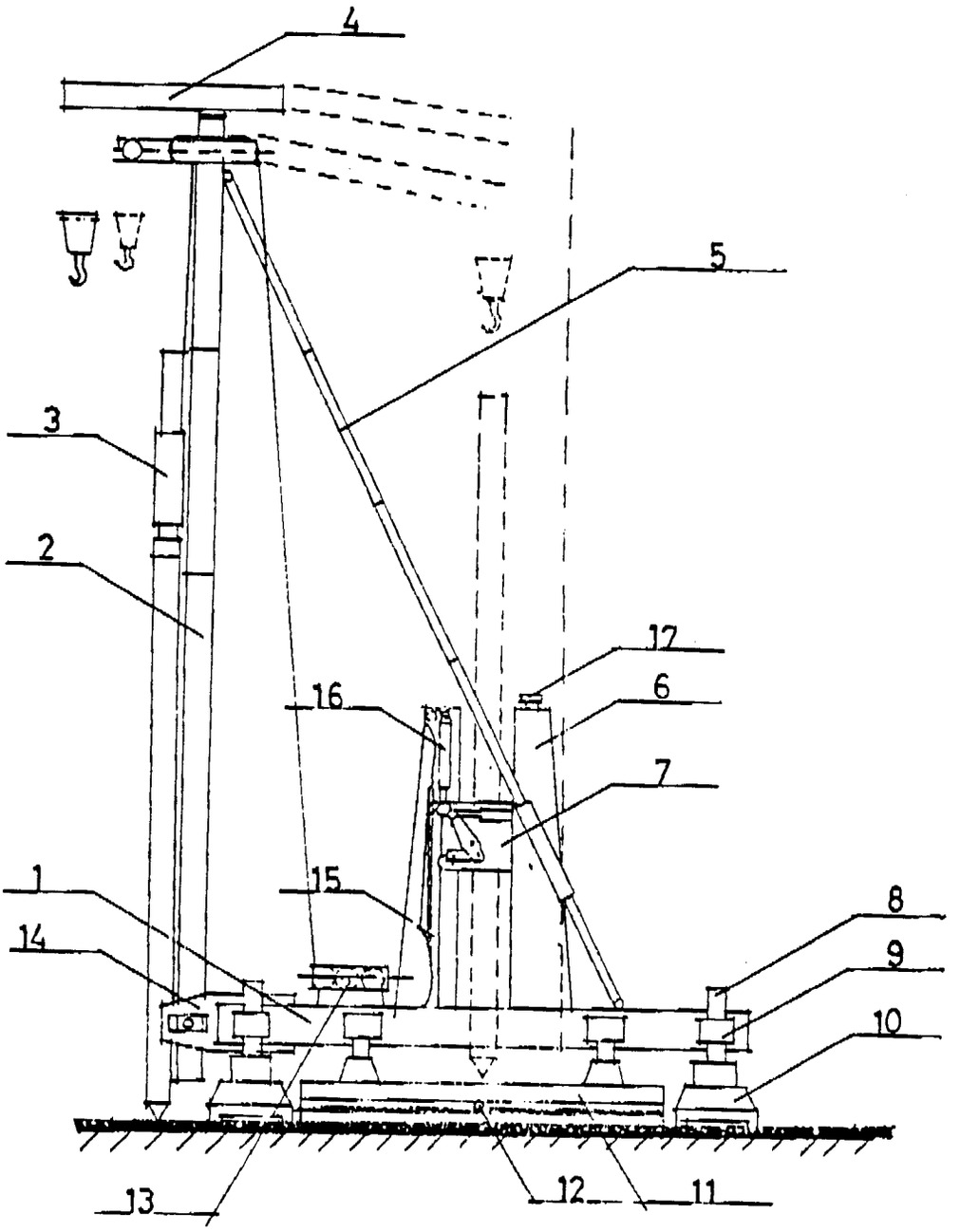

FIGURE 1

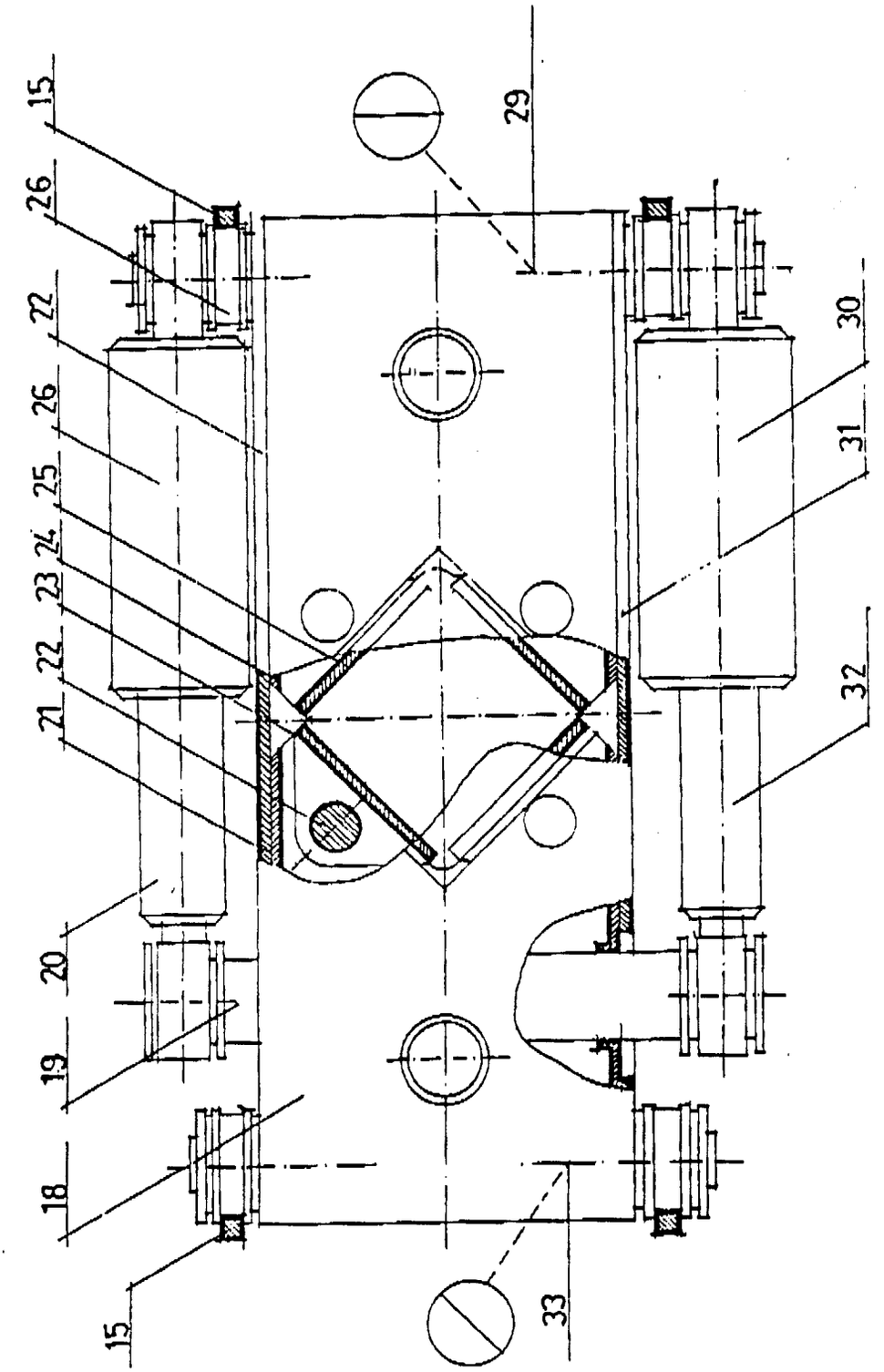

Figure 2

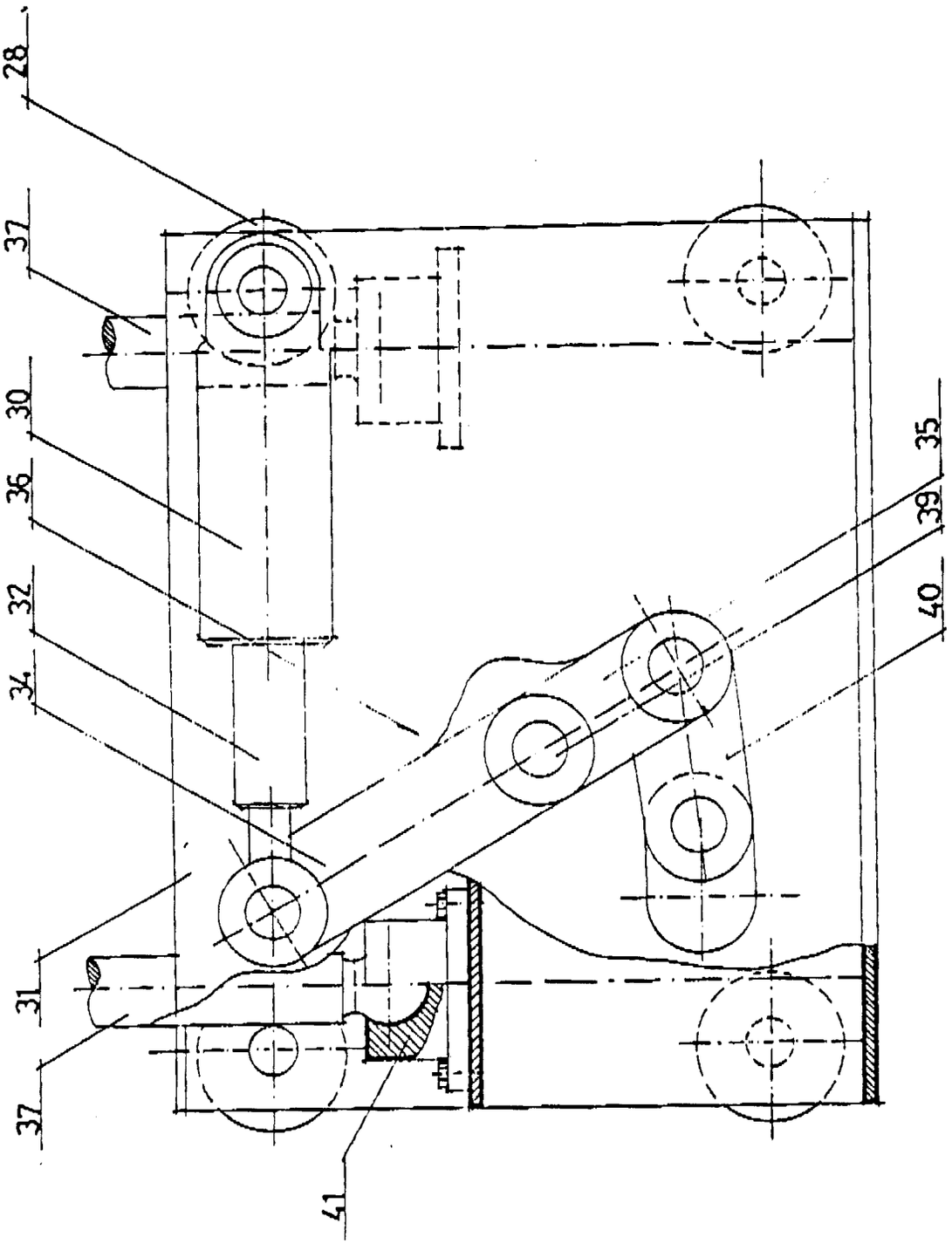

Figure 3

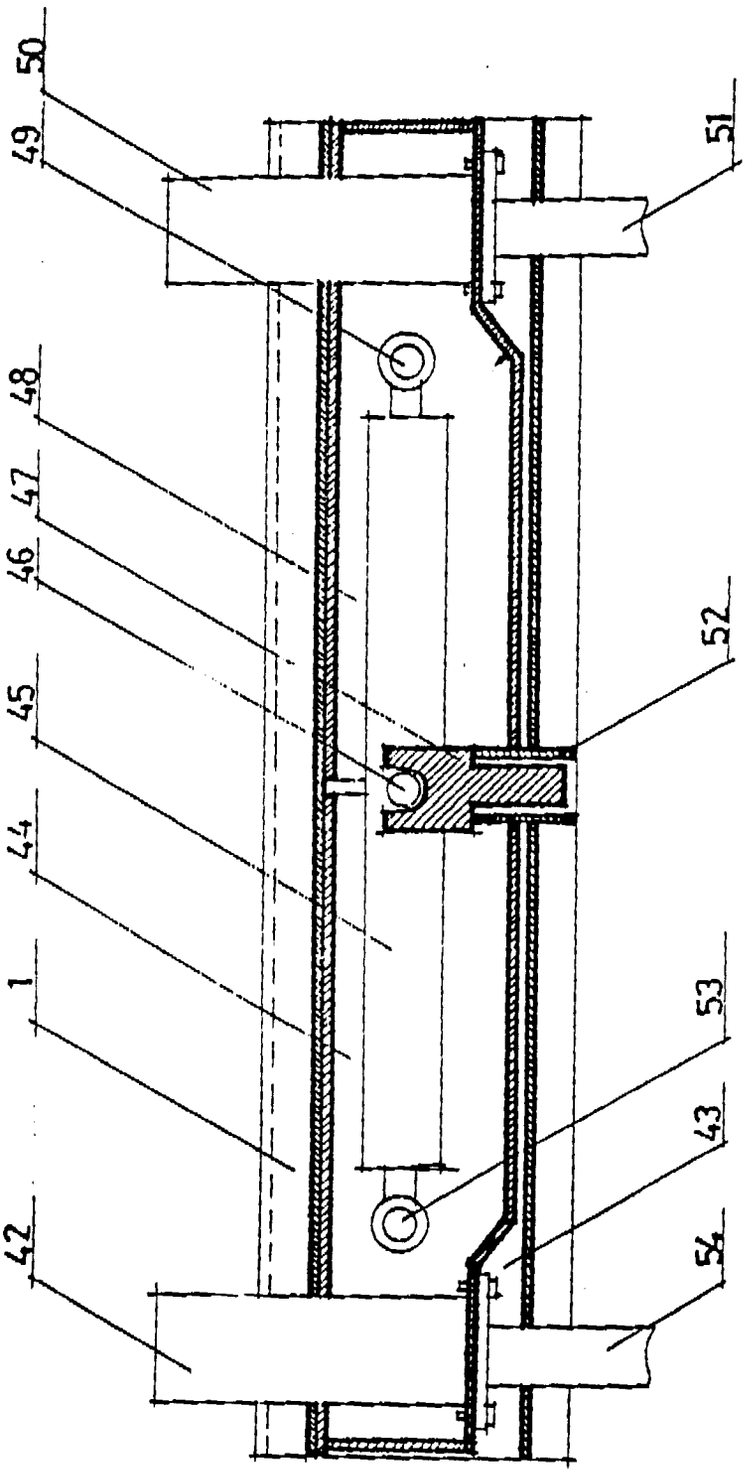

Figure 4

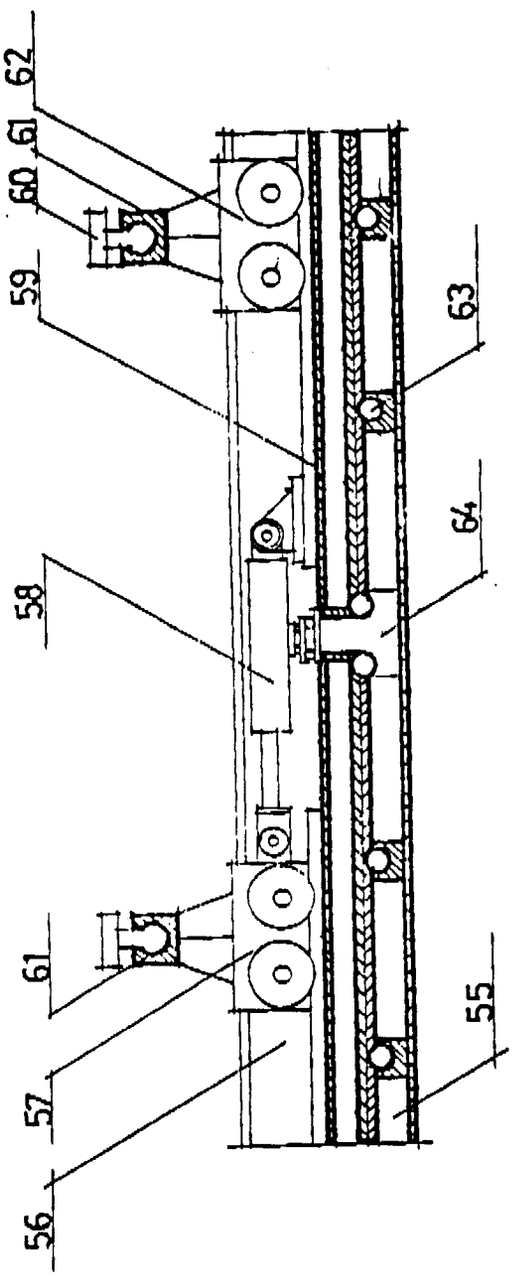

Figure 5

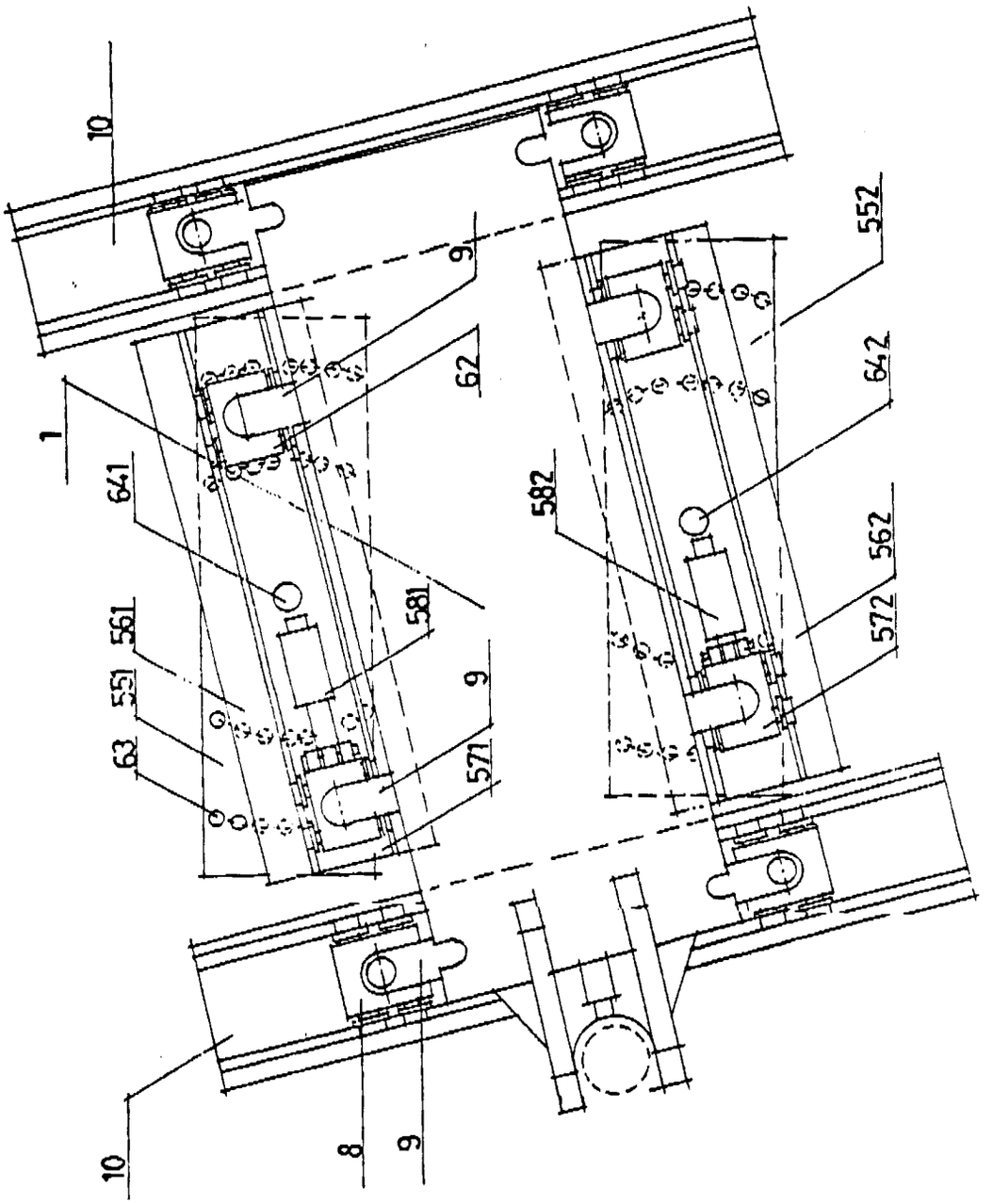

Figure 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 30 2328

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	FR-A-1 540 446 (REIMANN) * left column, line 1 - page 3, left column, line 24; figures 1-5 *	1,5,6	E02D7/16 E02D7/26
A	US-A-3 763 654 (MATSUHITA) * column 2, line 50 - column 5, line 22; figures 1-5 *	1-4	
A	US-A-2 600 542 (JOURDAIN) * column 2, line 15 - column 4, line 63; figures 1-3 *	1	
A	FR-A-1 553 320 (TREVISANI) * page 2, right column, line 1 - page 3, left column, line 36; figures 1,2A,2B *	1	
A	FR-A-2 140 005 (MITSUI SHIPBUILDING)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

E02D
B65G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 OCTOBER 1991	kergueno

CATEGORY OF CITED DOCUMENTS

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