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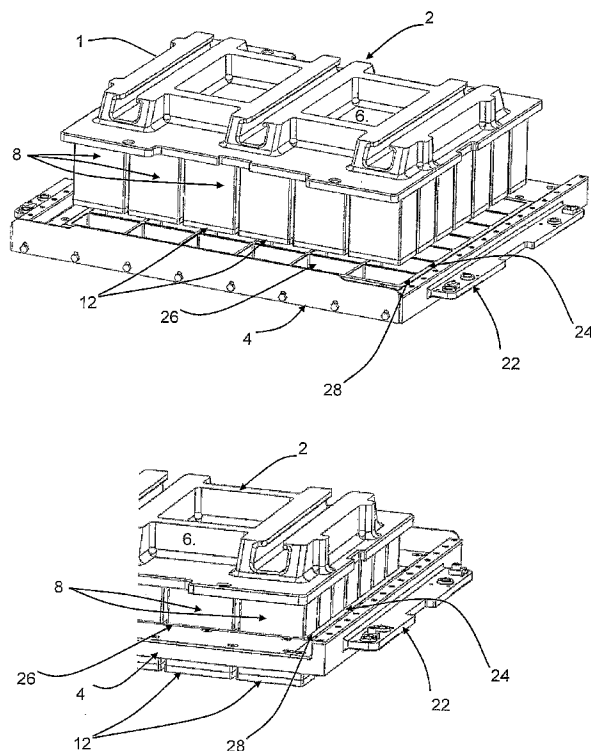
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(54) Title: CONCRETE MOULD SYSTEM HAVING PRESS PLATES AND FOOT PORTIONS WHICH REDUCES MOULD WEAR



(57) Abstract: In connection with casting concrete blocks for e.g. pavements etc., there is used a casting equipment including a bottom part (4) with casting cells (26) corresponding to the shape of the concrete blocks and a top part (2) with thrust plates (12) projecting downwards on rods (8) and substantially corresponding to the shape of the casting cells, and so that the thrust plates (12) by stripping the items by vertical displacement of the bottom part (4) are passed down through the casting cells (26). By the invention is provided a top part (2) which includes means in the form of rods that have the same shape as the thrust plate (12), thus preventing the concrete from falling down upon the thrust plate neither during the compression nor during the stripping operation, or in the form of thickened thrust plates or thicker bolt plates (14) ensuring that the top side of the thrust plates (26) or bolt plates (10) remain at a certain height above the top edge of the cells (26) during the entire compression stage, thus preventing the concrete residue, which is inevitably spilled on the mould table during the filling, cannot jump up upon the top side of the thrust plates (12) during the vibration. Hereby is avoided that these concrete remains accumulate and become a compact mass which during the stripping acts as grinding stone on the sides of the cell walls; this contributes to reduce the wear in the cells and the mould is thereby imparted a longer service life. Furthermore, the device has the advantage of considerably reducing the cleaning of the casting equipment.

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- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

Concrete mould system having press plates and foot portions which reduce mould wear

Description

5 The present invention concerns a rod and thrust plate construction which at the same time reduces wear on the casting equipment and reduces the extent of cleaning of casting equipment for concrete block machines of the kind typically used for production of cast items in the form of concrete blocks for pavement and wall construction, and including a cellular bottom part with upwards and downwards open
10 cells, which define the desired basic form of the individual blocks, and a complementing top part with an upper retainer plate having pressing pistons projecting downwards which are designed with lower thrust plates which fit into respective underlying cells in the bottom part and thereby are useful for downwards ejection of the cast items from the cells.

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The equipment is used in the way that the bottom part is placed on a casting board disposed upon a vibration table with the top part situated in an elevated position above the bottom part. A concrete supply vehicle is guided in along the upper side of the bottom part in the space below the top part, thus pouring concrete into the casting cells
20 and filling these with concrete completely, which is effected during one or more fill vibrating actions. After finished filling, the supply vehicle is drawn out, and the top part is lowered until the said thrust plates hits the concrete surfaces in respective casting cells. Then the top part is used as a multi-pressure piston for compressing the concrete mass in the individual casting cells, which occurs under strong chock
25 vibration of the casting equipment for separating air from the concrete mass. Hereby, the cast items are compressed for the desired compact block shape and uniform thickness. The top part is retained at its final level relative to the bottom part, and the bottom part applied force for elevating from the casting board, whereby the cast items, which under the pressure maintained by the top part do not participate in this
30 elevation, will remain standing on the casting board during the stripping concerned. When the stripping has ended by upwards displacing of the bottom part to a position, in which its underside is elevated to at least the level of the pressing plates of the top

part, the semi-solid cast items can be removed from the vibrating table by pushing out therefrom after lifting the top part, after which a new casting cycle can be commenced subsequent to lowering the bottom part to the casting board and elevating the top part to its starting position.

5

In the art it is known, see e.g. EP-A-1405704, to support the thrust plate with a large number of rods so that the pressure exerted by the casting machine in connection with the compacting process is distributed over a large number of rods, thereby effecting an approximate relief of the thrust plate itself.

10

The bottom part of the casting equipment is made with excess height compared with the finished product, corresponding to the compacting ability by the concrete from filling the cells to the finally compacted product, meaning that the thrust plate during compression moves down into the mould cell, and in many cases the top side of the thrust plate is moved below the level of the upper edge of the cell wall. When the top side of the thrust plate comes near the level, and particularly at level with or below the level of the upper edge of the cell wall, the concrete spillage which inevitably accumulates on the casting board during the fill vibration operation, will move and jump up on/over the top side of the thrust plate and fill the space between rod and the periphery of the thrust plate. This amount of concrete becomes larger and larger during a production shift. The concrete mass is gradually compressed and eventually sets, thereby becoming a compact mass which during the final compression stage wears the cell wall above the product, if the thrust plate moves under the level of the upper edge of the cell wall, and during the stripping stage it will scrape up along the side of the cell wall and give rise to further wear in addition to the wear coming from the compression stage itself. This is particularly pronounced in a design as indicated in EP-A-1405704 with a large number of rods between which concrete spill may be deposited and may only be cleaned off again with great difficulty.

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This discovery has resulted in development of a concept where either the rod is made just as large and with the same shape as the thrust plate, the thrust plate is made thicker or the bolt plate, on which the thrust plate is bolted, is made thicker so that the entire rod or the top side of the thrust plate/bolt plate maintains a certain height above

the upper edge of the cells. Regarding the thrust plate/bolt plate, the additional thickness is to be so great that the thrust plate and the bolt plate are somewhat over the upper edge of the cell wall in the final compression stage, so that the concrete spill accumulating on the casting table between and in front of/behind the cells does not jump up on this excess height during the compression stage. This design prevents accumulation of concrete residue during production which later becomes compact and hard due to the setting of the cement and thereby acts as grinding stone on the cell wall during compression and during stripping when the bottom part is lifted up above the product before the top part is lifted off the product. During the stripping process, the thrust plate will move all the way through the cell in the bottom part, both when the bottom part is lifted to release the newly cast items and when the bottom part is lowered again and the top part is lifted up to initial position before a new cycle can be commenced.

Particularly by high products, such as foundation blocks and concrete blocks for wall construction, the solution with rods with the same size as the thrust plate is the optimal solution, as the thrust plate almost always moves below the level of the top side of the upper edge of the cell wall and the thrust plate also moves a long way close to the cell wall, both when the mould is to be lifted at the stripping and when the mould is to be moved down again and the retainer is to move up to initial position. Besides, some moulds for high products are also born with slip for facilitating stripping, wider cross-section at the bottom than at the top for facilitating the stripping, and some products are simply wider at the bottom than at the top. By the rod having the same dimension as the thrust plate, it is prevented that loose concrete residue falls down upon the thrust plate/bolt plate. By products which are wider at the bottom, it is thus also prevented that the concrete residue does not fall down and is wedged/sprinkles down upon the newly cast product during the stripping operation. For filling the cavity, alternatively there may be made a block substantially corresponding to the outer periphery of the thrust plate and internally substantially corresponding to the outer periphery of the rod, the block may consist of several parts which then may be clamped around the rod or rods carrying the thrust plate. In many cases, the block may consist of two identical halves which are clamped around the rod/rods.

Since the thrust plates together with the cellular insert in the bottom part are wearing parts that are replaced after being worn out, for practical reasons it is typically the bolt plate that is made thicker to achieve the desired effect by the solution with thrust plate/bolt plate. Alternatively, intermediate plates can be made which in external dimensions correspond to the thrust plate which is then bolted between rod and thrust plate.

By other production methods, such as pressing of flagstones and clinkers, where very great pressing forces are applied to compress the casting material with separation of excess water, instead of the block machine production method with combined vibration and retaining pressure on plastic concrete it is often seen that the legs for the thrust plates have approximately the same dimension as the thrust plates, but this is mainly due to the thrust plate being perforated with many holes for separating excess water, and due to the perforation there is a great need of supporting the thrust plate under the extremely high pressures applied in the pressing technique. At the same time, there are also to be devices for removing the excess water from the process itself. The pressure in compacting flagstones is 20 to 50 times greater per area unit than in block machine production, which together with the perforation has necessitated support of the thrust plate right out to the edge. The thrust plate cannot just be made thicker for practical reasons, partly because of the perforation and partly because of the thrust plate also here being a wearing part which is also to be replaced at regular intervals. Pressing of flagstones typically occurs on what is called round table machines, where the mould after filling is rotated in under the pressure piston in order to minimise the movement of the pressure piston, as moving the pressure piston costs time and large amounts of oil. Having ended the pressing, the pressure piston is lifted off the cell, and the mould table is rotated for coming to the stripping station. Furthermore, the individual cells are filled with a measured amount of soft concrete without performing pre-vibration during the filling, and these condition provide that there is not so great spillage and possible spillage becomes a small lump of concrete which does not move, as no vibrations exist. Frequently, a piece of water permeable paper is placed in the mould before adding the concrete, and a piece of water permeable paper is placed upon the concrete before the pressing.

Pressing of these compacted products is quite different from the method applied by the present invention, as the mould stands still and the bottom of the mould is moved up, after which the newly cast flagstone is removed from the bottom plate of the mould, i.e. the thrust plate does not move along the inner side of the cell, why no comparison
5 can be made.

By concrete block machine production, there is used a process with very great chock vibration forces and small retainer pressure on plastic concrete. Due to pre-vibration, the plastic concrete will penetrate out under the sides of the concrete filling box, while
10 the plastic concrete, when subjected to vibrations, will divide itself into single particles coated with cement paste. It is these cement paste coated, single particles that are able to move during the vibrations. The particles simply jump on the casting board during the vibrating.

15 In DK 2001 00194 U4 is disclosed a thrust plate which is made thicker in order to ensure guiding of the top part and the bottom part during the stripping stage. Its effect is described to operate with one thicker thrust plate or alternatively a thicker thrust plate at each of the four corners. The guiding property can also be achieved by mounting an edge superstructure at the periphery. The thickness of the thrust plate is
20 here only depending on how much it is required to lift the bottom part off the cast product in order to avoid that the thrust plate of the top part goes through the cell of the bottom part. The new thicker thrust plate differs from the described in that the thickness of the thrust plate depends on the excess height that the bottom part cell is to have in relation to the final product in addition to the excess height having to continue
25 a length above the upper edge of the cell during the compression stage. Besides, the excess height is to appear on all thrust plates so that the wear is minimised in all cells.

The invention is now described briefly with reference to the drawing, on which:

30 Figs. 1A and 1B show a traditional mould structure for low products where the thickness of the thrust plate is only dimensioned on the basis of the required strength for the thrust plate. Here it appears that the top side of the thrust plate by the final compression of the concrete has moved down at level with the upper edge of the cell division in the bottom part.

Figs. 2A and 2B show a traditional mould structure for high products where the thickness of the thrust plate is only dimensioned on the basis of the required strength for the thrust plate. Here it appears that the top side of the thrust plate by the final compression of the concrete has moved down below the level of the upper edge of the cell division in the bottom part.

Fig. 2B shows the mould of Fig. 2A as seen obliquely from below so that it appears that the gap between thrust plates and the inner walls in the cells, also called the cores, is greater than the opening for the outer walls in the cells. This entails that concrete spill falling down may either fall through or wedge between core and thrust plate.

Figs. 3A and 3B show a form of the invention where the rod has the same dimension as thrust plate, whereby concrete residue cannot fall down upon the thrust plate at all and give rise to further wear.

Fig. 4 shows another form of the invention where the excess height of the thrust plate is attained by a jacket which is clamped externally on the pressing piston and thus fills the entire space where the rod moves in the cells, so that it is not possible that the concrete can fall down by itself during the entire stripping operation.

Fig. 5 shows a third form of the invention where the excess height of the thrust plate is achieved with a thicker bolt plate. It appears that the top side of between by the final compression of the concrete is located above the level of the upper edge of the cell division in the bottom part.

Fig. 6 shows a fourth form of the invention where the excess height of the thrust plate is achieved with a extra plates over the bolt plate.

On Fig. 1A appears a typical mould for low products, e.g. paving stones and flagstones. Fig. 1B shows a detail of Fig. 1A.

The mould top part (2) is shown in position in relation to the mould bottom part (4) with the thrust plates (12) down in the cells (26) corresponding to the final compression height. As it is seen, the top side of the thrust plate (12) has moved at level with the upper edge of the cell division (28). The concrete which during the filling is spilled on the casting board (20) may hereby unhindered move in on the top

side of the thrust plate (12) during the compression vibration, gradually filling the area (30) between rods (12) and the side of the cell (26).

5 On Fig. 2A appears a typical mould for high products, e.g. hollow concrete blocks for wall construction or foundation blocks. Fig. 2A is seen obliquely from above and Fig. 2B is seen obliquely from below.

The mould top part (2) is shown in position in relation to the mould bottom part (4) with the thrust plates (12), which cannot be seen, down in the cells (26) corresponding to the final compression height. It appears that the top side of the thrust plate (12) is
10 moved below the level of the upper edge of the cell division (28). The concrete which during the filling is spilled on the casting board (20) may hereby unhindered move in on the top side of the thrust plate (12) or the bolt plate (10) during the compression vibration and will gradually fill the area (30) between rods (12) and the side of the cell (26).

15

Fig. 3A shows a mould with rod design according to the invention, where the rods (8) have the same outer dimension as the thrust plates (12). Hereby it is prevented that a concrete build-up can occur at the top side of the thrust plates (12).

20 Fig. 3B shows the same mould as Fig. 3A, but shown in a position during the stripping where the bottom part (4) is lifted up and off the newly cast products which are not shown; it appears that it is not possible for the concrete residue to move in on the top side of the thrust plates.

25 Fig. 4 shows the same mould as Fig. 2A, but here the area between rods (8) and outer edge of pressure plates (12) are filled by a jacket (18) so that concrete residue cannot fall in on the top side of the thrust plates/bolt plates, while the jacket during the last part of the stripping, corresponding to the situation on Fig. 2B, simultaneously hinders concrete residue from falling down and wedging between thrust plate and the cell wall
30 when the bottom mould part is elevated for stripping. By high products, such as hollow concrete blocks, the cross-section of the product is often larger at the bottom in order to facilitate the stripping, and by some types of hollow blocks, the cavity does not go through and through, entailing that concrete residue may fall through from the

casting board and down on the newly cast products during stripping, and larger lumps of concrete may sometimes simply fall down and wedge in the gap (32) between thrust plate (12) and core which is part of the cell (26).

- 5 Fig. 5 shows a third form of the invention where between rods (8) and thrust plate (12) there is provided a thick bolt plate (14) ensuring that the concrete spillage can neither move up upon the top side of the thrust plate (12) nor up on the top side of the thick bolt plate (14).
- 10 Fig. 6 shows a fourth form of the invention, where upon the bolt plate (10) there is provided one or more overlay plates (16) ensuring that thrust plate (12), bolt plate (10) and overlay plates (16) together have a thickness ensuring that the top side of the overlay plate (16) is at a certain height above the top side of the cell division (28) not shown on the Figure.

List of position numbers

1. casting equipment consisting of a top part and a bottom part
2. top part
- 5 4. bottom part
6. upper retainer plate
8. rods
10. bolt plate
12. thrust plate
- 10 14. thick bolt plate
16. overlay plate
18. jacket
20. casting board
22. bottom part frame
- 15 24. cell division
26. cell
28. top side cell division
30. area where concrete may accumulate
32. gap between thrust plate and core by hollow concrete blocks

CLAIMS

1. A casting equipment (1) consisting of a top part (2) and a bottom part (4) for concrete casting machines of the kind typically used for production of cast items in the form of concrete blocks for paving and wall construction, including a bottom part (4) with cellular insert (24) with upwards as well as downwards open cells (26), which define the desired basic form of the individual concrete blocks, and a corresponding top part (2) with an upper retainer plate (6) having downwards projecting rods (8) designed with lower thrust plates (12) which fit into respective underlying cells (26) in the bottom part (4) and thereby are useful for downward ejection of the cast items from the cells (26), **characterised in that** the top part (2) includes means preventing inadvertent accumulation of concrete residue at the top side of the thrust plate (12), the means being provided either as an integrated part of the rods (8) projecting down from the upper retainer plate (6) or as a part of the thrust plates (12).

15

2. Casting equipment (1) according to claim 1, **characterised in that** the means for preventing inadvertent concrete accumulation is constituted by a jacket (18), the outer shape of which corresponding to the periphery of the thrust plate (12) and the inner side corresponding to the periphery of the rod (8) in the corresponding cell (26) in the bottom part (20), whereby the jacket (18) fills the space between the outer periphery of the thrust plate (12) and the outer periphery of the rod (8) along at least a part of the length of the rod (8) between the thrust plate (12) and the retainer plate (6).

20

3. Casting equipment (1) according to claim 1, **characterised in that** the means for preventing inadvertent concrete accumulation is constituted by a thrust plate with increased thickness, ensuring that the thrust plates (12) maintain a position above the top side of the cell division (24) of the corresponding cells (26) in the bottom part (4).

25

4. Casting equipment (1) according to claim 1, **characterised in that** the means for preventing inadvertent concrete accumulation is constituted by a bolt plate with increased thickness (14) and an outer shape corresponding to that of the thrust plate, which thus ensures that the bolt plates and the thrust plates (12) maintain a position

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above the top side of the cell division (24) of the corresponding cells (26) in the bottom part (4).

5 5. Casting equipment (1) according to claim 1, **characterised in that** the means for preventing inadvertent concrete accumulation is constituted by one or more overlay plates (16) with an outer shape corresponding to that of the thrust plate and arranged above the normal bolt plate, which together provide increased thickness ensuring that the overlay plates (16), the bolt plates (10) and the thrust plates (12) maintain a position above the top side of the cell division (24) of the corresponding cells (26) in
10 the bottom part (4).

6. Casting equipment according to claim 1, **characterised in that** the means preventing inadvertent concrete accumulation at the top side of the thrust plates is constituted by a rod (8) having substantially the same shape as the thrust plate.
15

Fig. 1A.

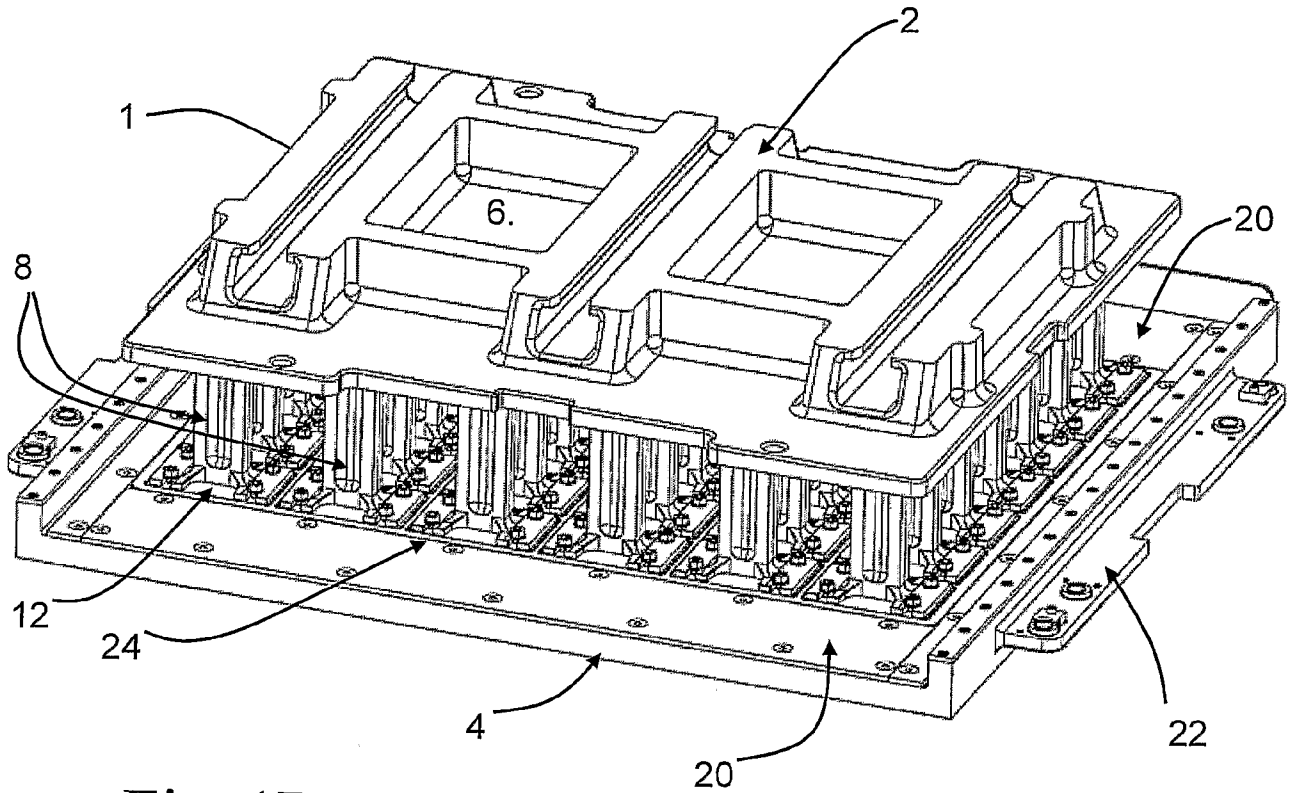


Fig. 1B.

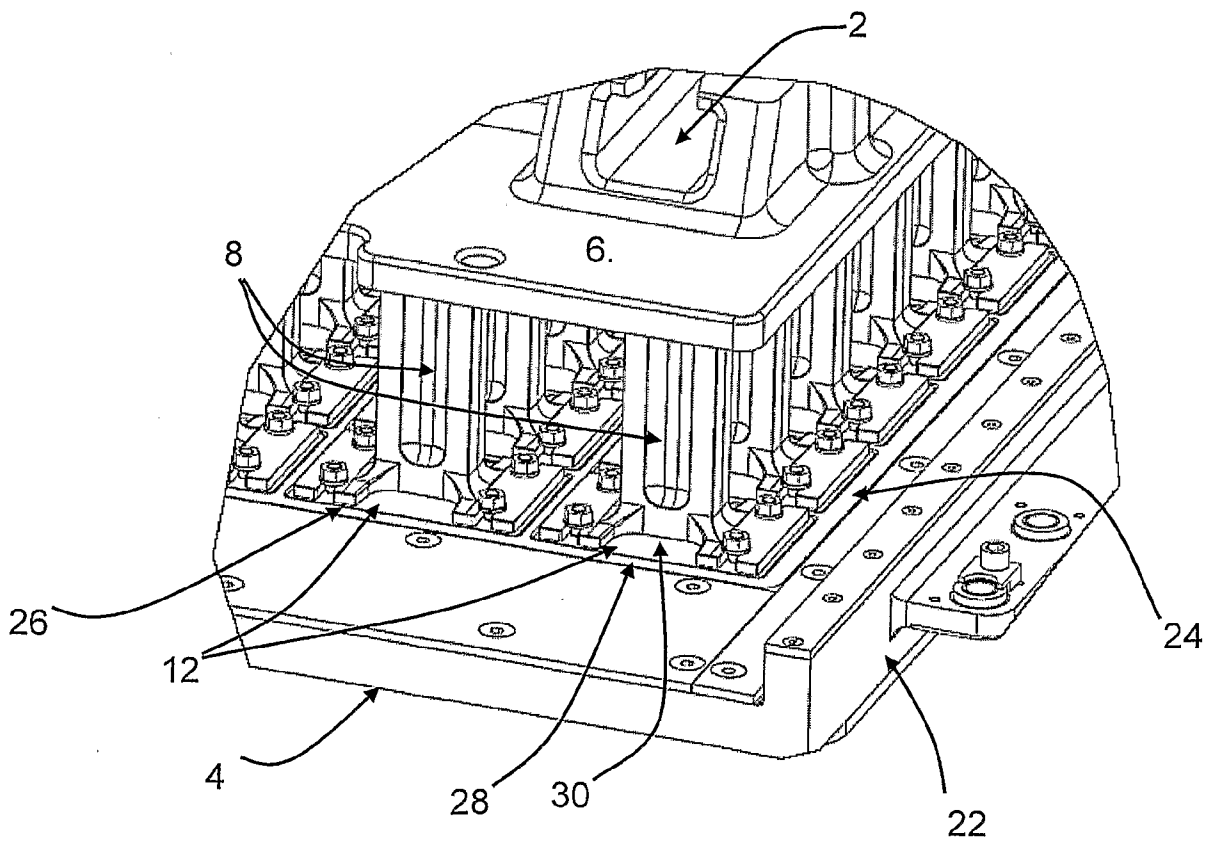


Fig. 2A

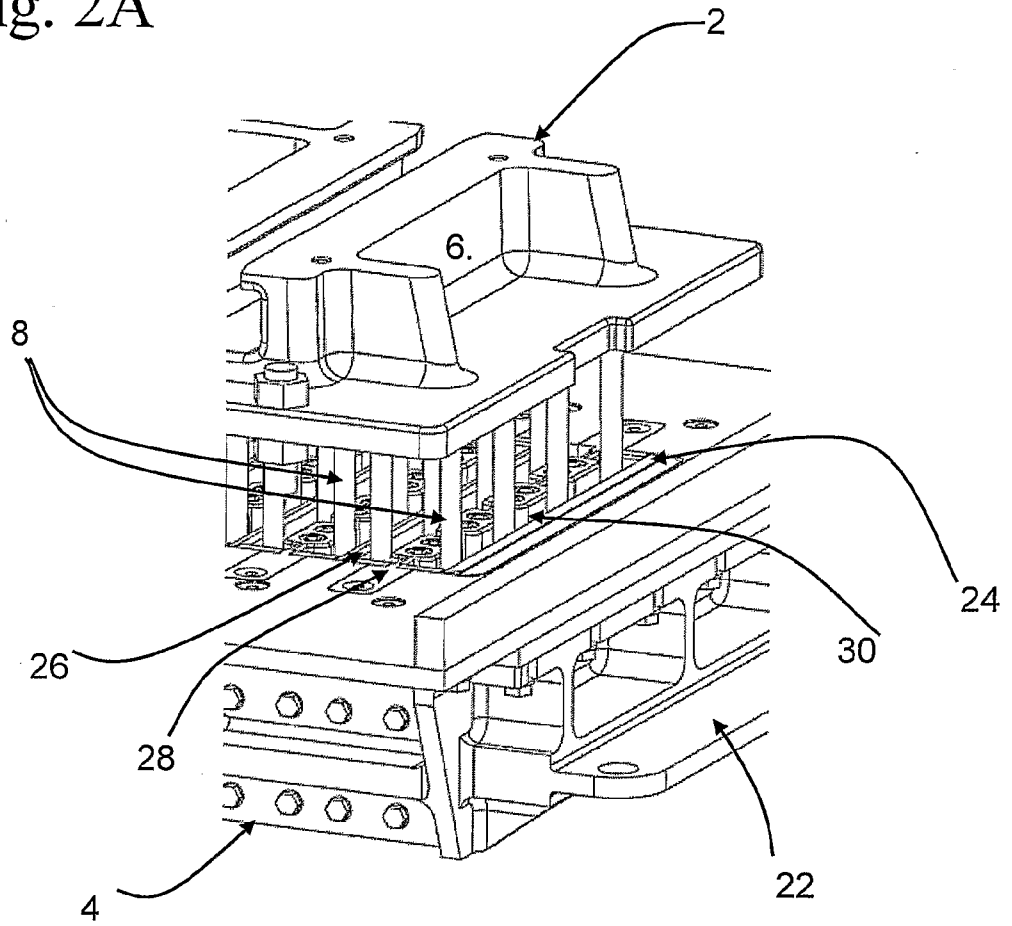


Fig 2B.

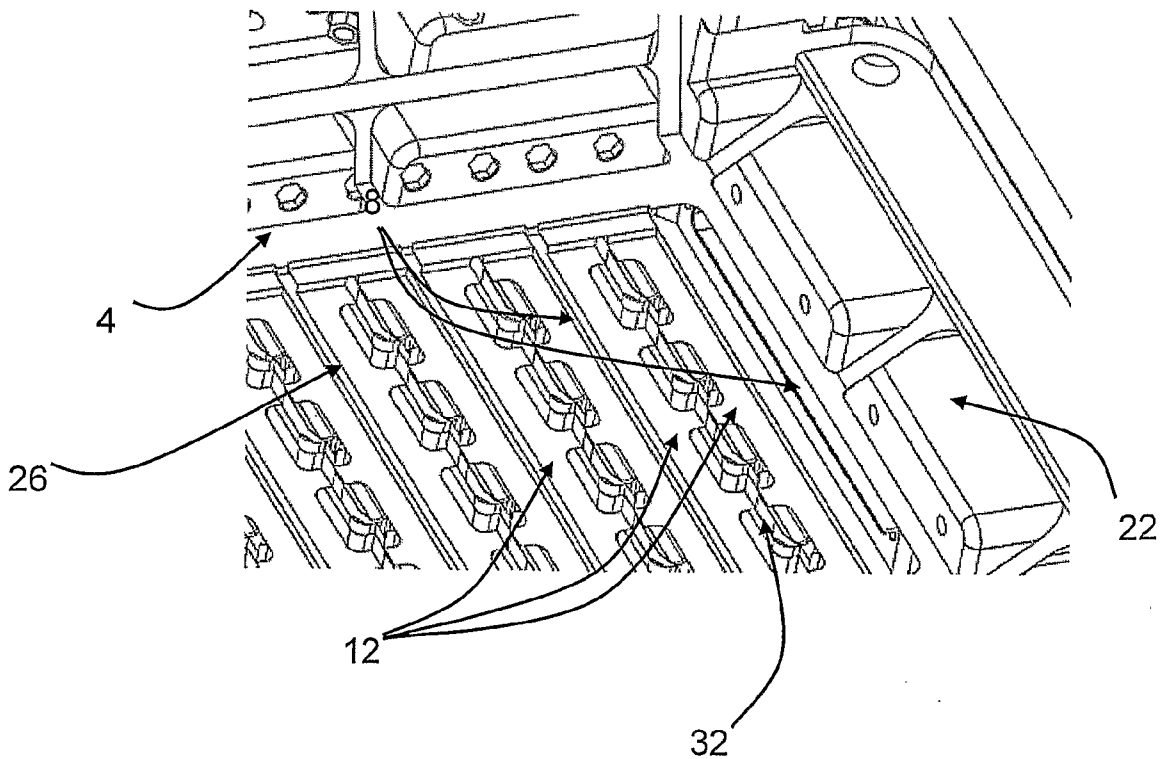


Fig 3.A

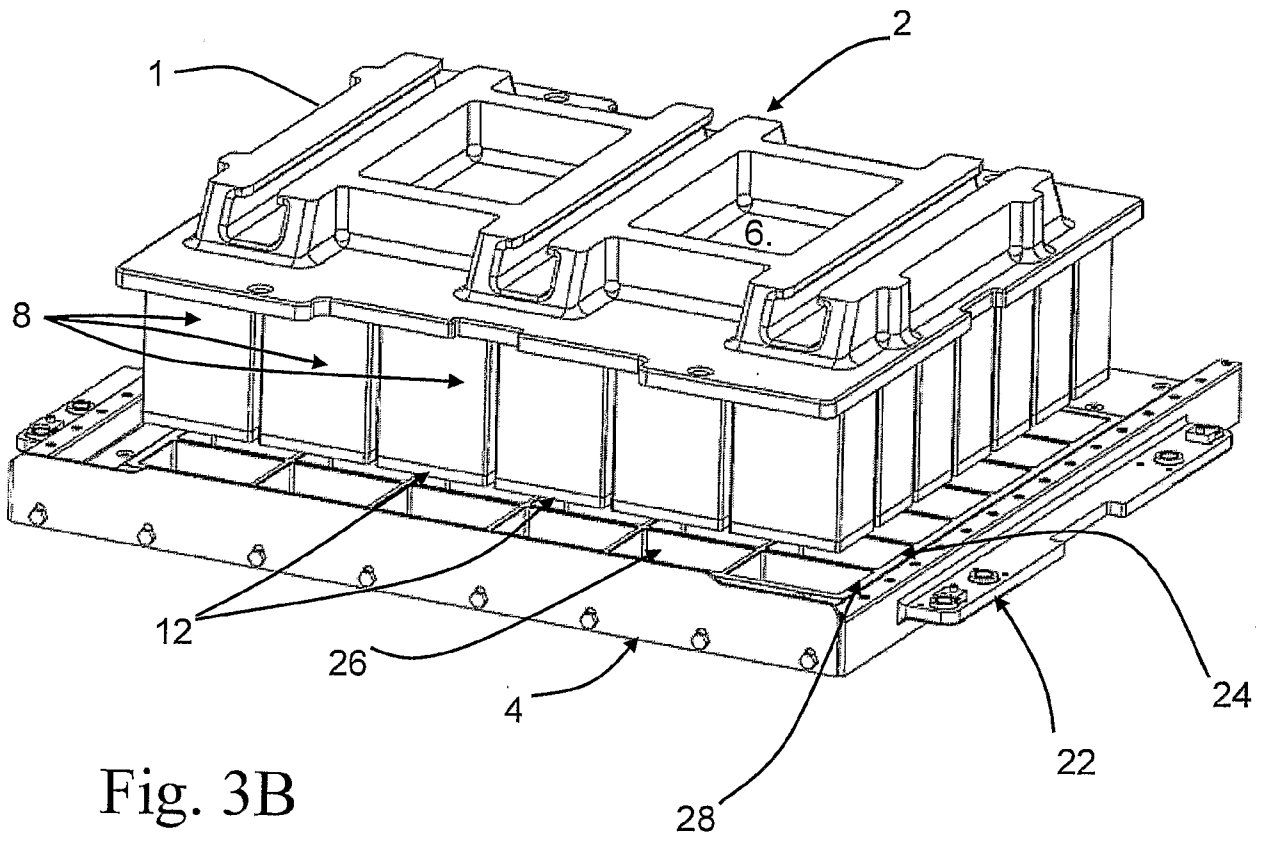


Fig. 3B

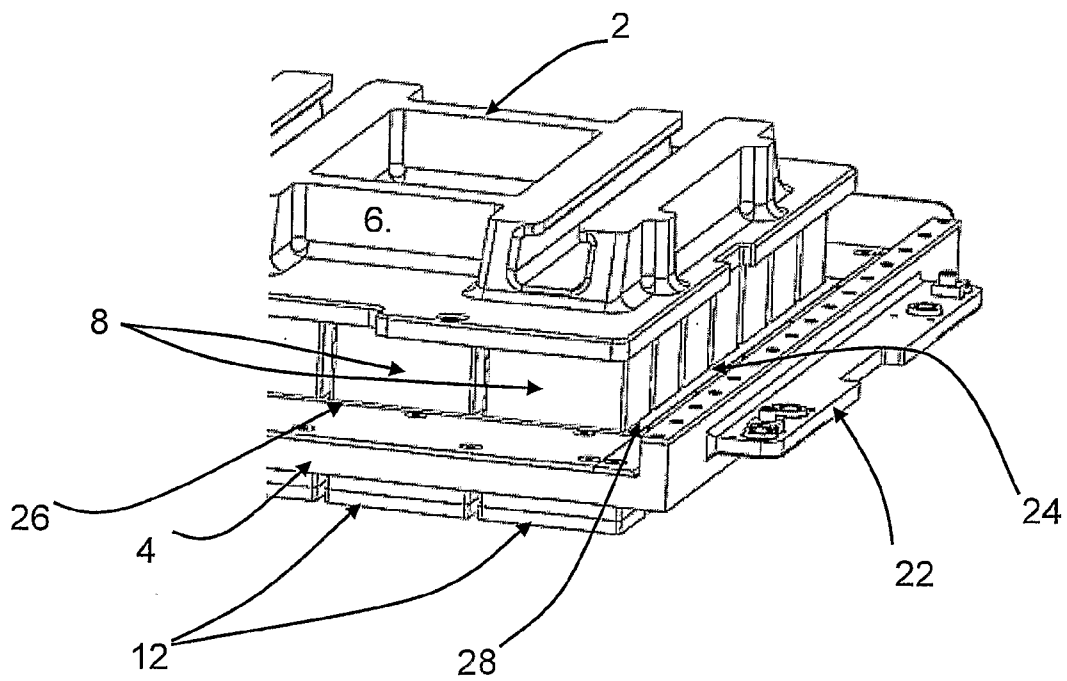


Fig. 4.

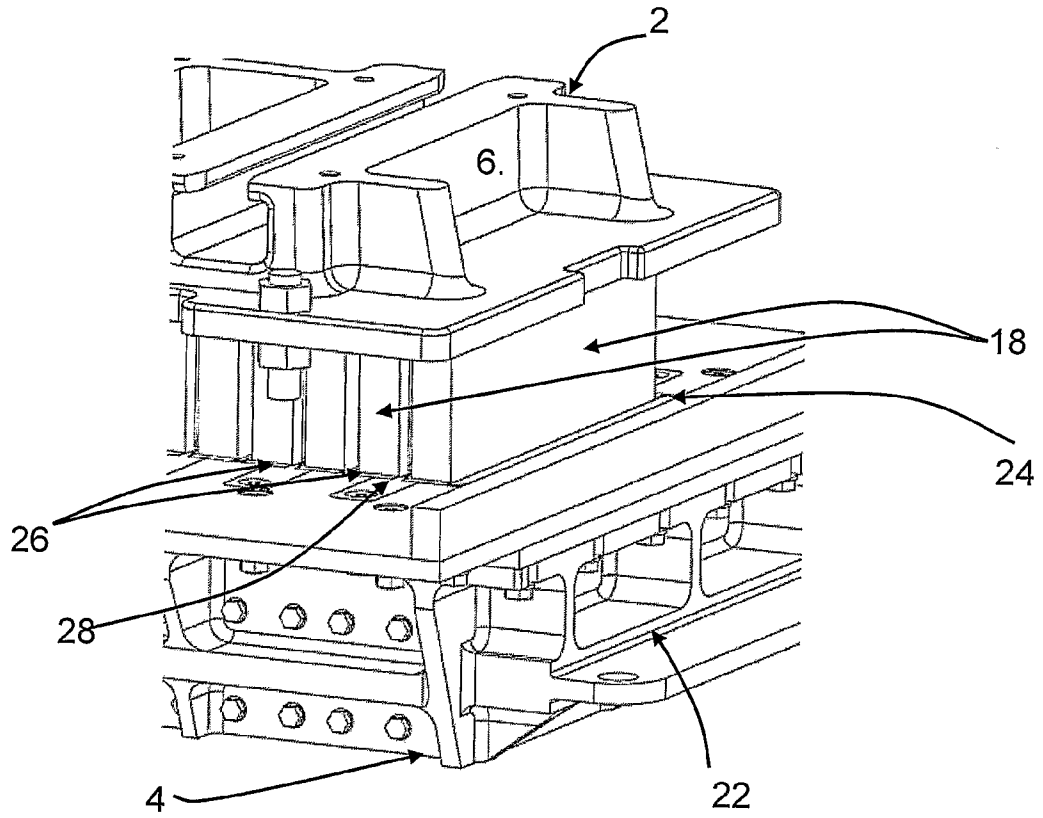


Fig. 5.

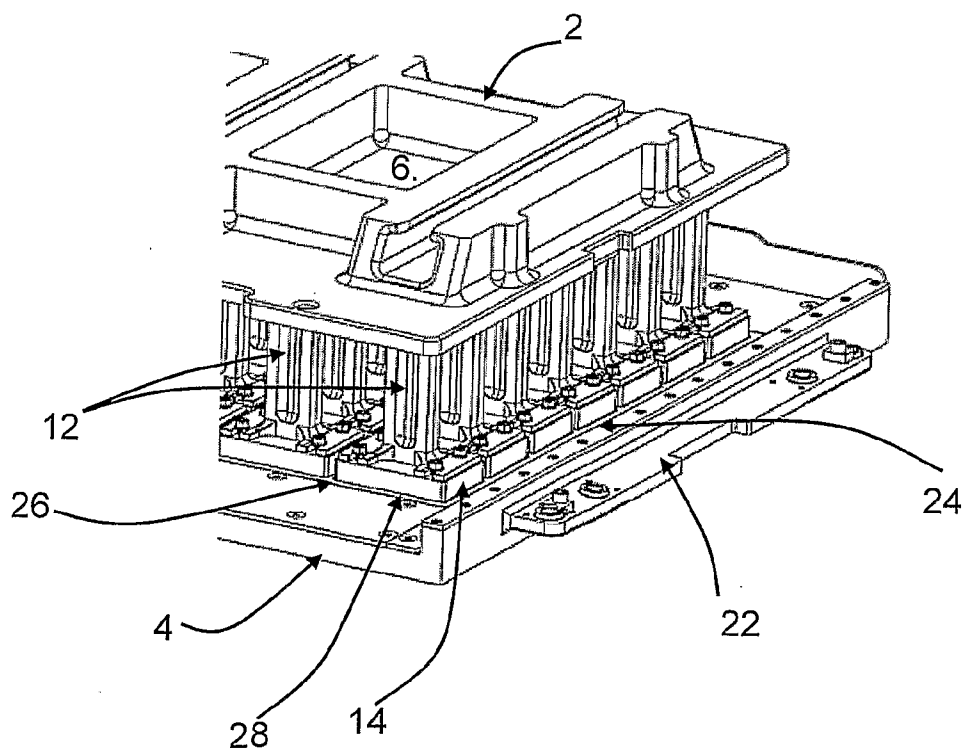
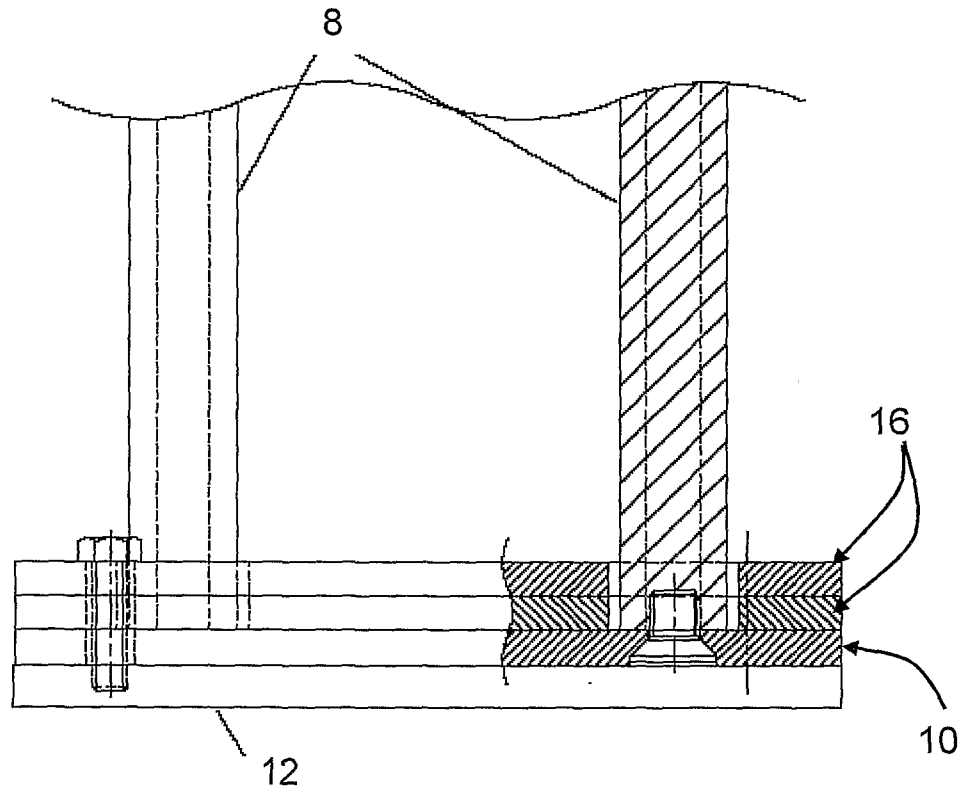


Fig. 6



INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER		
INV. B28B3/02	B30B11/02	B30B15/06
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) B28B B30B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	US 2004/130047 A1 (SKIDMORE DAVID A [US] ET AL) 8 July 2004 (2004-07-08)	1,3
Y	paragraph [0047] - paragraph [0055]; figures 3a-5a	4
X	US 2002/025357 A1 (SPANGENBERG ERIK [DK] ET AL) 28 February 2002 (2002-02-28) cited in the application paragraph [0033] - paragraph [0034]; figures 2,3	1,5
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<input checked="" type="checkbox"/>	Further documents are listed in the continuation of Box C.	<input checked="" type="checkbox"/> See patent family annex.
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Date of the actual completion of the international search	Date of mailing of the international search report	
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