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(54) MOULDING EQUIPMENT WITH VACUUM EQUALIZING MEANS

(57) The object of the present invention is to provide a concrete casting machine with vacuum equalizing means (9), so when the core members (8) are being lifted, the vacuum equalizing means (9) prevents vacuum from occurring in the volume between the core member (8), the casting material and the casting surface (6).

This is provided by a core member (8) for a concrete casting machine of the type providing a cavity in a cast item, where said core member (8) comprises at least one core conduit (9) for gas communication arranged through the core member (8) extending from a first gas opening (22) in a top surface (21) of said core member (8) to a second gas opening (23) in a bottom surface (20) of said core member (8), where in use said core member (8) is arranged in a moulding equipment (1) for a concrete casting machine.

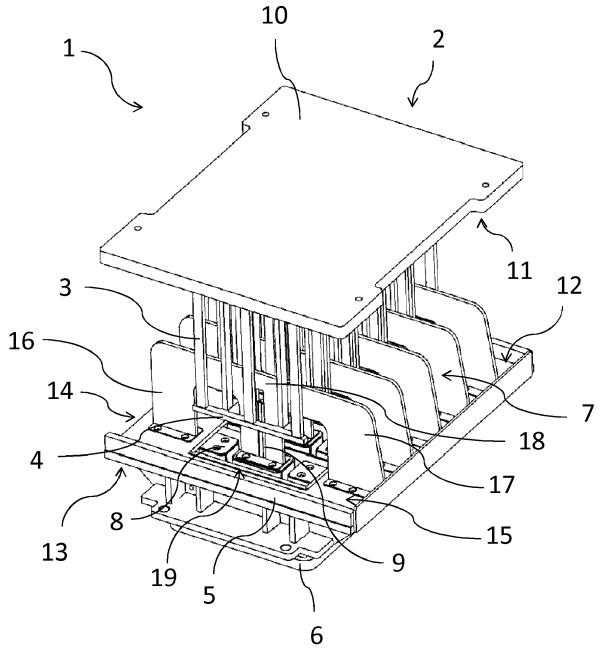

Fig. 1

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Description

Field of the Invention

[0001] The present invention relates to moulding equipment for concrete casting machines.

Background of the Invention

[0002] Moulding items with cavities, such as foundation blocks, perforated blocks and other elements are well-known. One example of prior art which relates to moulding equipment for concrete casting machines is to be found in the teaching of EP1597043B1.

[0003] EP1597043B1 relates to casting of concrete blocks with cavities, e.g. foundation blocks, perforated blocks and elements with cavities, a moulding equipment including a bottom part with casting cells with pendant core members bolted on to the top plate and corresponding to the shape of the concrete block, and a top part which has pressing plates projecting downwards on support rods and substantially corresponding to the shape of the casting cells, so that the pressing plates by vertical displacement of the bottom part, the pressing plates are passed down through the casting cells. EP1597043B1 describes a bottom part is indicated that includes means in the form of core members forming the defined cavities in the finished block/element. The core members may either be releasably bolted onto the top plate of the bottom part, or, alternatively, be suspended from a yoke which is releasably fastened to the mould frame. Between the mould frame and the yoke there may be a vibration dampening shim. Core members may furthermore be bolted on with a vibration dampening or compact shim.

[0004] Problems occur when the molding equipment releases the casted items (semi-wet concrete blocks). For example when the bottom part is lifted, a vacuum/under-pressure is created between the bottom of the core members and the contact surface between the core members and the semi-wet concrete blocks. The pull of the vacu-um/underpressure causes the sides of the casted items to be moved out of shape, and thereby generates cracks, deformations and other stress related damage. This may be somewhat alleviated with the prior art device by slowly and carefully elevating the core members relative to the newly cast object.

[0005] The cracks, deformations and other stress related damage prevents the production to provide uniform and flawless items. The quality and strength of the casted items are significantly impaired, and may get worse during further handling. The production process is time consuming and the production costs are high, trying to produce casted items with low production damage.

Object of the Invention

[0006] The object of the present invention is to provide a concrete casting machine with vacuum equalizing means, so when the core members are being lifted, the vacuum equalizing means prevents vacuum from occurring in the volume between the core member, the casting material and the casting surface.

Description of the Invention

[0007] The present invention addresses this by providing a core member for a concrete casting machine of the type providing a cavity in a casted item, where said core member comprises at least one core conduit for gas communication arranged through the core member extending from a first gas opening in a top surface of said core member to a second gas opening in a bottom surface of said core member, where in use said core member is arranged in a moulding equipment for a concrete casting machine.

[0008] Concrete blocks with cavities, e.g. foundation blocks, perforated blocks and elements with cavities, may be casted using different types of moulding equipment. All of the types may have a core member integrated in the mould, where the core member may be arranged to provide different shapes of concrete items, such as blocks or elements, with a cavity formed as the core member. The core member will be surrounded by casting material, in the process of producing concrete elements in a predefined form defined by core member and a cavity in the moulding equipment. In this example, it may be a concrete casting machine casting concrete items, but it could be other types of moulding material as well. It would also apply for polymers or plastic materials, or other types or mixture of molding material.

[0009] When the items are being casted, the core member is surrounded with hardenable concrete material, which may be poured or otherwise added into the mould. After the hardenable concrete material is formed and maybe even cured, the core members are lifted away from the inside of the concrete item forming a cavity.

[0010] When the moulding equipment is lifted, a vacuum may occur between the bottom part of the core member and the casting surface, enclosed by the casting material walls forming an expanding volume. To prevent the casted items to be exposed to cracks, deformations and other stress related damage, vacuum equalizing means may be arranged so the expanding volume between the concrete item, the bottom part of the core member and the casting surface may be equalized as the core member together with the moulding equipment is being lifted away from the concrete item.

[0011] Due to the significant reduction in errors during casting, it is possible to provide a casting process where the production speed is increased without harming the concrete items. Also the form of the concrete items may be optimized according to dimension and weight. The walls of the concrete items may be casted thinner, because the walls may not be subject to the vacuum during the casting process, which easily damages thin walls.

This also provides a more rapid casting, since the material poured into the mould may be reduced, and the time for filling the mould is therefore also decreased. This will subsequently cause a weight reduction of the casted concrete items, which is crucial for the freight costs, which can be reduced.

[0012] The present invention provides core member for moulding equipment, which may be used in casting machines. The design of the core member courses the moulding equipment to perform with an increased casting speed, reduce the production costs significantly, and at the same time approximately eliminate the casted items' defects. Furthermore, using this production process, it will be possible to provide a weight reduction of each of the casted items, which leads to an easy handling of the concrete item, and a major reduction in costs, both in relation to material used during casting, and also in freight.

[0013] In an advantageous embodiment of the invention, said first gas opening of said core conduit is provided with connecting means.

[0014] The connection means may be used for core conduit extensions, extending the core conduit gas opening to the ambient surroundings, so the opening is moved away from the top surface of the core member. Thereby prevent any clogging of the core conduit in the casting process.

[0015] The first gas opening of said core conduit may otherwise be provided with at least one connecting means for example for connecting to a device containing compressed gas. The device may be a source of pressurized gas, which provides compressed gas through said core conduit to the casting surface. The gas flow of the compressed gas prevents vacuum in the expanding volume between the casting surface, the casting material and the bottom surface of said core member, when the core member is being lifted from the casting surface.

[0016] The gas flow may be compressed gas controlled through the core conduit and out through a gas opening provided in the bottom of the core member facing the casting surface. The gas opening is in gas communication with the expanding volume, and through the continuing gas flow into the expanding volume, equalizing the pressure between the casting material, the bottom surface and the casting surface. By providing a controlled vacuum equalizing system in the casting process, enhances a uniform production of casted items, without or highly reduced damaging effect.

[0017] In a further advantageous embodiment of the invention, said core conduit extends a predefined distance above said top surface of said core member in a direction away from said bottom surface of said core member.

[0018] To ensure that the core conduits do not get clogged in the casting process, the core conduits are extended beyond the top surface and away from the core member. The casting material is poured into the mould, and the concrete is in liquid form. The liquid concrete may easily get in the core conduits and completely or partially stop the gas flow through the core conduit. This will cause damage to the casted items and the failure rate may increase significantly. The top of the core conduits may therefore be arranged in a safe distance from the moulds' highest level of the casting material and where the casting material is poured into the mould.

[0019] The core conduit extends above the top surface of the core member, in an extension of more than 5 %, preferably 10%, relative to a height of said core member, measured from the bottom surface to the top surface. An alternative solution is that the extension is more than 1cm, preferably more than 5 cm. The optimal extension may depend on the height of said core member.

[0020] The connection means may also be provided in the remote end of the core conduit extensions, where the connection means may be used for vacuum equalizing gas flow through the core conduit.

[0021] The present invention also provides a moulding equipment for a concrete casting machine, where the moulding equipment comprises:

- at least one bottom frame provided with a frame aperture, where said bottom frame is positioned between a top plate and a casting surface such that the frame aperture defines a cavity enclosed by said bottom frame, said casting surface,
- at least one core member comprising a top surface and a bottom surface, where said core member is arranged in said frame aperture of the bottom frame, where the bottom surface is facing said casting surface, where said core member is provided with at least one core conduit arranged through the core member extending from a first gas opening provided in the top surface to a second gas opening provided in the bottom surface,
- at least one yoke plate, where the yoke plate connects said bottom frame and said core member,

where in use said frame aperture and said core member provides the form of a casted item.

[0022] The moulding equipment used in e.g. a concrete casting machine, may be casting the concrete item on a casting surface, such as a board or a floor. The core member or core members may be rather huge in relation to the casted items and the thickness of the wall of the items. If the core members are huge, the vacuum provided in the expanding volume between the core bottom part and the casting surface, enclosed by the concrete material, is rapidly increased when the core member is lifted. This is prevented when using a core member provided with one or more conduits. The conduits extend in a predefined distance beyond the core members' top surface, so the risk of getting the core conduit or core conduits clogged is limited.

[0023] By using more than one core conduit in a core member, the pressure inside the expanding volume may be smoothly equalized. The gas flow through the conduits

may provide the volume with a stabile pressure, which equals the ambient level of pressure. If one of the core conduits may be clogged, the other core conduit is still open for gas flow. The core conduit may also be arranged in each end of the core member.

[0024] If the core member is symmetrical, more than one core conduit may be arranged in the centre part of the core member, and extending from the bottom surface's casting surface through the top surface. If the core member is unsymmetrical, it might be preferred to arrange the core conduit in each end of the core member or otherwise arrange the core conduits so the pressure compensation is optimally distributed in relation to the core member, the casting surface and the casting material.

[0025] The moulding equipment may be arranged on a casting surface, where the moulding equipment may comprise a top plate with an outer surface and a pressing surface. The bottom frame may be provided with a frame aperture and bottom frame is positioned between the top plate and the casting surface. The bottom frame has a yoke side facing the top plate and a casting side facing said casting surface. The bottom frame may be provided with a first frame side and a second frame side, where the second frame side is arranged opposite the first frame side. The frame aperture is arranged through the bottom frame, with openings from the yoke side to the casting side. The frame aperture is arranged between the first frame side and the second frame side.

[0026] At least one pressing piston comprising at least one pressing foot may be arranged between the top plate and the bottom frame, connected to the pressing surface of said top plate. The pressing piston extends toward the bottom frame where the pressing foot may be arranged in the end of the extension away from the top plate. The pressing foot in use may be arranged to move in and out of the frame aperture through the bottom frame, and easily pressing the casted material and easily pushing and/or holding the casted item, when moving the moulding equipment away from the casted item at the end of the casting process.

[0027] At least one yoke plate may be provided with a first end and a second. The yoke plate is connected to the bottom frame and at least one core member, where the core member may be arranged in the frame aperture of the bottom frame. The purpose of the yoke plate is for example to arrange the core member or core members in a constant position in the frame aperture during the casting process.

[0028] The yoke plate's first end may be connected to the first frame side on the yoke side of the bottom frame. The yoke plate's second end may be connected to the second frame side on the yoke side of the bottom frame. The middle part of the yoke plate extends from the first end to the second end, and passing the opening of the frame aperture, where the core member or core members may be connected to the middle part of the yoke plate. A plurality of yoke plates may be arranged perpendicularly to the bottom frame and said top plate, and alternately arranged adjacent to a plurality of pressing piston and pressing feet.

[0029] The core member provided with the top surface and the bottom surface may be partly arranged on the casting side of the bottom frame towards the casting surface. The bottom surface of the core member may face said casting surface. Part of said top surface of said core member may be connected to the middle part of the yoke plate through the frame aperture.

[0030] The core member may be provided with at least one core conduit for gas flow, where the core conduit may be arranged through the core member extending from a first gas opening provided in the top surface to a second gas opening provided in the bottom surface. The core conduit may also be provided from the bottom surfaces to one or more sides of the core member, where the side or sides surround the core member from the bottom surface to the top surface.

[0031] In use the bottom frame and the core member may be are arranged adjacent to the casting surface. The core conduit extends from the second gas opening to the first gas opening, where the core member may be surrounded by casting material. The core conduit provides a gas communication from the first gas opening to the casting surface, where a gas flow is led through said core conduit, and prevents vacuum in an expanding volume between the casting surface, the casting material and the bottom surface of said core member, when the core member or core members is being lifted from the casting surface leaving the casting material in a predefined casted form on the casting surface.

[0032] The yoke plate has a bottom side adjacent to the bottom frame and/or the core member, where at least one recess may be provided perpendicular to the longitudinal direction of the bottom side of the yoke plate. The longitudinal direction may be defined as the direction from the first end to the second end of the yoke plate, parallel to the bottom frame. The recess provides an opening space for the core conduit during use, where the core conduit is not blocked by the yoke plate.

[0033] In an advantageous embodiment of the invention, said first gas opening of said core conduit is provided with connecting means.

[0034] The first gas opening of the core conduit may be provided with one or more connecting means provided for a natural or controlled gas flow. In use a source of pressurized gas provides a controlled gas flow through said core conduit to the casting surface. The may be connected to the core conduit by using the connecting means. The controlled gas flow from the source of pressurized gas or other pressurizing equipment prevents vacuum in the expanding volume between the casting surface, the casting material and the bottom surface of said core member, when the core member is lifted from the casting surface.

[0035] When providing connecting means for connecting for example an external source of pressurized gas to

the first gas opening of the core conduit, the gas flow through the core conduit may be controlled very accurate. When the core member or part of the core member is surrounded by casting material, it is difficult and energy consuming to redraw a core member out of the casting material. When compressed gas is released into the expanding volume in the cavity of the casting item, the core member may be removed much easier, and without harming the casting item in the process. Then it will be possible to speed up the casting process even more.

[0036] In a further advantageous embodiment of the invention, said core conduit with the first gas opening extends in a predefined distance above said top surface of said core member.

[0037] To prevent the core conduits to clog in the casting process, the core conduit is extended beyond the top surface and away from the core member. The top of the conduits may therefore be arranged in a safe distance from the moulds' highest level of the casting material and where the casting material is poured into the mould. To prevent the core conduit to clog, first gas opening of said core conduit may be provided with connecting means for gas controlling the gas flow through the core conduit even though the core conduit has been extended. For example a source of pressurized gas may provide compressed gas through the core conduit to the casting surface, where the controlled gas flow of the compressed gas prevents vacuum in the expanding volume between the casting surface, the casting material and the bottom surface of said core member, when the core member is being lifted from the casting surface.

[0038] The core conduit extends therefore in a predefined distance above said top surface of said core member in a direction away from said casting surface. Vacuum equalizing means, such as a core member provided with a core conduit extending from a first gas opening provided in the top surface to a second gas opening provided in the bottom surface, leads a gas flow easily from the top surface to a bottom surface through the core member. The vacuum equalizing means may be in use when the core members are being rapidly lifted, and where the vacuum equalizing means prevents vacuum from occurring in the expanding volume between the core member, the casting material and the casting surface.

[0039] The moulding equipment also comprises at least one yoke plate, where each yoke plate has a bottom side attached to one or more of the core members. The yoke plate extends in a direction away from said core member toward the top plate. One or more recesses are provided at the bottom side on the yoke plate. The core conduit may be arranged substantially within the recess, where the length of the recess is longer than a length of the core conduit extending from the top surface of the core member.

[0040] The recess or recesses provided in the yoke plate provides a safe space for the core conduit extension during use, as the core conduit extension fits in or partly in the recess. The recess or recesses may also be provided with an edge plate in the bottom of the recess in the opposite direction of the core member. The recess may have a rim provided with an edge plate arranged substantially perpendicular to the rim or part of said rim. The core conduit may not reach the bottom of the recess, but may stop in a predetermined distance from the bottom of the recess. The edge plate may have one of following shapes: oval, rectangular, spherical or similar. The edge plate has a function as an umbrella over the core conduit's first opening, but may still provide the necessary gas flow through the core conduit. This edge plate will protect the first gas opening of the core conduit from a distance, when the casting material is poured into the mould.

[0041] Because the recess allows the core conduit or core conduits to be arranged completely or partially in the recessed space, and the core conduit therefore may be carefully protected against shock, strokes and/or shakes. The yoke plate also has a preventive effect, so that liquid or solid concrete does not get into the core conduit easily, so the liquid or solid concrete completely or partially suspends the gas flow through the core conduit.

[0042] Method for casting items using a moulding equipment having at least one bottom frame provided with a frame aperture, where said bottom frame is positioned between a top plate and a casting surface such that the frame aperture defines a cavity enclosed by said bottom frame, said casting surface and said top plate,

- at least one core member comprising a top surface and a bottom surface, where said core member is arranged in said frame aperture of the bottom frame, where the bottom surface is facing said casting surface, where said core member is provided with at least one core conduit arranged through the core member extending from a first gas opening provided in the top surface to a second gas opening provided in the bottom surface,
- at least one yoke plate, where the yoke plate connects said bottom frame and said core member,

where in use said frame aperture and said core member provides the form of a casted item and at least one core member having at least one core conduit for gas communication arranged through the core member extending from a first gas opening in a top surface of said core member to a second gas opening in a bottom surface of said core member, where in use said core member is arranged in a moulding equipment for a concrete casting machine, where said core member is provided with at least one core conduit for gas communication, where said core member has a top surface and a bottom surface, where said core conduit has a first gas opening provided in or above the top surface and a second gas opening provided in the bottom surface, where the casted items are produced by the following steps:

a. proving a casting surface
b. arranging the moulding equipment on the casting surface,
c. pouring a hardenable casting material into the cavity,
d. forcing the top plate against the hardenable casting material, thereby compressing said hardenable casting material,
e. either lifting said moulding equipment and said top plate away from said casting surface or lowering said casting surface relative to said moulding equipment and said top plate, and at the same time allowing gas to flow from the first gas opening through said core conduit and out through the second gas opening, equalizing the pressure in an expanding volume between the bottom surface of the core member and the casting material and/or the casting surface.

[0043] A casting machine comprising the moulding equipment is arranged on a suitable casting surface, which may be a floor or a table or other suitable surfaces. The moulding equipment comprises at least one core member with vacuum equalizing means provided for providing gas flow, to provide at least one cavity in the casted item.
The moulding equipment may be placed solid on the casting surface, where the bottom surface of the core member is arranged adjacent to the casting surface surrounded by the bottom frame. The core member is in a fixated position in the frame aperture, held by the yoke plate. The casting material is purred into the moulding equipment between the bottom frame, the core member and the casting surface, without clogging the core conduit. The top plate is pressed against the casting material, and at the same time the moulding equipment may vibrate and compress the casting material, forming a predefined shape.

[0044] After processing the casted items, the moulding equipment may lift the core member away from the casted item and/or the casting surface, maybe even together with the top plate and the bottom frame. At the same time the gas flow is provided through the core conduit, where the gas flow from the first gas opening through said core conduit and out through the second gas opening, thereby preventing a drag force by equalizing the pressure in an expanding volume between the casting material, bottom surface and/or the casting surface. The moulding method may easily mould a various of casted items based on one or more casting materials single or combine, such as one or more of following materials concrete, plastic, polymer etc.

[0045] The first gas opening of said core conduit is provided with connecting means for connecting said core conduit to a source of pressurized gas.

[0046] By providing connection means for vacuum equalizing, using vacuum equalizing means such as a source of pressurized gas or similar equipment, the gas flow through the core conduit can be controlled either manually or automatically. The source of pressurized gas may easily be connected and disconnected from the core conduit using the connection means. The source of pressurized gas may be arranged outside the casting machine as an external source of pressurized gas or the source of pressurized gas may be integrated in the casting machine.

[0047] Gas from the source of pressurized gas is introduced before step c. and/or after step d. The source of pressurized gas may easily be controlled during use, providing a gas flow through the core conduit. When the gas flow is activated before step c., preferably before the moulding equipment is arranged on the casting surface in step b., the pressurized gas will blow unwanted subjects away from the casting surface, providing a substantially clean casting surface for casting items.

[0048] If the gas flow through the conduit is activated after step d., the gas flow prevents vacuum from occurring in the expanding volume between the bottom surface of said core member, the casting surface and/or the casting material, when the core member is lifted from the casting surface.

[0049] Equalizing the pressure in the expanding volume, for example by providing a controlled vacuum equalizing system in the casting process, enhances a uniform production of casted items, without or highly reduced damaging effect.

[0050] The pressurized gas introduced before step c. is introduced with a higher pressure than the pressurized gas introduced after step d.

[0051] The source of pressurized gas may be introduced with a higher pressure during use, through the core conduit. When the gas flow is activated before step c., preferably before the moulding equipment is arranged on the casting surface in step b., with a high pressure, the pressurized gas will easily and effectively blow unwanted subjects away from the casting surface, before casting the items.

[0052] If the gas flow through the conduit is activated with equally high pressure as before step c. will cause damage to the casted items and the failure rate may increase significantly. By providing a predefined pressure introduced after step d. in the casting process, which preferably will be lower than the pressure introduced before step c., the casting process will enhance a uniform production of casted items, without or highly reduced damaging effect.

Description of the Drawing

[0053] The embodiments of the invention are described in the following with reference to:

Fig. 1: Showing moulding equipment for a concrete casting machine.
Fig. 2a and fig. 2b: Showing one embodiment of core member including conduits.
Fig. 3: Showing a position of the moulding equipment

after casting concrete items.

Detailed Description of the Invention

[0054] An embodiment of the invention is explained in the following detailed description. It is to be understood that the invention is not limited in its scope to the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or carried out in various ways.

[0055] Fig. 1 shows a moulding equipment 1 including vacuum equalizing means for a casting machine. The moulding equipment 1 comprises a top plate 2, pluralities of pressing pistons 3 with pressing feet 4, a bottom frame 5, a casting surface 6, yoke plates 7 and core members 8 with integrated extended conduits 9.

[0056] The top plate 2 has an outer surface 10 and a pressing surface 11. The bottom frame 5 is provided with a frame aperture 9, where said bottom frame 5 is positioned between the top plate 2 and the casting surface 6. The bottom frame 5 has a yoke side 12 facing said top plate 2, and a casting side 13 facing the casting surface 6. The bottom frame 5 also has a first frame side 14 and a second frame side 15, where the frame aperture 19 is arranged from the yoke side 12 to the casting side 13, arranged between the first frame side 14 and second frame side 15.

[0057] The pressing pistons 3 are attached to the pressing surface 11 of said top plate 2, where the pressing pistons 3 are extending toward the bottom frame 5. The pressing pistons 3 comprise each at least one pressing foot 4 arranged between the pressing piston 3 and the bottom frame 5. The shape of the open cells between the core member parts 8', 8" and the bottom frame 5 forms the shape of the concrete items to be casted. The pressing feet 4 form a pressing plate broken by a pattern, where the pattern will correspond to the shape of the open cells. The pressing foot 3 is able to move in and out of the frame aperture 19 through the bottom frame 5. Because the pressing feet 4 are forming a pressing plate broken by a pattern, where the pattern will correspond to the shape of the top edge of the casted items, the pressing feet 4 are arranged so that the pre-casted items easily are pushed out of the moulding equipment 1 using the pressing piston 3.

[0058] The yoke plate 7 has a first end 16, a second end 17 and a middle part 18. The yoke plate 7 is arranged perpendicular between the bottom frame 5 and the top plate 2. The yoke plates 7 and the pressing pistons 3 are alternately arranged adjacent to each other. The yoke plates 7 first end 16 is attached to the first frame side 14 on the yoke side 12 of the bottom frame 5. The yoke plates' 7 second end 17 is attached to the second frame side 15 on the yoke side 12 of the bottom frame 5. The middle part 18 of the yoke plate 7 extends from the first end 16 to the second end 17, and thereby passing the opening of the frame aperture 19 in the bottom frame 5.

[0059] The core member 9 comprises a top surface 21 and a bottom surface 20. The core member 8 is arranged on the casting side 13 of the bottom frame 5. The bottom surface 20 of the core member 8 facing said casting surface 6. Part of the top surface 21 of said core member 8 is attached to the middle part 18 of the yoke plate 7 through the frame aperture 19. The core member 8 is provided with two core conduits 9 extending from a first gas opening 22 provided in the core conduit 9 extended from the top surface 21 to a second gas opening 23 provided in the bottom surface adjacent to the casting surface.

[0060] The bottom frame 5 and the core member 8 are arranged adjacent to the casting surface 6. The core conduit 8 extends from the second gas opening 23 and above the top surface 21 to the first gas opening 22. The core member 8 is surrounded by casting material during most of the casting process. The core conduit 9 provides a gas communication from the first gas opening 22 to the casting surface 6, where a gas flow prevents vacuum in an expanding volume between the casting surface 6, the casting material and the bottom surface 20 of said core member 8. Said core member 8 is being lifted from the casting surface 6 leaving the casting material in a predefined casted form on the casting surface 6.

[0061] The core member 8 is provided with conduits 9 for gas communication to prevent vacuum to occur in the expanding volume between the core member 8 and the casting board 6, during casting process. This prevents the casting material from accidentally to flow into the core conduit 9 and block the gas flow, when molding items.

[0062] When the moulding equipment including the core member is being lifted from the casting surface 6, a vacuum will occur in the expanding volume between the casting surface 6, the casting material and the core member 8. The vacuum may pull the sides of the casted items, and move the wall of the items out of shape, which generates cracks, deformations and other stress related damage.

[0063] Fig 2a and fig 2b show one embodiment of a core member 8 in this example is divided into the core member parts 8', 8". The core member parts 8', 8" are located on each side of the centered core member part 8". The centred core member part 8" will be surrounded on all four surfaces, and preferably not the bottom surface 20 and the top surface 21, by the casting material during the casting process. The core member part 8' which is arranged to each side of the centred core member part 8", will only be surrounded on three surfaces by the casting material during the casting process, and preferably not the side attached to the end gable 24, the bottom surface 20 and the top surface 21.

[0064] The core member 8 has a top surface 21 and a bottom surface 20. Two conduits 9 are arranged adjacent to each other in the centred core member part 8". The conduits 9 extend from the bottom surface 20 to the top surface 21, and furthermore the conduits 9 extend upwards and away from the top surface 21. The core member parts 8', 8" will be surrounded by casting material

such as concrete in the open cells between the core member parts 8', 8". The shape of the open cells between the core member parts 8', 8" and the bottom frame 5 showed in fig. 1 forms the shape of the predefined concrete items to be casted. An end gable 24 is attached to one outer side of the core member part 8', where the end gable 24 is facing away from the centered core member part 8". The end gable 24 may also be attached to the bottom frame 5 on each side of the frame aperture 19, showed in fig. 1.

[0065] The two core conduits 9 provide gas communication path through the centered core member 8", from the first gas opening 22 of the core conduits 9 to the second gas opening at the bottom surface 20 of the centered core member part 8". The extended part of the core conduits 9 arranged above the core member part 8" may be tubes or similar, providing a first gas opening 22 located away from the top surface 21 of the centered core member part 8".

[0066] The yoke plate 7 has a bottom side 26 attached to the top surface 21 on the core member part 8 ". The yoke plate 7 extends in the direction away from the core member part 8". The conduit recess 25 is provided from the bottom side 26 above the core member part 8", where the core conduit 9 is arranged within the conduit recess 25 and the length of the conduit recess 25 is longer than the length of the part of the core conduit 9 extending from the core member part 8". The core conduits 9 are arranged in the centre of the centered core member part 8", extending into a conduit recess 25 provided in the yoke plate 7. This arrangement stabilises the extended core conduit 9 tubes and prevents the tubes from being damaged during the casting process.

[0067] The core member parts 8' are each attached to respective end gables 24, which is attached to respectively the first frame side 14 and the second frame side 15 of the bottom frame 5, showed in fig. 1.

[0068] Fig. 3 shows the finishing position of the moulding equipment after casting concrete items 30. The casting material, in this example concrete, has been filled into the open cells limited by the bottom frame, casting surface and core members in the moulding equipment. After the casting material has been vibrated, the bottom frame 5 has been lifted towards the top plate 2. By this movement of the bottom frame 5 relative to the top plate 2, the pressing pistons 3, are kept in position relative to the casted items 30, so that the casted item is pressed out of the bottom frame 5 by the pressing feet 4, showed in fig. 1, and the newly casted items 30 remain standing on the casting board 6.

[0069] When lifting, illustrated with an arrow F, the bottom plate 5, the yoke plate 7 and the core member parts 8', 8" will also be lifted. When lifting the core member parts 8' which are attached to the end gable 24, the expanding volume 29 between the core bottom surface 20 and the casting board 6 will be provided with gas from the ambient surroundings, passed the expanding bottom opening provided by the end gable 24. The gas will flow from the outer ambient and into the expanding volume 29 provided in the predefined form of the casted items 30.

[0070] The centered core member part 8" is not provided with a similar gas path from the ambient soundings as the core member parts 8' are through the end gables 24. A vacuum may occur inside the expanding volume which occurs between the bottom surface 20 of the centered core member 8", the casted concrete item 30 and the casting surface 6, when the bottom frame 5 is being lifted. Therefore it may cause the vacuum to pull the sides of the casted items 30 generating cracks, deformations and other stress related damages to the casted items 30.

[0071] To prevent damages inflicted on the casted items 30, the core conduits 9 are provided in the centered core member part 8" and prevent vacuum to occur in the expanding volume between the casting board 6 and the core bottom part 13 of the centered core member part 8", when the centered core member part 8" is lifted upwards together with the bottom frame 5 from the casting board 6. The conduits 9 provide the expanding volume with a pressure equalized gas from the ambient surroundings. This prevents the casted items 30 to be exposed to any related damage during the casting process.

[0072] The first gas opening 22 may be provided with connection means for supplying the gas flow with compressed gas to the expanding volume, which occurs below the centered core member part 8". The casted items 30 are produced by providing a suitable casting surface 5, such as a floor or a table. Then providing a casting machine which comprises a moulding equipment 1 provided with one or more core members 8, with vacuum equalizing means for providing gas flow, such as connecting means arranged in the first gas opening 22 of the core conduit 9. Then arranging the moulding equipment 1 on the casting surface 6, and connecting an external source of pressurized gas to the connecting means provided on the first gas opening 22 of the core conduit 9. The gas flow of compressed gas from the external source of pressurized gas may be controlled separately by manual means and/or controlled automatically within the casting process.

[0073] Now the moulding equipment 1 is in place and ready for pouring casting material into the moulding equipment 1. After the casting material is poured into the open cells between the bottom frame 5 and the core members 8, which is arranged directly on the casting surface 6, the processing of the items on the casting surface starts.

[0074] When the casted items 30 are formed by the moulding equipment 1, the moulding equipment 1 is lifting the bottom frame 5 including the core members 8 away from said casting surface 6. At the same time the core conduits 9 are providing a gas flow using compressed gas through the second gas opening, equalizing the pressure in an expanding volume between the casting material, the bottom surface 5 and the casting surface 6, while lifting the core member 8 out of the cavity of the newly casted item 30.

[0075] The newly casted items 30 remain standing on the casting board 6, when the bottom frame 5 of the moulding equipment 1 has been lifted. The casting machine moves the moulding equipment for example to an empty casting surface or places an empty casting surface underneath the moulding equipment. Now the moulding equipment is ready to cast new items 30.

Claims

1. Core member for a concrete casting machine of the type providing a cavity in a casted item, where said core member comprises at least one core conduit for gas communication arranged through the core member extending from a first gas opening in a top surface of said core member to a second gas opening in a bottom surface of said core member, where in use said core member is arranged in a moulding equipment for a concrete casting machine.

2. Core member according to claim 1, where said first gas opening of said core conduit is provided with connecting means.

3. Core member according to claim 1 or 2, where said core conduit extends a predefined distance above said top surface of said core member in a direction away from said bottom surface of said core member.

4. Moulding equipment for a concrete casting machine, where the moulding equipment comprises:

   - at least one bottom frame provided with a frame aperture, where said bottom frame is positioned between a top plate and a casting surface such that the frame aperture defines a cavity enclosed by said bottom frame, said casting surface,
   - at least one core member comprising a top surface and a bottom surface, where said core member is arranged in said frame aperture of the bottom frame, where the bottom surface is facing said casting surface, where said core member is provided with at least one core conduit arranged through the core member extending from a first gas opening provided in the top surface to a second gas opening provided in the bottom surface,
   - at least one yoke plate, where the yoke plate connects said bottom frame and said core member,

   where in use said frame aperture and said core member provides the form of a casted item.

5. Moulding equipment according to claim 4, where said first gas opening of said core conduit is provided with connecting means.

6. Moulding equipment according to claim 4 or 5, where said core conduit with the first gas opening extends in a predefined distance above said top surface of said core member.

7. Method for casting items using a moulding equipment having at least one bottom frame provided with a frame aperture, where said bottom frame is positioned between a top plate and a casting surface such that the frame aperture defines a cavity enclosed by said bottom frame, said casting surface and said top plate,

   - at least one core member comprising a top surface and a bottom surface, where said core member is arranged in said frame aperture of the bottom frame, where the bottom surface is facing said casting surface, where said core member is provided with at least one core conduit arranged through the core member extending from a first gas opening provided in the top surface to a second gas opening provided in the bottom surface,
   - at least one yoke plate, where the yoke plate connects said bottom frame and said core member,

   where in use said frame aperture and said core member provides the form of a casted item and at least one core member having at least one core conduit for gas communication arranged through the core member extending from a first gas opening in a top surface of said core member to a second gas opening in a bottom surface of said core member, where in use said core member is arranged in a moulding equipment for a concrete casting machine, where said core member is provided with at least one core conduit for gas communication, where said core member has a top surface and a bottom surface, where said core conduit has a first gas opening provided in or above the top surface and a second gas opening provided in the bottom surface, where the casted items are produced by the following steps:

   a. proving a casting surface
   b. arranging the moulding equipment on the casting surface,
   c. pouring a hardenable casting material into the cavity,
   d. forcing the top plate against the hardenable casting material, thereby compressing said hardenable casting material,
   e. either lifting said moulding equipment and said top plate away from said casting surface or lowering said casting surface relative to said moulding equipment and said top plate, and at the same time allowing gas to flow from the first gas opening through said core conduit and out

through the second gas opening, equalizing the pressure in an expanding volume between the bottom surface of the core member and the casting material and/or the casting surface.

8. Method according to claim 7, where said first gas opening of said core conduit is provided with connecting means for connecting said core conduit to a source of pressurized gas.

9. Method according to claim 8 where gas from the source of pressurized gas is introduced before step c. and/or after step d.

10. Method according to claim 9, where the pressurized gas introduced before step c. is introduced with a higher pressure than the pressurized gas introduced after step d.

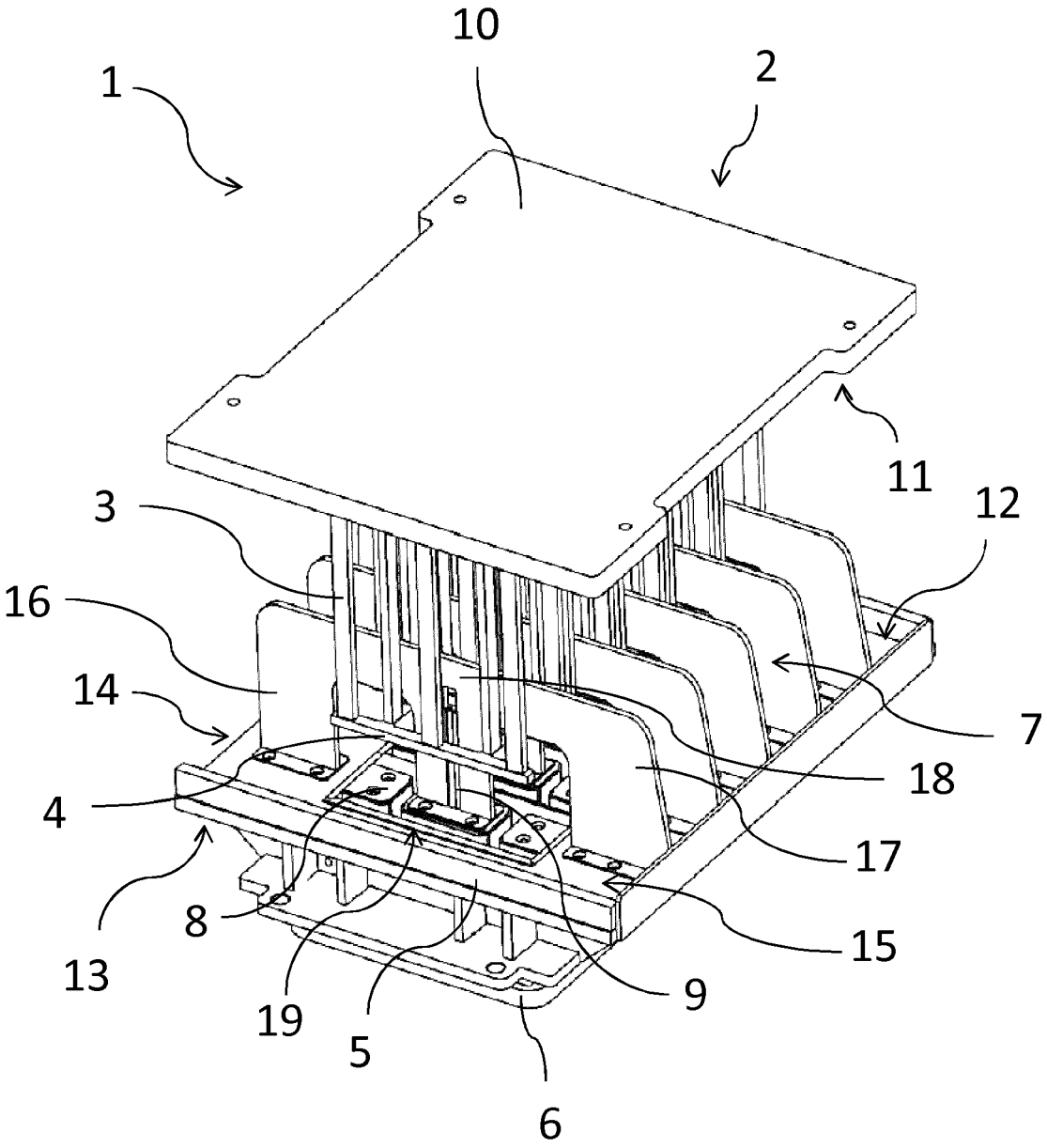

Fig. 1

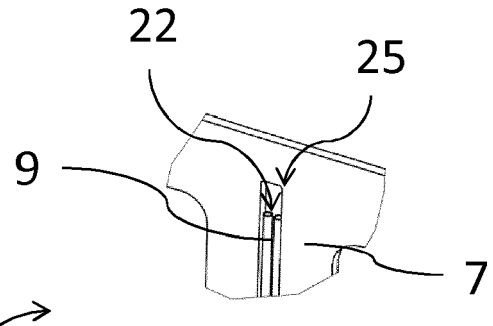

Fig. 2b

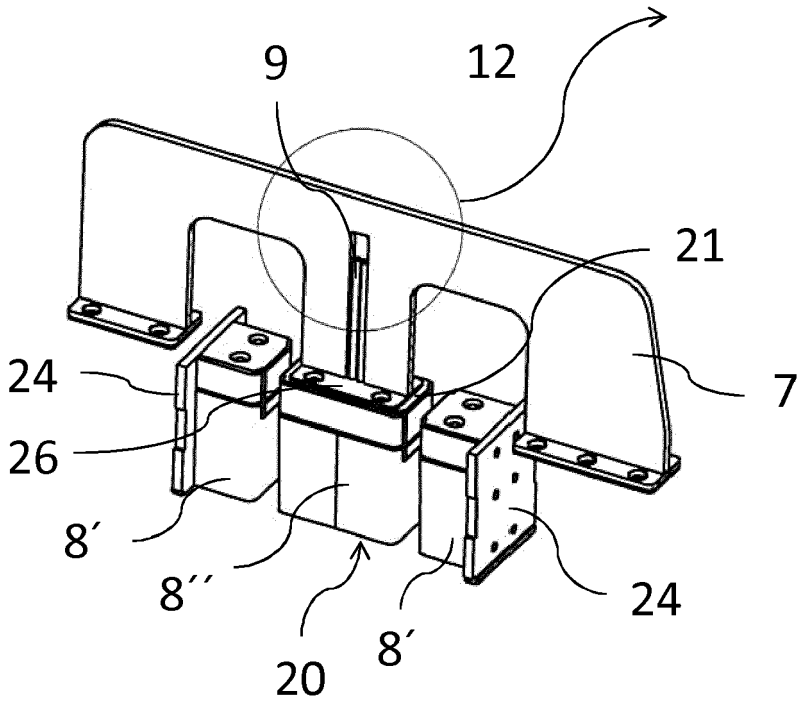

Fig. 2a

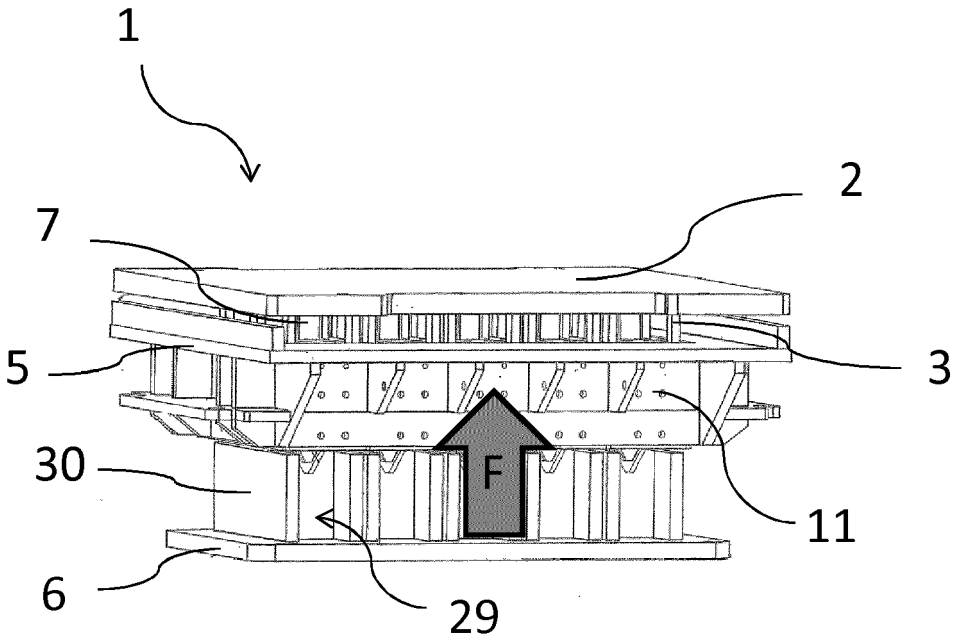

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 18 21 2141

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 2 646 607 A (DAVIS ROBERT O ET AL) 28 July 1953 (1953-07-28) * page 2, line 5 - page 3, line 49; figures * -----	1-9 10	INV. B28B7/12 B28B7/18
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TECHNICAL FIELDS SEARCHED (IPC)

B28B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13 August 2019	Orij, Jack

CATEGORY OF CITED DOCUMENTS

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13-08-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 2319291 A	18-05-1943	NONE	
FR 1042483 A	02-11-1953	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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