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(54) **MOULD FOR PRODUCING CONCRETE TUBES**

(57) The invention relates to a mould (1) for producing concrete tubes, which mould (1) comprises:
- a base frame (2) with a support surface;
- at least one elongate core (3) arranged to the base frame (2) and perpendicular to the support surface;
- one partitioned shell (6, 7) arranged around the at least one elongated core (3), which one shell (6, 7) is detachable arranged to the base frame (2); and
- at least one flexible joint arranged between each elongate core (3) and the base frame (2) to allow tilting of the elongate core relative to the perpendicular direction from the support surface.

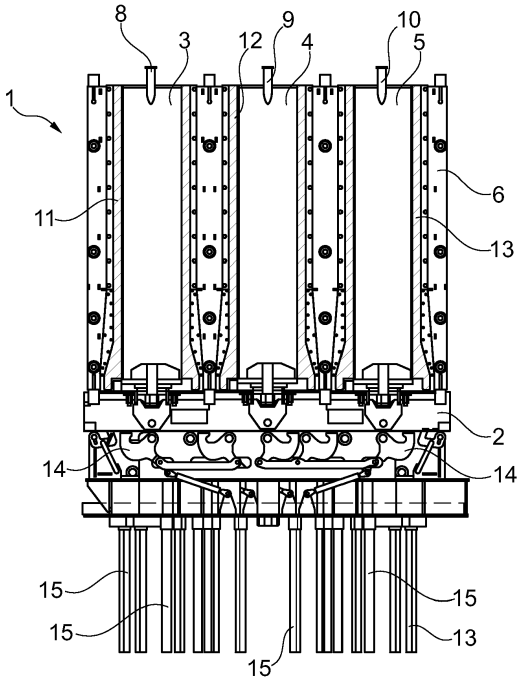

Fig. 1

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Description

[0001] The invention relates to a mould for producing concrete tubes, which mould comprises:

- a base frame with a support surface;
- at least one elongate core arranged to the base frame and perpendicular to the support surface;
- one partitioned shell arranged around the at least one elongated core, which one shell is detachable arranged to the base frame

[0002] Such a mould is for example known from WO 2014048648.

[0003] In this document a method is described for producing concrete tubes, in which a vertical mould is provided having a partitioned shell and an elongate core arranged in the shell. The elongate core can be shrunk in diameter.

[0004] The vertical mould is filled with liquid concrete. The liquid concrete is then allowed to set and cure inside of the mould. When the concrete is sufficiently cured, the partitioned shell is taken apart and the core is shrunk in diameter, such that the core can be taken out of the cured concrete tube.

[0005] The shrinkable elongate core has a complex mechanism to allow for the reduction in diameter. This complex mechanism is prone to malfunctioning as the cured concrete typically adheres to the outer surface of the core and prevents the reduction in diameter.

[0006] Another known method for producing a concrete tube, which method is used for decades, is by providing a vertical mould having a shell out of one piece and an elongate core arranged within the shell. The mould is filled with an almost set concrete mixture. The concrete is compressed in the mould and directly afterwards, the mould is slid of the compacted almost set concrete mixture, which will more or less maintain the shape of the mould.

[0007] The construction of the mould for this last method is more simple, especially for the elongate core. As the elongate core is already removed before the concrete has cured, any misalignment of the elongate core relative to the outer shell will be compensated by the mouldability of the not yet cured concrete. However, if the concrete would be cured and the elongate core would be misaligned, pulling out of the elongate core would cause damage to the concrete tube, if it would even be possible to pull out the elongate core to begin with.

[0008] Accordingly, it is an object of the invention to reduce or even remove the above mentioned disadvantages.

[0009] This object is achieved with a mould according to the preamble, which mould is characterized by at least one flexible joint arranged between each elongate core and the base frame to allow tilting and shifting of the elongate core relative to the perpendicular direction from the support surface.

[0010] When the at least one elongate core is misaligned relative to the partitioned shell and the elongate core is pulled out, the elongate core can seek the optimal position due to the flexible joint by tilting and shifting. As a result, the set concrete tube will not be damaged when the core is pulled out.

[0011] Even when more than one elongate core is used in a partitioned shell, for example to mould two or more concrete tubes, any misalignment between the elongate cores and between the elongate cores and the shell are compensated by the flexible joints, which provide each elongate core with the ability to shift and tilt.

[0012] A preferred embodiment of the mould according to the invention further comprises a coupling arranged between the free end of the partitioned shell opposite of the base frame and the at least one elongate core.

[0013] With the coupling, the free end of the elongate core is coupled to the free end of the partitioned shell. This ensures a basic alignment of the elongate core relative to the shell. When the elongate core is pulled out of the set concrete tube and accordingly out of the partitioned shell, the coupling will be released.

[0014] Preferably, the coupling comprises a hole centrally arranged in the end face of the elongate core and an axle arranged to the free end of the partitioned shell and axially slidable into the hole of the core.

[0015] In order to center the axle relative to the hole, the end of the axle could be truncated cone shaped to provide a self centering function to the axle.

[0016] When the elongate core is slid back into the partitioned shell, the axle will slide into the hole of the core providing the desired coupling. After assembly of the mould, the concrete can be poured in and when the concrete has set, the elongate core can be pulled out again, wherein the axle will be pulled out of the hole of the core automatically releasing the coupling.

[0017] In another preferred embodiment of the mould according to the invention the at least one flexible joint comprises a first joint part arranged to the respective elongate core, a second joint part arranged to the base frame, an elastic layer arranged between the first and second joint parts and a fastener, such as a bolt and nut, extending through the first joint part, the elastic layer and the second joint part for securing the joint parts and elastic layer together.

[0018] The elastic layer provides for the ability of the two joint parts to tilt relative to each other. Furthermore, when the holes through which the bolt extends are at least slightly larger than the diameter of the bolt, the elastic layer also provides the ability for the two joint parts to shift relative to each other.

[0019] In yet a further preferred embodiment of the mould according to the invention, the second joint part is movable arranged to the base frame in longitudinal direction of the core between a first position and a second position, wherein at least one guide pin is arranged on either the first joint part or the base frame and extends with a tight fit in the first position into a hole arranged in

the other of the first joint part and the base frame and has at least a loose fit in the second position.

[0020] The at least one guide pin ensures that the flexible joint is brought into a starting position in the first position of the second joint part. In this position, the flexible joint is effectively locked to the base frame. When the elongate core is pulled out of the shell, the second joint part will be moved to the second position to provide the desired freedom of movement in the joint. So, when the mould is filled with concrete and during the setting of the concrete, the flexible joint is centered relative to the base frame. Only, when the elongate core is pulled out of the shell, the flexible joint is released to provide the tilting and shifting ability to resolve any misalignment between the elongate core and the partitioned shell.

[0021] In yet another embodiment of the mould according to the invention the detachable shell parts comprise at least one lock having a T-shaped pin arranged to one shell part and extending into a hole in an adjacent shell part and a fork-element arranged to the adjacent shell part and slidable around and transverse to the T-shaped pin.

[0022] Preferably, the fork-elements of adjacent locks are coupled by a connection rod. This allows for simultaneous operation of the locks and speeds up the release of the shell parts.

[0023] With such a lock for the shell parts, the T-shaped pin is inserted into a hole of an adjacent shell part, when the shell parts are brought together. Then by sliding the fork-element around the T-shaped pin as simple locking is provided.

[0024] When the contact surface of the fork-element with the T-shaped pin is made wedge shaped, the lock can also be used to tighten the shell parts together, simply by exerting a sufficient sliding force to the fork-element.

[0025] In still a further embodiment of the mould according to the invention, at least one shell part comprises a support bracket arranged on one end of the shell part for connection with another shell part to support the shell part perpendicular on the another shell part.

[0026] After removal of the elongate core, the partitioned shell is opened to remove the concrete tube from the shell. Typically, the partitioned shell will be placed in a horizontal position, such that after removal of the top shell part, the concrete tube is still supported by the lower shell part. In order to keep the shell parts together, the removed top shell part is provided with a bracket, such that it can be placed on the lower shell. This ensures that the shell parts are kept together at all times, and no parts of different partitioned shells are mixed up.

[0027] In yet a further preferred embodiment of the mould according to the invention the outer surface of the at least one elongate core is a steel surface and wherein the outer surface is polished.

[0028] Furthermore, the at least one elongate core is preferably tapering in longitudinal direction providing a releasing shape.

[0029] The polished steel surface and the tapering shape both contribute to release of the elongate core from a set concrete tube.

[0030] In still a further embodiment of the mould according to the invention the inner surface of the partitioned shell is provided with at least one exchangable insert wall part for changing the shape of the inner surface of the partitioned shell.

[0031] This allows one to quickly change the outer shape of a concrete tube to be moulded with the mould according to the invention.

[0032] Preferably, the at least one exchangable insert wall part is a polyurethane plate. Polyurethane can easily be moulded into a desired shape, which then is arranged into the mould of the invention.

[0033] These and other features of the invention will be elucidated in conjunction with the accompanying drawings.

Figure 1 shows a cross sectional longitudinal view of an embodiment of the mould according to the invention in a first position.

Figure 2 shows a cross sectional transverse view of the mould of figure 1.

Figure 3 shows the mould of figure 1 in a second position.

Figures 4A and 4B show a detail of the mould of figure 1 and 3 in the first and second position.

Figure 5 shows a perspective view of the upper shell part of the mould of figure 1.

Figure 6 shows a schematic view of a lock for the shell parts of the mould of figure 1.

[0034] Figure 1 and 3 show a cross sectional view of an embodiment 1 of the mould according to the invention in a first position. The mould 1 has a base frame 2 on which three elongate cores 3, 4, 5 are arranged. A partitioned shell 6, 7 is arranged around the elongate cores 3, 4, 5 and also supported on the base frame 2.

[0035] A coupling 8, 9, 10 is arranged at the top of each elongate core 3, 4, 5, which has a pin with a tapered end extending into a hole in the elongate cores 3, 4, 5.

[0036] The mould 1 is positioned above a device for pulling the elongate cores 3, 4, 5 out of the set concrete tubes 11, 12, 13. This device has a number of hooks 14, which engage on the flexible joint between the base frame 2 and the respective elongate core 3, 4, 5 (see figures 4A and 4B) and a number of hydraulic pins 15, which can be operated separately to push the concrete tubes 11, 12, 13 together with the partitioned shell 6, 7 upwardly. Depending on the shape of the mould 1 some of the hydraulic rods 15 are actuated.

[0037] Figure 3 shows the mould of figure 1 in a second position, in which the hooks 14 are coupled with the flexible joints of the elongate cores 3, 4, 5 and in which some of the hydraulic rods 15 are moved up, to push the concrete tubes 11, 12, 13 together with the partitioned shell 6, 7 upwardly and accordingly pull the elongate cores 3, 4, 5 out of the set concrete tubes 11, 12, 13. With this

motion, the couplings 8, 9, 10 are decoupled.

[0038] Figures 4A and 4B show a detail of the mould 1 of figure 1 and 3 in the first and second position and particular of the flexible joint.

[0039] The flexible joint of the mould 1 is build out of a first joint part 16 arranged to the respective elongate core 3, 4, 5, a second joint part 17 arranged to the base frame 2, an elastic layer 18 arranged between the first 16 and second joint parts 17 and a fastener 19, in this embodiment a nut 19 arranged on a threaded end of the part 16.

[0040] In the first position shown in figure 4A, two guide pins 20, 21 arranged to the first joint part 16 and the elongate core 3, 4, 5 extend through holes 22, 23 in the base frame 2 with a tight fit, such that the joint parts 16, 17 can only move in longitudinal direction of the elongate core 3, 4, 5.

[0041] When the mould 1 is pushed up with the hydraulic rods 15 (as shown in figure 4B), the end with reduced diameter of the guide pins 20, 21 will be positioned in the holes 22, 23 such that the two joint parts 16, 17 can tilt and shift relative to each other and accordingly allow the elongate core 3, 4, 5 to tilt and shift relative to the base 2.

[0042] Figure 5 shows a perspective view of the upper shell part 6 of the mould of figure 1. The inner surface of the shell part 6 is provided with grooves 25 and a widening end 26 to shape the outer surface of the concrete tubes 11, 12, 13. Along the mould cavity 25, 26 a number of locks 27 are provided, which allow the two shell parts 6, 7 to be locked together.

[0043] Figure 6 shows a schematic view of a lock 27 for the shell parts 6, 7 of the mould of figure 1. The lock 27 has a T-shaped member 28 with rollers 29 at each arm of the T-shape. This T-shaped member 28 is arranged to the shell part 6 and is inserted into a hole 30 in the shell part 7.

[0044] The shell part 7 has a cavity 31, in which a fork-element 32 is movable. This fork-element 32 is pushed between the rollers 29 and the outer wall of the shell part 7, such that the shell part 6 is pulled against the shell part 7 and a liquid concrete tight assembly of the two shell parts 6, 7 is obtained.

Claims

1. Mould for producing concrete tubes, which mould comprises:

- a base frame with a support surface;
- at least one elongate core arranged to the base frame and perpendicular to the support surface;
- one partitioned shell arranged around the at least one elongated core, which one shell is detachable arranged to the base frame, **characterized by**
- at least one flexible joint arranged between each elongate core and the base frame to allow tilting and shifting of the elongate core relative to the perpendicular direction from the support surface.

2. Mould according to claim 1, further comprising a coupling arranged between the free end of the partitioned shell opposite of the base frame and the at least one elongate core.

3. Mould according to claim 2, wherein the coupling comprises a hole centrally arranged in the end face of the elongate core and an axle arranged to the free end of the partitioned shell and axially slidable into the hole of the core.

4. Mould according to any of the preceding claims, wherein the at least one flexible joint comprises a first joint part arranged to the respective elongate core, a second joint part arranged to the base frame, an elastic layer arranged between the first and second joint parts and a fastener, such as a bolt and nut, extending through the first joint part, the elastic layer and the second joint part for securing the joint parts and elastic layer together.

5. Mould according to claim 4, wherein the second joint part is movable arranged to the base frame in longitudinal direction of the core between a first position and a second position, wherein at least one guide pin is arranged on either the first joint part or the base frame and extends with a tight fit in the first position into a hole arranged in the other of the first joint part and the base frame and has at least a loose fit in the second position.

6. Mould according to any of the preceding claims, wherein the detachable shell parts comprise at least one lock having a T-shaped pin arranged to one shell part and extending into a hole in an adjacent shell part and a fork-element arranged to the adjacent shell part and slidable around and transverse to the T-shaped pin.

7. Mould according to claim 6, wherein fork-elements of adjacent locks are coupled by a connection rod.

8. Mould according to any of the preceding claims, wherein at least one shell part comprises a support bracket arranged on one end of the shell part for connection with another shell part to support the shell part perpendicular on the another shell part.

9. Mould according to any of the preceding claims, wherein the outer surface of the at least one elongate core is a steel surface and wherein the outer surface is polished.

10. Mould according to any of the preceding claims,

wherein the at least one elongate core is tapering in longitudinal direction providing a releasing shape.

11. Mould according to any of the preceding claims, wherein the inner surface of the partitioned shell is provided with at least one exchangable insert wall part for changing the shape of the inner surface of the partitioned shell.

12. Mould according to claim 11, wherein the at least one exchangable insert wall part is a polyurethane plate.

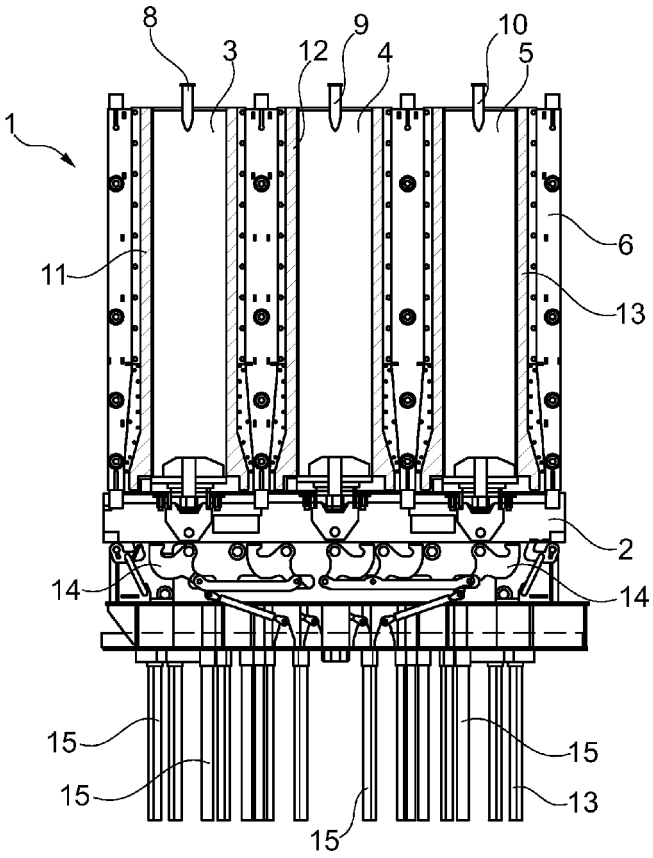

Fig. 1

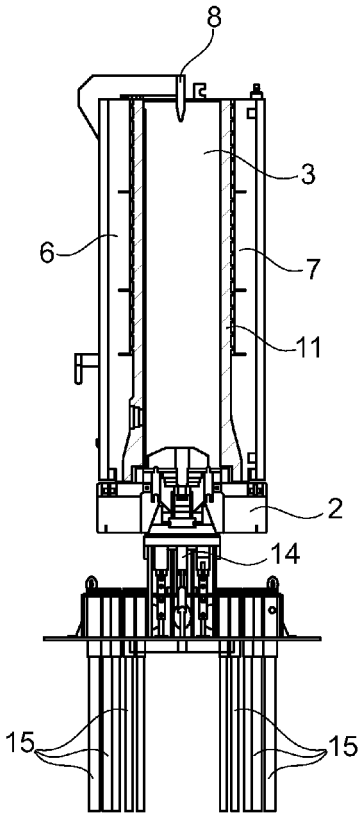

Fig. 2

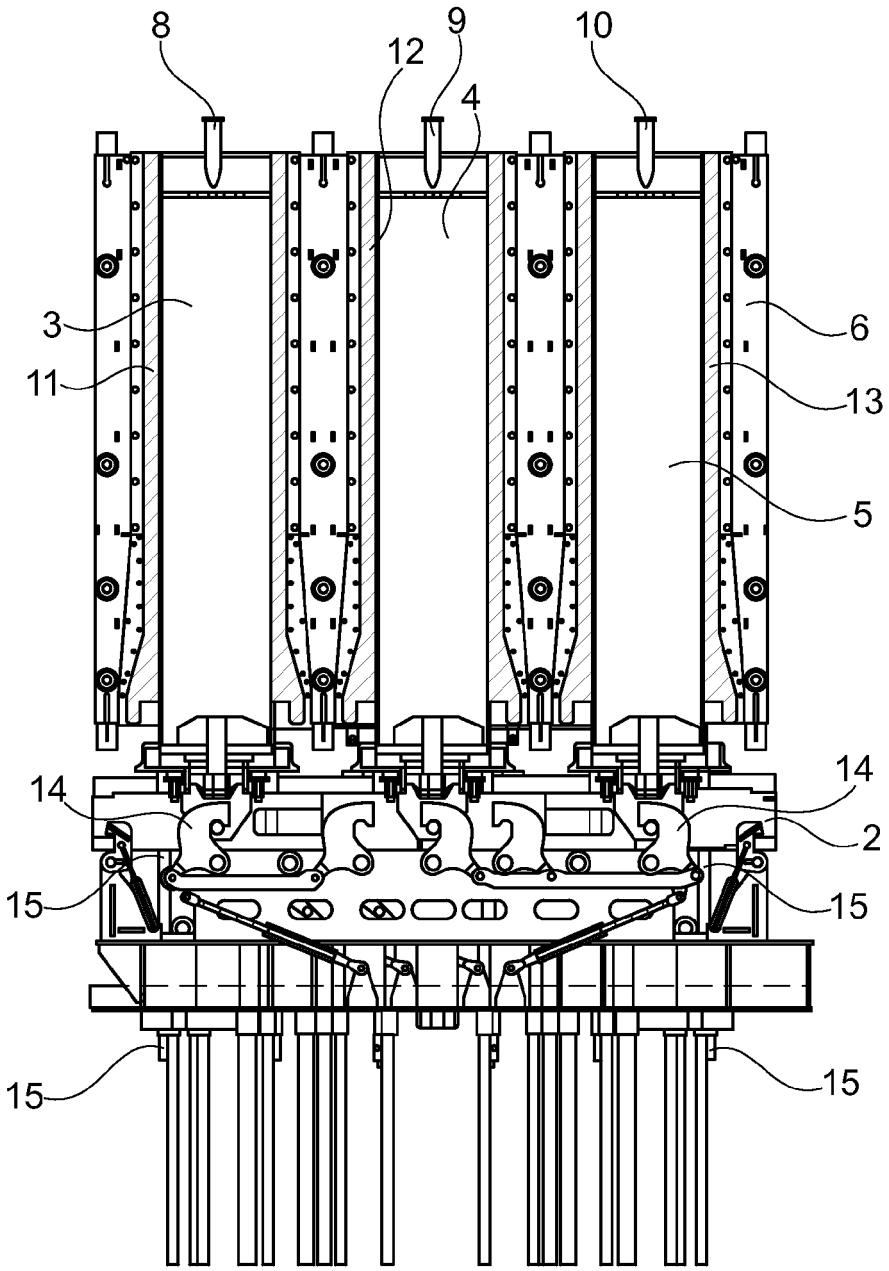

Fig. 3

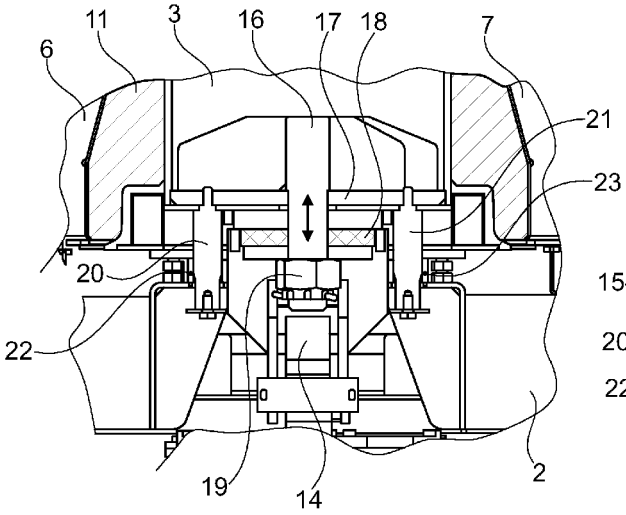
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Fig. 4A

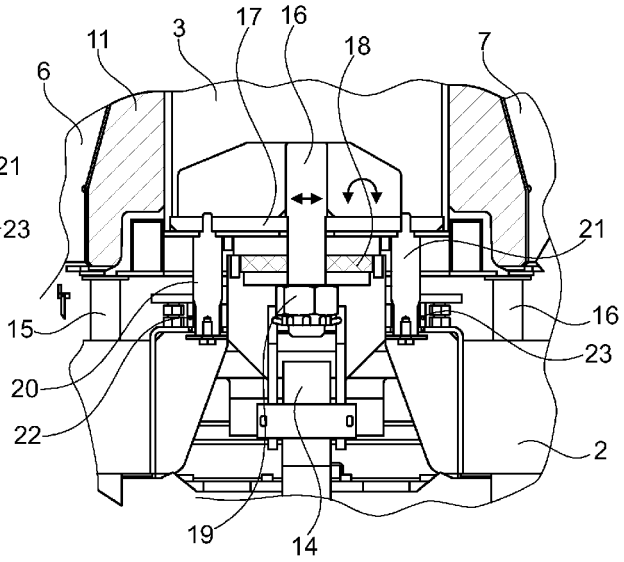
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Fig. 4B

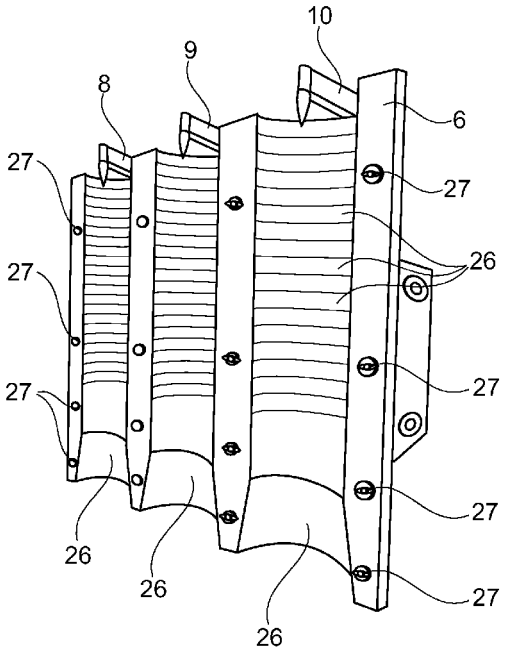

Fig. 5

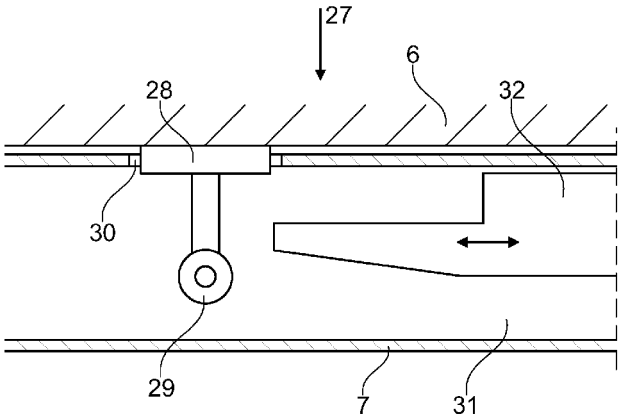

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 9468

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
The Hague	15 February 2016	Orij, Jack

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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Application Number
EP 15 16 9468

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☒ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

1-7

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 15 16 9468

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-3

   Mould for producing concrete tubes, further comprising a coupling arrangement

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2. claims: 4, 5

   Mould for producing concrete tubes, further comprising a first joint part and a second joint part

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3. claims: 6, 7

   Mould for producing concrete tubes, wherein the detachable shell parts comprise a lock

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4. claim: 8

   Mould for producing concrete tubes, wherein at least one shell part comprises a support bracket

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5. claims: 9, 10

   Mould for producing concrete tubes, further comprising a polished steel core

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6. claims: 11, 12

   Mould for producing concrete tubes, wherein the inner surface of the shell is provided with an exchangable insert

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 16 9468

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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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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