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(54) Mold assembly for continuous casting

Gussanordnung für den durchgehenden Guss

Ensemble de moule pour moulage continu

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(73) Proprietor: **Siemens VAI Metals Technologies
GmbH
4031 Linz (AT)**

(72) Inventors:
• **Das, Subroto Kumar
700052 Kolkata (IN)**
• **Hrazdera, Gerald
4470 Enns (AT)**
• **Pal, Amit
700047 Kolkata (IN)**
• **Poepl, Johann
4202 Kirchschlag (AT)**

- **Pühringer, Thomas
4020 Linz (AT)**
- **Steins, Roger
90409 Nürnberg (DE)**
- **Thoene, Heinrich
4020 Linz (AT)**
- **Wimmer, Franz
4752 Riedau (AT)**

(74) Representative: **Maier, Daniel Oliver
Siemens AG
Postfach 22 16 34
80506 München (DE)**

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Description

[0001] The present invention relates to continuous casting. In particular, the present invention relates to a mold assembly enabling uniform cooling during continuous casting.

[0002] Continuous casting is widely used to produce cast products such as billets, blooms, thick slabs/ingots, thin slabs, strips, and the like.

[0003] During continuous casting, molten metal is poured into an open-ended mold that cools and solidifies a peripheral region of the molten metal to form a metal strand. The metal strand is continuously withdrawn from the bottom of the mold while the molten metal is being continuously poured from the top. At steady state, the solid shell exiting the mold should form a stable metal strand that should have adequate mechanical strength to support the liquid metal core.

[0004] The mold is cooled using a cooling fluid to effect the formation of a solid shell in the peripheral region of the molten metal. The heat transfer from the molten metal at metal-mold interface leads to an initial solidification and subsequent growth of the solid shell against the mold. One of the objectives while designing a mold assembly is to match the rate of heat removal at the surface with the internal supply of heat from the molten metal core such that a surface temperature of the metal strand is reduced monotonically and uniformly along the peripheral region of the molten metal. The quality of the cast metal product and the production rates are directly dependent on the efficiency of the cooling process. Evidently, production of cast metal products of high quality at faster rates can be achieved through increasing the efficiency of the cooling process.

[0005] Non-uniform cooling of the metal strand leads to differential thickness, metallurgical structure and strength of the solid shell in the metal strand. Moreover, non-uniform cooling also results in differential thermal expansion and shrinkage in different regions, which in turn lead to thermal stress and strain inside the solid shell. These undesirable effects often lead to cracks or break-outs in the metal strand.

[0006] Thus, one of the challenges while designing the mold assembly is to ensure efficient and uniform cooling of the metal strand across the peripheral region. It is imperative that the temperature of the mold is effectively regulated to ensure sufficient mechanical strength and stability of the metal strand exiting the mold. Moreover, it is necessary to ensure uniform cooling of the inner surface of the mold along the circumference to effect uniform cooling of the metal strand along the peripheral region.

[0007] In various mold assemblies known in the art, a cooling jacket is attached to the mold. The mold, along with the attached cooling jacket, is placed in housing provided with inlet and outlet ports such that a cooling fluid may be flowed continuously through the space enclosed between the mold and the cooling jacket. The cooling jacket interfaces with the housing to partition the en-

closed space into two chambers, which are interconnected through the flow space formed between the mold and the cooling jacket. A suitable sealing means is disposed between an interface of the cooling jacket and the housing to prevent leakage of the cooling fluid from one chamber to another. In addition, the cooling jacket is aligned with respect to the mold to achieve uniform spacing between an outer wall of the mold and an inner wall of the cooling jacket along the circumference such that a uniform temperature is maintained along the circumference of the mold.

[0008] One such assembly is known from the US patent 4,807,691. The patent discloses a mold unit for insertion into a water tank in a machine for continuous casting. The mold unit includes a mold tube, a pair of flanges, and a cooling jacket. The mold tube is resiliently held between the pair of flanges. The cooling jacket surrounds the mold tube such that there is formed a flow space between the cooling jacket and the mold tube. A flange extends radially outwardly from the cooling jacket. A plurality of rods interconnect the flanges in the pair of flanges and the flange extending from the cooling jacket such that the cooling jacket is suitably positioned with respect to the mold tube.

[0009] Various mold assemblies known in the prior art, as exemplified by the aforementioned patent, strive to provide a uniform gap between the mold and the cooling jacket through aligning the cooling jacket to a fixed axis such as the central axis of the mold using spacer bolts and the like. However, the two design objectives - providing a leakage-resistant interface between the cooling jacket and the housing, and ensuring a uniform gap between the mold and the cooling jacket - present an inherent contradiction. As the cooling jacket is adjusted to ensure symmetric alignment with respect to the mold, there is a risk that the interface between the housing and the cooling jacket becomes prone to leakage due to misalignment of the seal disposed therein. Moreover, this approach leads to disturbing lateral and longitudinal forces on the mold. Such forces may undesirably alter geometrical construction of the mold affecting the quality of the cast product formed there-through.

[0010] In light of the foregoing, there is a need for an improved mold assembly suitable for use in continuous casting such that efficient cooling of molten metal is enabled.

[0011] Accordingly, an object of the present invention is to provide a mold assembly suitable for use in continuous casting such that efficient cooling of molten metal is enabled.

[0012] The object of the present invention is achieved by a mold assembly according to claim 1. Further embodiments of the present invention are addressed in the dependent claims.

[0013] In accordance with the object of the present invention, a mold assembly suitable for use in continuous casting is provided. The mold assembly includes a mold, a cooling jacket, an intermediate tubular structure, and

a housing assembly.

[0014] The mold delimits a mold cavity for flow of molten metal along a longitudinal direction. The cooling jacket surrounds the mold such that a flow gap is formed between the mold and the cooling jacket. At least one of the mold and the cooling jacket is provided with adjusting means for adjusting a dimension of the flow gap between the mold and the cooling jacket along a radial direction. The intermediate tubular structure surrounds the cooling jacket and is coupled thereto through first coupling means disposed therein for coupling the cooling jacket and the intermediate tubular structure. The housing assembly encloses the mold such that an enclosed space is formed between the housing assembly and the mold. The cooling jacket and the intermediate tubular structure are disposed within the enclosed space such that the housing assembly surrounds the intermediate tubular structure. The housing assembly is coupled to the intermediate tubular structure through second coupling means disposed therein for coupling the intermediate tubular structure and the housing assembly, wherein the second coupling means couple the intermediate tubular structure to the housing assembly in a non-rigid manner.

[0015] The mold assembly of the present invention facilitates improved alignment between the mold and the cooling jacket to ensure uniform flow gap along a circumference of the mold. The uniform flow gap facilitates efficient heat transfer from the incipient metal strand inside the mold towards the outside, and thereby advantageously eliminates thermal stress and strain inside the solid shell of the resulting metal strand; and hence, mitigates the risk of cracks or break-outs in the resulting metal strand exiting the mold. Further, owing to the inventive design of the mold assembly in accordance with the present invention, an alignment of the mold and the cooling jacket to ensure uniform flow gap along a circumference of the mold neither leads to undesirable mechanical forces on the mold nor renders an interface between the cooling jacket and the intermediate tubular structure and an interface between the intermediate tubular structure and the housing assembly, susceptible to leakage.

[0016] In accordance with an embodiment of the present invention, the first coupling means include a coupling flange extending outwards from the cooling jacket. This technical feature provides the first coupling means for coupling the cooling jacket and the intermediate tubular structure.

[0017] In accordance with the present invention, the second coupling means couple the intermediate tubular structure to the housing assembly in a non-rigid manner. In accordance with an embodiment of the present invention, the second coupling means include an engaging flange extending outwards from the intermediate tubular structure and a supporting structure formed in the housing assembly such that the engaging flange rests on the supporting structure in a non-rigid manner. These technical features ensure that any undesirable mechanical forces on the mold due to alignment of the mold and the

cooling jacket are minimized.

[0018] In accordance with another embodiment of the present invention, the mold assembly includes first and second sealing means. The first sealing means provide a leakage-resistant coupling between the cooling jacket and the intermediate tubular structure. The second sealing means provide a leakage-resistant coupling between the intermediate tubular structure and the housing assembly. This technical feature ensures that formation of any undesirable flow path of a cooling fluid is avoided.

[0019] In accordance with still another embodiment of the present invention, the mold assembly includes third coupling means adapted for suspending the cooling jacket from the housing assembly and permitting movement of the cooling jacket in any direction along a transverse plane, the transverse plane being orthogonal to the longitudinal direction. In accordance with yet another embodiment of the present invention, the third coupling means feature brackets, wherein each bracket includes a through-hole elongated in the longitudinal direction, and lugs on diametrically opposite sides of the cooling jacket, which may be coupled to brackets, wherein the third coupling means are further adapted for displacing the cooling jacket with respect to the mold and suitably positioning along the longitudinal direction. These technical features ensure enhanced flexibility in positioning the cooling jacket with respect to the mold along a longitudinal direction.

[0020] In accordance with another embodiment of the present invention, the cooling jacket, the first coupling means, the intermediate tubular structure and the second coupling means partition the enclosed space into an inlet chamber and an outlet chamber such that the inlet chamber and the outlet chamber are interconnected through the flow gap. In accordance with an embodiment of the present invention, a cooling fluid flows from the inlet chamber to the outlet chamber through the flow gap. These technical features facilitate establishing a flow path for flow of a cooling fluid through the mold assembly for effectively extracting heat from the molten metal flowing through the mold.

[0021] The present invention is further described hereinafter with reference to illustrated embodiments shown in the accompanying drawings, in which:

FIG 1 illustrates a first perspective view of a mold assembly in accordance with an embodiment of the present invention,

FIG 2 illustrates a second perspective view of the mold assembly in accordance with an embodiment of the present invention,

FIG 3 illustrates a top view of the mold assembly in accordance with an embodiment of the present invention,

FIG 4 illustrates a first longitudinal sectional view of

the mold assembly in accordance with an embodiment of the present invention,

FIG 5 illustrates a second longitudinal sectional view of the mold assembly in accordance with an embodiment of the present invention,

FIG 6 illustrates a third longitudinal sectional view of the mold assembly in accordance with an embodiment of the present invention, and

FIG 7 illustrates a transverse sectional view of the mold assembly in accordance with an embodiment of the present invention.

[0022] Various embodiments are described with reference to the drawings, wherein like reference numerals are used to refer to like elements throughout. In the following description, for purpose of explanation, numerous specific details are set forth in order to provide a thorough understanding of one or more embodiments. It may be evident that such embodiments may be practiced without these specific details.

[0023] During continuous casting, molten metal flows from a ladle into a small intermediate vessel known as a tundish. The molten metal then flows from the tundish through a submerged nozzle according to the position of a stopper-rod or a slide-gate or an open-pour nozzle, to enter a mold assembly. The mold assembly includes a mold, which is an open-ended tubular structure, which is cooled using a cooling fluid circulated through various elements of the mold assembly surrounding the mold. The peripheral region of the molten metal loses heat to the cooled walls of the mold to form a metal strand with a thin solid shell. A drive rolls assembly located below the mold assembly continuously withdraws the metal strand out of the mold assembly. At steady state, the metal strand exiting the mold should have adequate mechanical strength to support the liquid metal core. The mold assembly should be efficiently cooled to satisfy this requirement.

[0024] The present invention provides an improved mold assembly suitable for use in continuous casting as described above.

[0025] Referring now to the drawings, FIG 1 and FIG 2 illustrate a first perspective view and a second perspective view respectively of the mold assembly 100 in accordance with an embodiment of the present invention.

[0026] The mold assembly 100 includes an inlet 102, outlet 104, inlet 106 and outlet 108. FIG 1 also illustrates metal strand 110 exiting the mold assembly 100.

[0027] The molten metal enters the mold assembly 100 through the inlet 102. A peripheral region of the molten metal gets cooled in the mold assembly 100 such that a metal strand 110 with a molten core and a solid shell is formed. The metal strand 110 exits the mold assembly 100 from the outlet 104.

[0028] The mold assembly 100 is cooled by circulating

a cooling fluid through an enclosed space inside the mold assembly 100. The cooling fluid enters the mold assembly 100 through the inlet 106 and exits the mold assembly 100 from the outlet 108.

[0029] It should be noted that the term "metal", as used herein, is intended to refer to any material, such as pure metals and any alloys thereof such as steel and so on, and the like, that is suitable for forming a cast product such as billets, blooms, thick slabs/ingots, thin slabs, strips, and the like.

[0030] FIG 3 illustrates a top view of the mold assembly 100 in accordance with an embodiment of the present invention. FIGS 4 and 5 will illustrate longitudinal sectional views of the mold assembly 100 along A-A' and B-B' shown in FIG 3.

[0031] FIGS 4 and 5 illustrate longitudinal sectional views of the mold assembly 100 respectively along A-A' and B-B' shown in FIG 3. Similarly, FIG 6 illustrates a longitudinal sectional view of the mold assembly 100 along C-C' shown in FIG 4.

[0032] The mold assembly 100 includes a mold 202, a cooling jacket 204, an intermediate tubular structure 206, and a housing assembly 208.

[0033] The mold 202 is an open-ended tubular structure which delimits a mold cavity. The mold cavity defines a longitudinal casting direction along which molten metal flows during continuous casting.

[0034] The mold 202 shown in FIGS 4 through 6 has a curved development suitable for curved apron casting set-up. Further, the mold 202 has a substantially square cross-section. However, in various alternative embodiments of the present invention, the mold 202 may be straight and may have any desired cross-section in accordance with a desired cross-section of the cast product.

[0035] The cooling jacket 204 has a cross-sectional shape that corresponds to the cross-sectional shape of the mold 202. The cooling jacket 204 has such dimensions that the cooling jacket 204 surrounds the mold 202 such that a flow gap 210 is formed between the mold 202 and the cooling jacket 204.

[0036] In various embodiments of the present invention, various structural elements, such as baffles and the like, may be disposed on an inner surface of the cooling jacket 204 to facilitate uniform distribution of the cooling fluid. Such structural elements are well-known in the art and are not being described in detail for the sake of brevity.

[0037] The cooling jacket 204 is coupled to the housing assembly 208 through third coupling means 218. The housing assembly 208 includes a top covering flange 230 with such cross-section and dimensions that is suitable for receiving the top portion of the mold 202. The top covering flange 230 is provided with a pair of brackets 232 symmetrically disposed on either side of a central axis 'X' of the mold 202. The cooling jacket 204 is provided with lugs 234 on diametrically opposite sides such that the cooling jacket 204 may be coupled to the brackets 232. Each bracket 232 includes a through-hole elongated

along a longitudinal direction. The cooling jacket 204 is coupled to the brackets 232 through use of fasteners 236. As the through-hole is elongated along the longitudinal direction, the cooling jacket 204 may be displaced with respect to the mold 202 and suitably positioned along a longitudinal direction. It should be noted that the third coupling means 218 are such that the cooling jacket 204 is suspended from the housing assembly 208. In other words, the third coupling means 218 permit movement of the cooling jacket 204 in any direction along a transverse plane orthogonal to planes A-A' and B-B'.

[0038] At least one of the mold 202 and the cooling jacket 204 is attached to adjusting means 212 that enable adjustment of a dimension of the flow gap 210 along a radial direction with respect to central axis 'X'. In one exemplary embodiment, the adjusting means 212 include one or more spacer bolts disposed along the circumference of the cooling jacket 204 in a suitable manner.

[0039] The intermediate tubular structure 206 surrounds the cooling jacket 204. At least one of the cooling jacket 204 and the intermediate tubular structure 206 are provided with a first coupling means 214. In accordance with an embodiment of the present invention, the first coupling means 214 include a coupling flange 220. The coupling flange 220 extends outwards from the cooling jacket 204. In an alternative embodiment of the present invention, the first coupling means 214 include a coupling flange extending inwards from the intermediate tubular structure 206. The first coupling means 214 further include a first sealing means 222. The first sealing means 222 is disposed at an interface of the coupling flange 220 and the intermediate tubular structure 206 to ensure that the corresponding interface is leakage-resistant. In an exemplary embodiment of the present invention, the first sealing means 222 include an o-ring.

[0040] The region where the first coupling means 214 are disposed relative to longitudinal dimensions of the cooling jacket 204 and the intermediate tubular structure 206 will determine the relative longitudinal position of the cooling jacket 204 and the intermediate tubular structure 206.

[0041] The housing assembly 208 surrounds the intermediate tubular structure 206. At least one of the intermediate tubular structure 206 and the housing assembly 208 are provided with a second coupling means 216 for coupling thereof. In an exemplary embodiment of the present invention, the intermediate tubular structure 206 is provided with an engaging flange 224 and the housing assembly 208 is provided with a supporting structure 226. The engaging flange 224 rests on the supporting structure 226. The second coupling means 216, as described above, provides a non-rigid coupling between the intermediate tubular structure 206 and the housing assembly 208. This facilitates minimizing any undesirable mechanical forces on the mold 202. Further, a second sealing means 228 is disposed at an interface of the intermediate tubular structure 206 and the housing assembly 208. In

an exemplary embodiment of the present invention, the second sealing means 228 includes an o-ring.

[0042] The housing assembly 208 encloses the mold 202. The housing assembly 208 includes openings formed in a top portion and a bottom portion with such cross-section and dimensions that it is suitable for receiving top and bottom portions of the mold 202 respectively. The mold 202 is rigidly attached to the housing assembly 208 through additional flanges and bolts arrangement and a sealing means.

[0043] The mold 202 and the housing assembly 208 form an enclosed space. The enclosed space includes the cooling jacket 204 and the intermediate tubular structure 206. The cooling jacket 204 and the intermediate tubular structure 206, along with the first and the second coupling means 214 and 216, form a leakage-resistant partition that splits the enclosed space into an inlet chamber 238 and an outlet chamber 240. The inlet and the outlet chambers 238 and 240 are interconnected through the flow gap 210.

[0044] The cooling fluid enters the inlet chamber 238 through the inlet 106 under pressurized condition. The cooling fluid subsequently flows through the flow gap 210 in a direction substantially counter to a direction of flow of molten metal in the mold 202. The cooling fluid exits the flow gap 210 to enter into the outlet chamber 240 and eventually, is removed from the enclosed space through the outlet 108. The flow of cooling fluid through the enclosed space is indicated through arrows marked in FIGS 4 through 6.

[0045] FIG 7 illustrates a transverse sectional view of the mold assembly 100 along D-D' shown in FIG 4. In particular, FIG 7 is intended to illustrate the flow gap 210 and the adjusting means 212 disposed along a circumference of the mold 202. Various other elements of the mold assembly 100 shown in FIG 7 have already been described in detail in conjunction with the foregoing figures.

[0046] The mold assembly of the present invention facilitates improved alignment between the mold and the cooling jacket to ensure uniform flow gap along a circumference of the mold.

[0047] The uniform flow gap facilitates efficient heat transfer from the incipient metal strand inside the mold towards the outside, thereby advantageously eliminating thermal stress and strain inside the solid shell of the resulting metal strand; and hence, mitigating the risk of cracks or break-outs in the resulting metal strand after exit from the mold.

[0048] As explained in the foregoing description, the cooling jacket in the mold assembly of the present invention may be adjusted not only in a transverse direction (i.e. in a plane perpendicular the casting direction) but also in a longitudinal plane. Hence, the mold assembly enables a fully-floating design of the cooling jacket attached to the mold such that the flexibility for adjusting the cooling jacket with respect to the mold is increased manifold.

[0049] The mold assembly in accordance with the present invention provides a cooling jacket that interfaces with the housing assembly through an intermediate tubular structure. The intermediate tubular structure through its coupling to the cooling jacket on one side and the housing assembly on the other side, partitions the enclosed space between the mold and the housing assembly into an inlet chamber and an outlet chamber, which are interconnected through the flow gap formed between the cooling jacket and the mold.

[0050] Owing to the inventive design of the mold assembly in accordance with the present invention, an alignment of the mold and the cooling jacket to ensure uniform flow gap along a circumference of the mold does not lead to any undesirable mechanical forces on the mold. Furthermore, owing to the inventive design of the mold assembly in accordance with the present invention, an alignment of the mold and the cooling jacket does not render an interface between the cooling jacket and the intermediate tubular structure and an interface between the intermediate tubular structure and the housing assembly, susceptible to leakage.

Claims

1. A mold assembly (100) suitable for use in continuous casting, the mold assembly (100) comprising:

- a mold (202), the mold (202) delimiting a mold cavity for flow of molten metal along a longitudinal direction,
- a cooling jacket (204), the cooling jacket (204) surrounding the mold (202) such that a flow gap (210) is formed between the mold (202) and the cooling jacket (204), wherein at least one of the mold (202) and the cooling jacket (204) is provided with adjusting means (212) for adjusting a dimension of the flow gap (210) between the mold (202) and the cooling jacket (204) along a radial direction,
- an intermediate tubular structure (206), the intermediate tubular structure (206) surrounding the cooling jacket (204) and coupled thereto through first coupling means (214) disposed therein for coupling the cooling jacket (204) and the intermediate tubular structure (206), and
- a housing assembly (208), the housing assembly (208) enclosing the mold (202) such that an enclosed space is formed between the housing assembly (208) and the mold (202), wherein the cooling jacket (204) and the intermediate tubular structure (206) are disposed within the enclosed space such that the housing assembly (208) surrounds the intermediate tubular structure (206), and wherein the housing assembly (208) is coupled to the intermediate tubular structure (206) through second coupling means (216) disposed

therein for coupling the intermediate tubular structure (206) and the housing assembly (208), wherein the second coupling means (216) couple the intermediate tubular structure (206) to the housing assembly (208) in a non-rigid manner.

2. The mold assembly (100) according to claim 1, the first coupling means (214) comprise a coupling flange (220) extending outwards from the cooling jacket (204).
3. The mold assembly (100) according to any of claims 1 to 2, wherein the second coupling means (216) comprise an engaging flange (224) extending outward from the intermediate tubular structure (206) and a supporting structure (226) formed in the housing assembly (208) such that the engaging flange (224) rests on the supporting structure (226) in a non-rigid manner.
4. The mold assembly (100) according to any of claims 1 to 3 further comprising first sealing means (222) for providing a leakage-resistant coupling between the cooling jacket (204) and the intermediate tubular structure (206), and second sealing means (228) for providing a leakage-resistant coupling between the intermediate tubular structure (206) and the housing assembly (208).
5. The mold assembly (100) according to any of claims 1 to 4 further comprising third coupling means (218) adapted for suspending the cooling jacket (204) from the housing assembly (208) and permitting movement of the cooling jacket (204) in any direction along a transverse plane, the transverse plane being orthogonal to the longitudinal direction.
6. The mold assembly (100) according to claim 5, wherein the third coupling means (218) feature brackets (232), wherein each bracket (232) includes a through-hole elongated in the longitudinal direction, and lugs (234) on diametrically opposite sides of the cooling jacket (204), which may be coupled to brackets (232), wherein the third coupling means (218) are further adapted for displacing the cooling jacket (204) with respect to the mold (202) and suitably positioning along the longitudinal direction.
7. The mold assembly (100) according to any of claims 1 to 6, wherein the cooling jacket (204), the first coupling means (214), the intermediate tubular structure (206) and the second coupling means (216) partition the enclosed space into an inlet chamber (238) and an outlet chamber (240) such that the inlet chamber (238) and the outlet chamber (240) are interconnected through the flow gap (210).

8. The mold assembly (100) according to claim 7, wherein a cooling fluid flows from the inlet chamber (238) to the outlet chamber (240) through the flow gap (210).

Patentansprüche

1. Formanordnung (100), welche zur Verwendung beim Stranggießen geeignet ist, wobei die Formanordnung (100) umfasst:

- eine Form (202), wobei die Form (202) einen Formhohlraum für den Fluss von geschmolzenem Metall entlang einer Längsrichtung begrenzt,
- einen Kühlmantel (204), wobei der Kühlmantel (204) die Form (202) umgibt, derart, dass ein Durchflussspalt (210) zwischen der Form (202) und dem Kühlmantel (204) gebildet wird, wobei die Form (202) und/oder der Kühlmantel (204) mit Einstellmitteln (212) zum Einstellen einer Abmessung des Durchflussspalts (210) zwischen der Form (202) und dem Kühlmantel (204) entlang einer radialen Richtung versehen ist,
- eine rohrförmige Zwischenstruktur (206), wobei die rohrförmige Zwischenstruktur (206) den Kühlmantel (204) umgibt und mit diesem durch in ihr angeordnete erste Kupplungsmittel (214) zum Kuppeln des Kühlmantels (204) und der rohrförmigen Zwischenstruktur (206) gekuppelt ist, und
- eine Gehäuseanordnung (208), wobei die Gehäuseanordnung (208) die Form (202) umschließt, so dass ein umschlossener Raum zwischen der Gehäuseanordnung (208) und der Form (202) gebildet wird, wobei der Kühlmantel (204) und die rohrförmige Zwischenstruktur (206) innerhalb des umschlossenen Raumes angeordnet sind, derart, dass die Gehäuseanordnung (208) die rohrförmige Zwischenstruktur (206) umgibt, und wobei die Gehäuseanordnung (208) mit der rohrförmigen Zwischenstruktur (206) durch in ihr angeordnete zweite Kupplungsmittel (216) zum Kuppeln der rohrförmigen Zwischenstruktur (206) und der Gehäuseanordnung (208) gekuppelt ist, wobei die zweiten Kupplungsmittel (216) die rohrförmige Zwischenstruktur (206) in einer nicht-starren Art und Weise mit der Gehäuseanordnung (208) kuppeln.

2. Formanordnung (100) nach Anspruch 1, wobei die ersten Kupplungsmittel (214) einen Kupplungsflansch (220) umfassen, der sich von dem Kühlmantel (204) aus nach außen erstreckt.

3. Formanordnung (100) nach einem der Ansprüche 1 bis 2, wobei die zweiten Kupplungsmittel (216) einen Eingriffsflansch (224), der sich von der rohrförmigen Zwischenstruktur (206) aus nach außen erstreckt, und eine Stützstruktur (226), die in der Gehäuseanordnung (208) ausgebildet ist, umfassen, derart, dass der Eingriffsflansch (224) in einer nicht-starren Art und Weise auf der Stützstruktur (226) ruht.

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4. Formanordnung (100) nach einem der Ansprüche 1 bis 3, welche ferner erste Dichtmittel (222) zum Gewährleisten einer leakagebeständigen Kupplung zwischen dem Kühlmantel (204) und der rohrförmigen Zwischenstruktur (206) und zweite Dichtmittel (228) zum Gewährleisten einer leakagebeständigen Kupplung zwischen der rohrförmigen Zwischenstruktur (206) und der Gehäuseanordnung (208) umfasst.

5. Formanordnung (100) nach einem der Ansprüche 1 bis 4, welche ferner dritte Kupplungsmittel (218) umfasst, die dazu eingerichtet sind, den Kühlmantel (204) an der Gehäuseanordnung (208) aufzuhängen und eine Bewegung des Kühlmantels (204) in einer beliebigen Richtung entlang einer Querebene zu ermöglichen, wobei die Querebene orthogonal zu der Längsrichtung ist.

6. Formanordnung (100) nach Anspruch 5, wobei die dritten Kupplungsmittel (218) Halter (232) aufweisen, wobei jeder Halter (232) eine in der Längsrichtung lang gestreckte Durchgangsbohrung aufweist, und Ansätze (234) auf einander diametral gegenüberliegenden Seiten des Kühlmantels (204) aufweisen, welche mit den Haltern (232) gekuppelt werden können, wobei die dritten Kupplungsmittel (218) ferner dazu eingerichtet sind, den Kühlmantel (204) in Bezug auf die Form (202) zu verschieben und entlang der Längsrichtung geeignet zu positionieren.

7. Formanordnung (100) nach einem der Ansprüche 1 bis 6, wobei der Kühlmantel (204), die ersten Kupplungsmittel (214), die rohrförmige Zwischenstruktur (206) und die zweiten Kupplungsmittel (216) den umschlossenen Raum in eine Einlasskammer (238) und eine Auslasskammer (240) aufteilen, derart, dass die Einlasskammer (238) und die Auslasskammer (240) durch den Durchflussspalt (210) miteinander verbunden sind.

8. Formanordnung (100) nach Anspruch 7, wobei ein Kühlfluid aus der Einlasskammer (238) durch den Durchflussspalt (210) zu der Auslasskammer (240) fließt.

Revendications

1. Ensemble de moule (100) approprié à une utilisation dans une coulée continue, l'ensemble de moule (100) comprenant :
 - un moule (202), le moule (202) délimitant une cavité de moule pour l'écoulement du métal en fusion le long d'une direction longitudinale,
 - une chemise de refroidissement (204), la chemise de refroidissement (204) entourant le moule (202) de telle sorte qu'un espace d'écoulement (210) soit formé entre le moule (202) et la chemise de refroidissement (204), dans lequel au moins le moule (202) ou la chemise de refroidissement (204) est prévu(e) avec des moyens d'ajustement (212) pour ajuster une dimension de l'espace d'écoulement (210) entre le moule (202) et la chemise de refroidissement (204) le long d'une direction radiale,
 - une structure tubulaire intermédiaire (206), la structure tubulaire intermédiaire (206) entourant la chemise de refroidissement (204) et étant couplée à celle-ci par l'intermédiaire de premiers moyens d'accouplement (214) disposés à l'intérieur de celle-ci pour coupler la chemise de refroidissement (204) et la structure tubulaire intermédiaire (206), et
 - un ensemble de boîtier (208), l'ensemble de boîtier (208) enfermant le moule (202) de telle sorte qu'un espace clos soit formé entre l'ensemble de boîtier (208) et le moule (202), dans lequel la chemise de refroidissement (204) et la structure tubulaire intermédiaire (206) sont disposées à l'intérieur de l'espace clos de telle sorte que l'ensemble de boîtier (208) entoure la structure tubulaire intermédiaire (206), et dans lequel l'ensemble de boîtier (208) est couplé à la structure tubulaire intermédiaire (206) par l'intermédiaire de deuxièmes moyens d'accouplement (216) disposés à l'intérieur de celle-ci pour coupler la structure tubulaire intermédiaire (206) et l'ensemble de boîtier (208), dans lequel les deuxièmes moyens d'accouplement (216) couplent la structure tubulaire intermédiaire (206) à l'ensemble de boîtier (208) de manière non rigide.
2. Ensemble de moule (100) selon la revendication 1, dans lequel les premiers moyens d'accouplement (214) comprennent une bride d'accouplement (220) s'étendant vers l'extérieur de la chemise de refroidissement (204).
3. Ensemble de moule (100) selon une des revendications 1 à 2, dans lequel les deuxièmes moyens d'accouplement (216) comprennent une bride d'engagement (224) s'étendant vers l'extérieur de la structure tubulaire intermédiaire (206) et une structure support (226) formée dans l'ensemble de boîtier (208) de telle sorte que la bride d'engagement (224) repose sur la structure support (226) de manière non rigide.
4. Ensemble de moule (100) selon une des revendications 1 à 3, comprenant en outre des premiers moyens de scellement (222) pour fournir un accouplement anti-fuite entre la chemise de refroidissement (204) et la structure tubulaire intermédiaire (206), et des seconds moyens de scellement (228) pour fournir un accouplement anti-fuite entre la structure tubulaire intermédiaire (206) et l'ensemble de boîtier (208).
5. Ensemble de moule (100) selon une des revendications 1 à 4, comprenant en outre des troisièmes moyens d'accouplement (218) adaptés pour suspendre la chemise de refroidissement (204) à partir de l'ensemble de boîtier (208) et permettre un mouvement de la chemise de refroidissement (204) dans une quelconque direction le long d'un plan transversal, le plan transversal étant orthogonal à la direction longitudinale.
6. Ensemble de moule (100) selon la revendication 5, dans lequel les troisièmes moyens d'accouplement (218) comportent des supports (232), dans lequel chaque support (232) inclut un trou traversant allongé dans la direction longitudinale, et des pattes (234) sur des côtés diamétralement opposés de la chemise de refroidissement (204), lesquelles peuvent être couplées à des supports (232), dans lequel les troisièmes moyens d'accouplement (218) sont en outre adaptés pour déplacer la chemise de refroidissement (204) par rapport au moule (202) et la positionner de manière appropriée dans la direction longitudinale.
7. Ensemble de moule (100) selon une des revendications 1 à 6, dans lequel la chemise de refroidissement (204), les premiers moyens d'accouplement (214), la structure tubulaire intermédiaire (206) et les deuxièmes moyens d'accouplement (216) partitionnent l'espace clos en une chambre d'admission (238) et une chambre d'évacuation (240) de telle sorte que la chambre d'admission (238) et la chambre d'évacuation (240) sont interconnectées par l'espace d'écoulement (210).
8. Ensemble de moule (100) selon la revendication 7, dans lequel un fluide de refroidissement s'écoule depuis la chambre d'admission (238) jusque dans la chambre d'évacuation (240) à travers de l'espace d'écoulement (210).

FIG 1

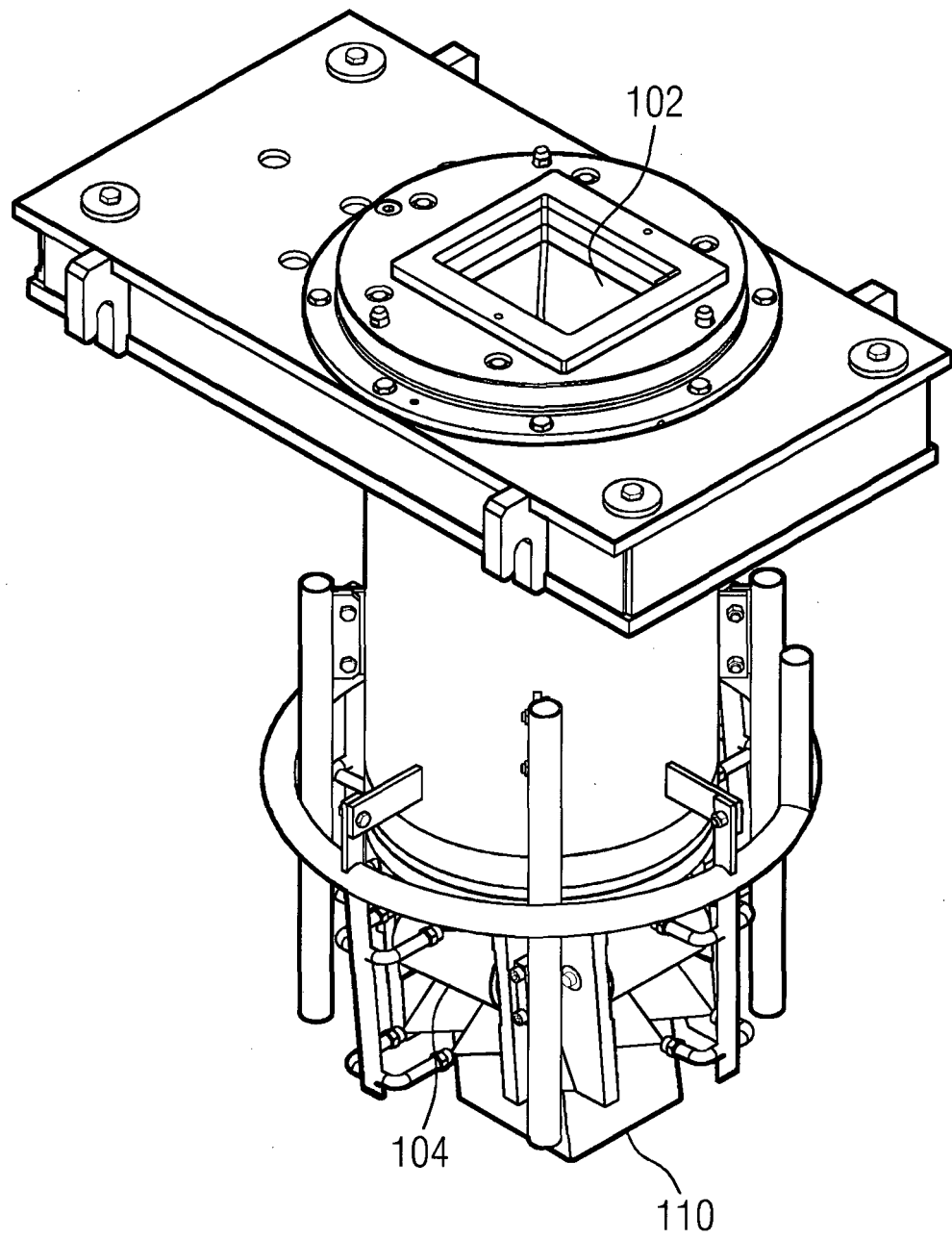


FIG 2

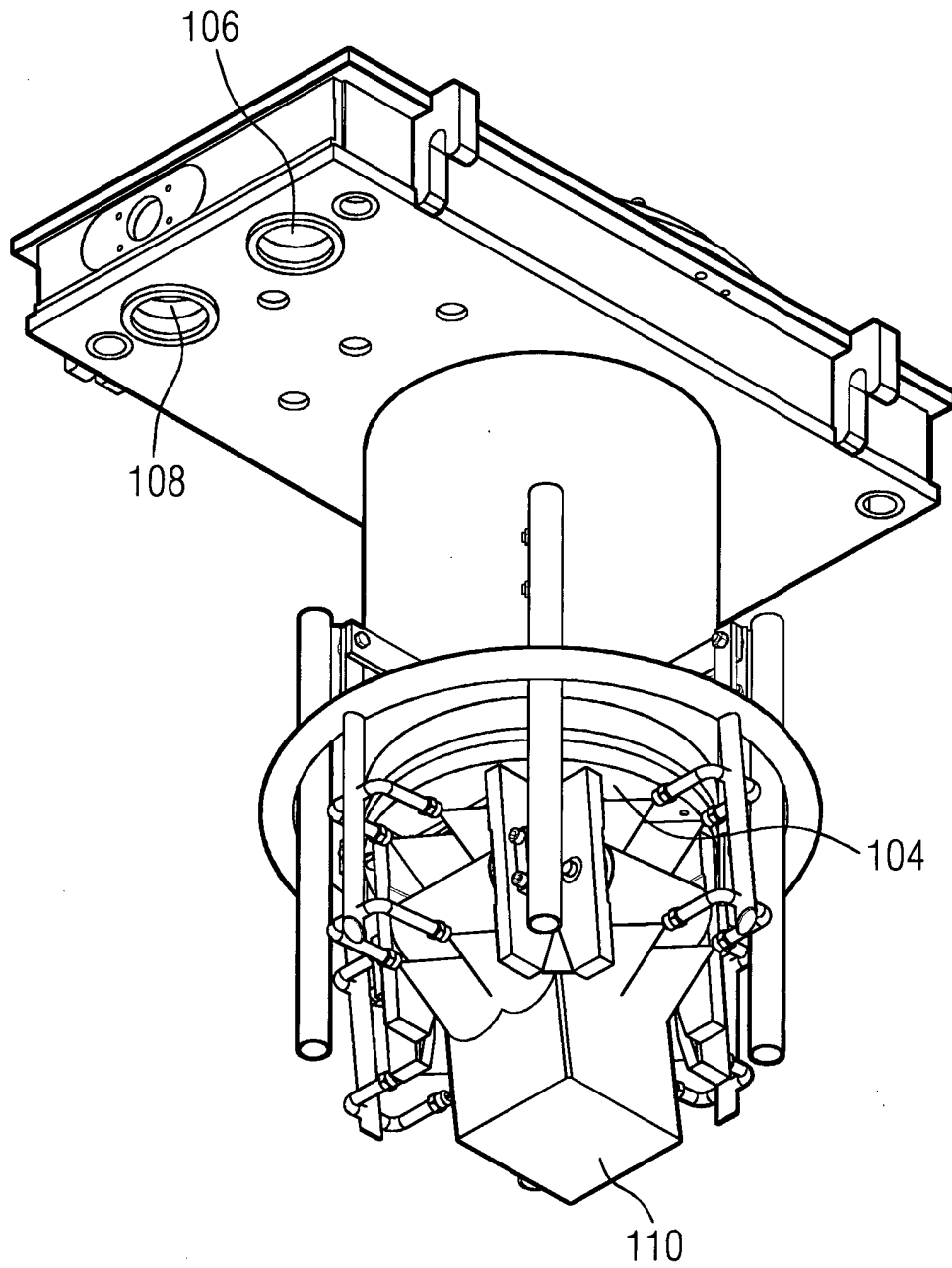


FIG 3

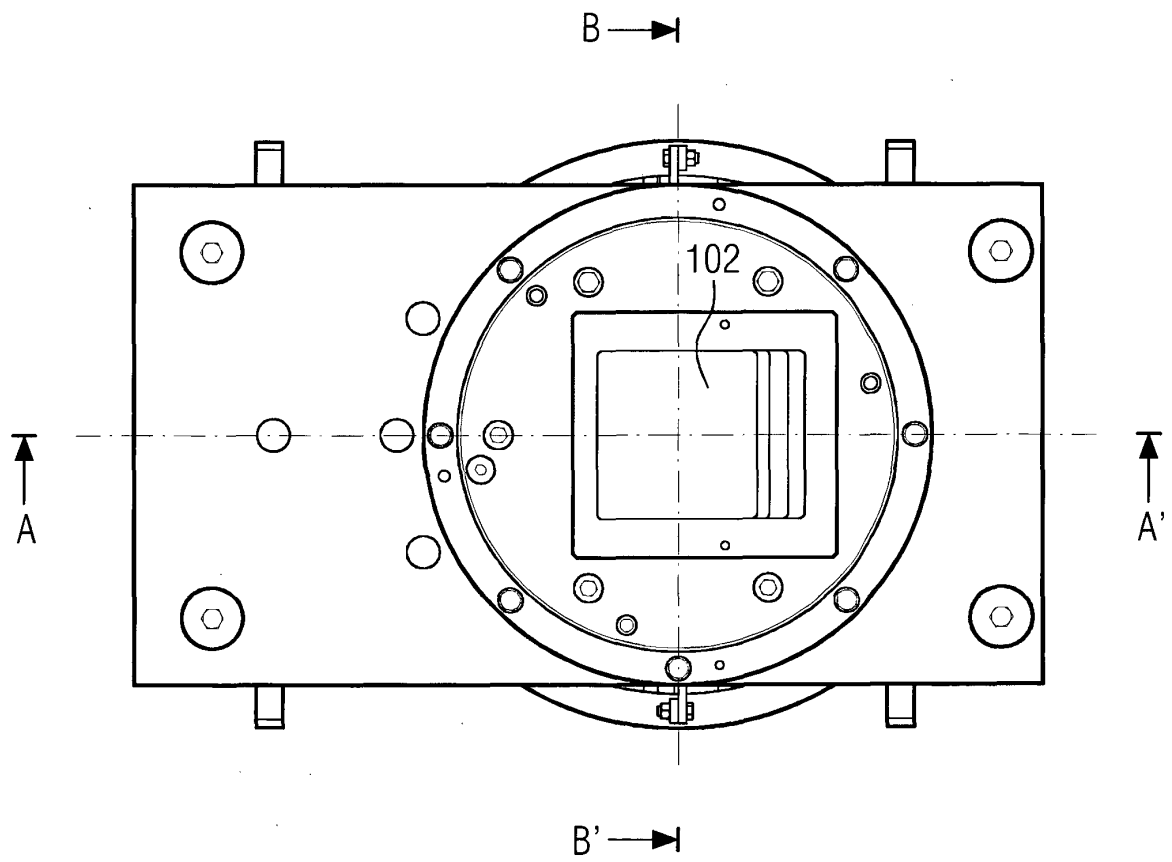


FIG 4

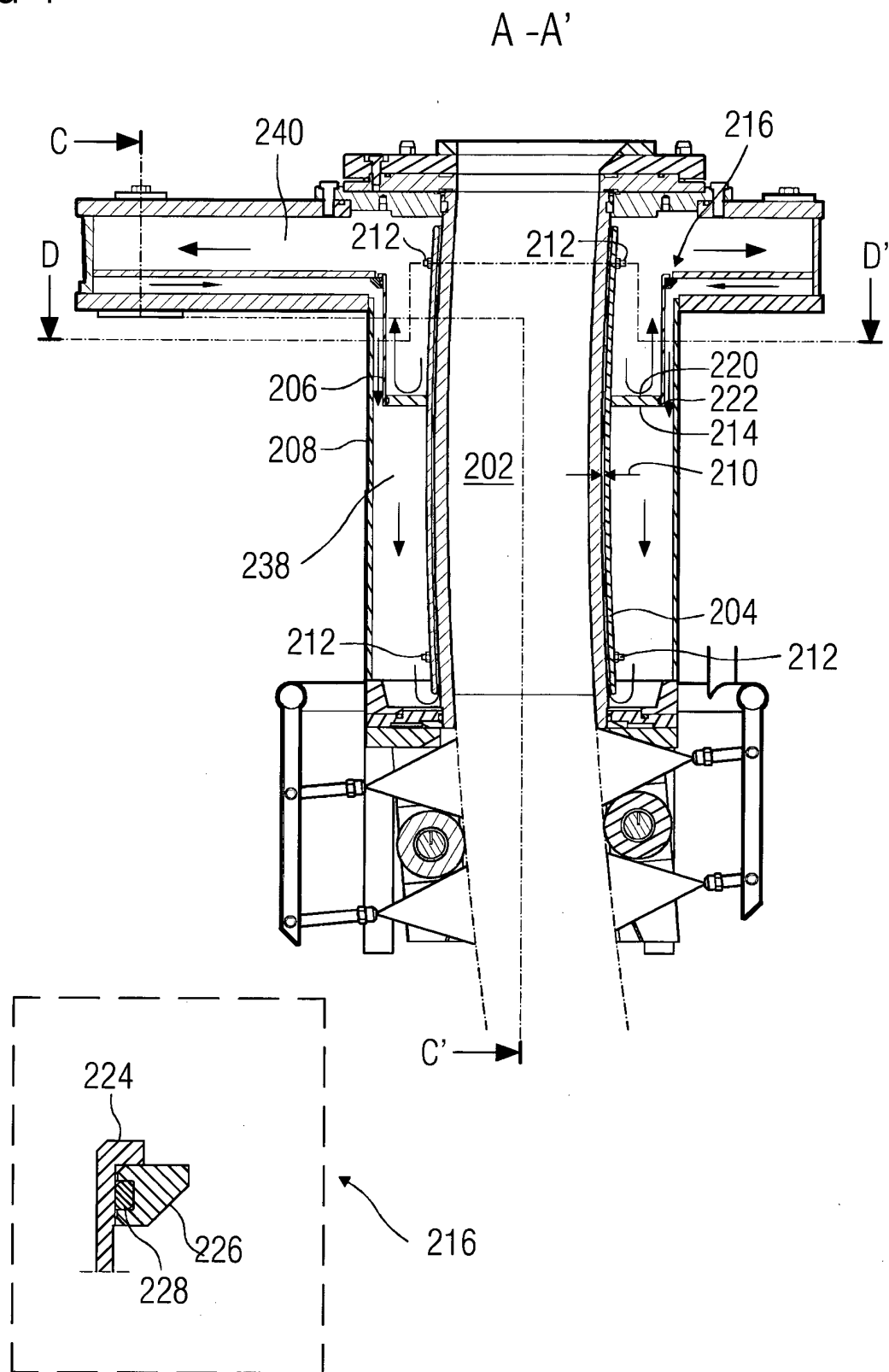


FIG 5

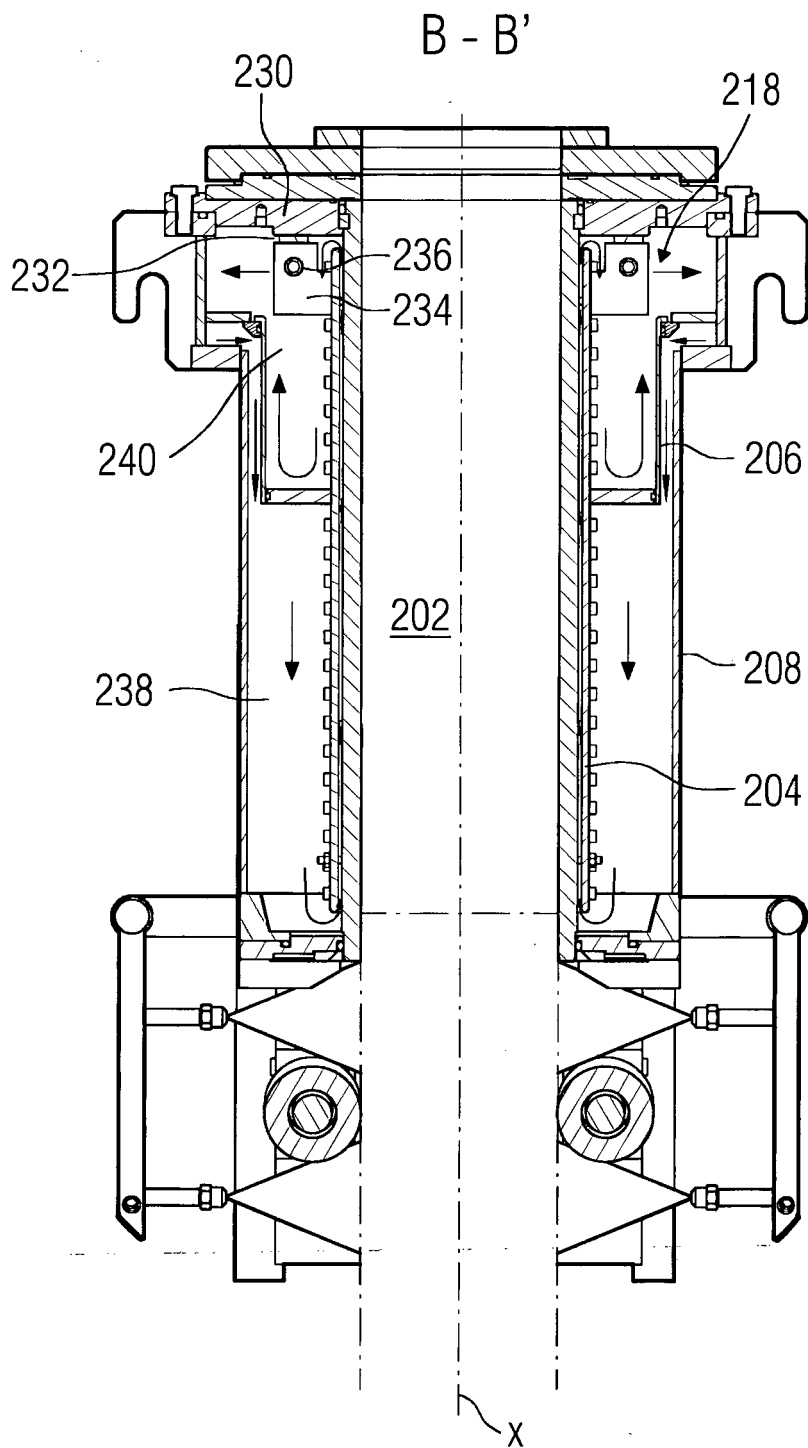


FIG 6

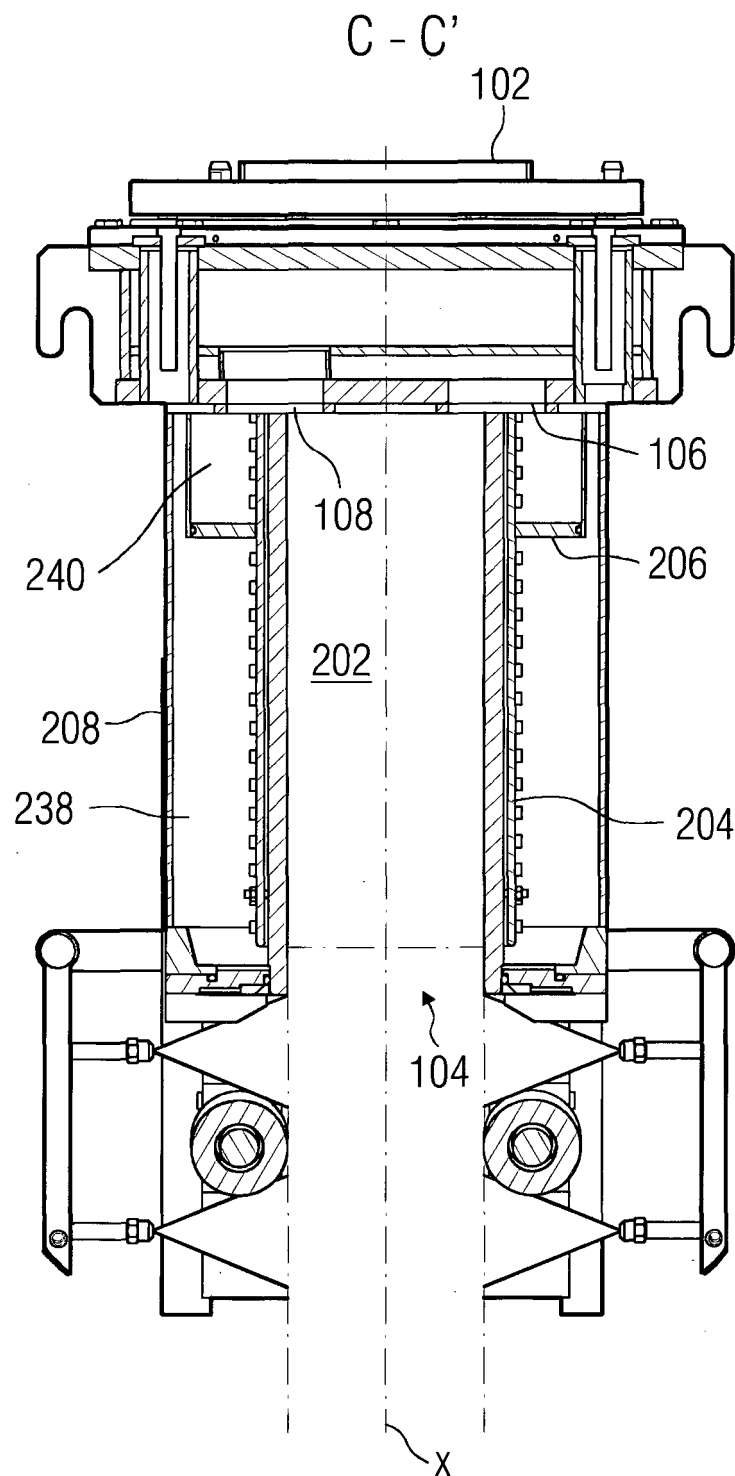
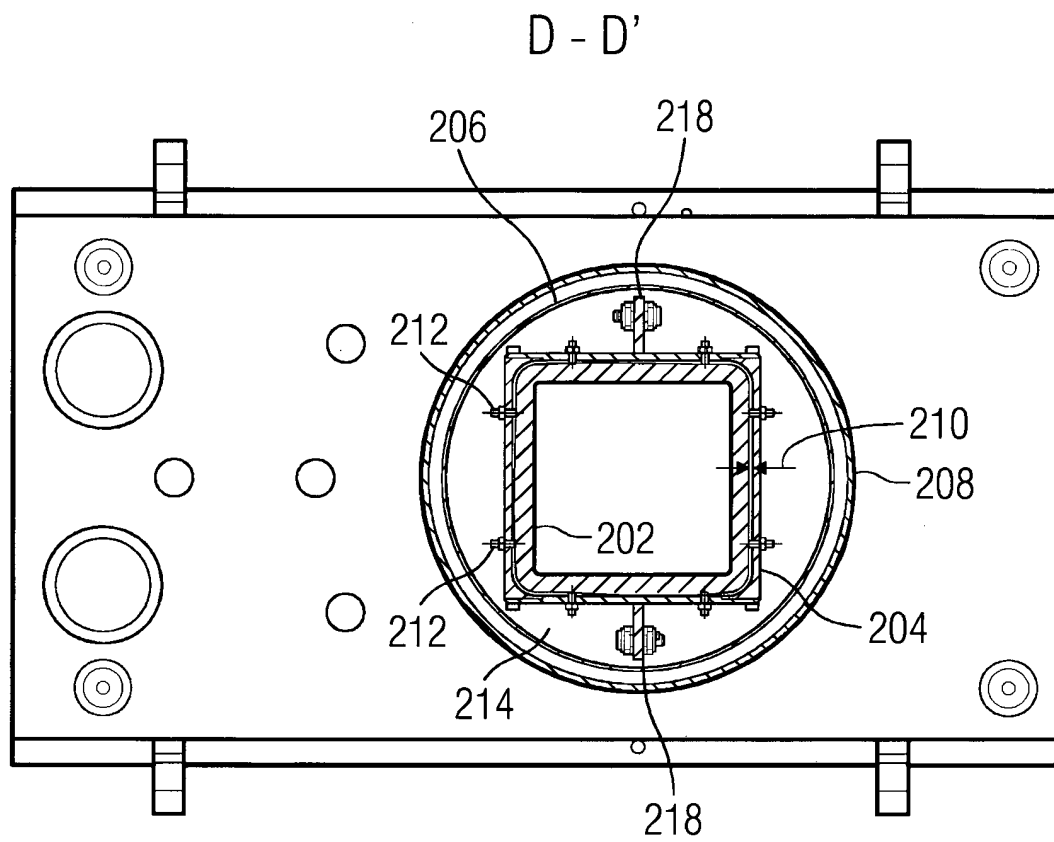


FIG 7



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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