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(72) Inventors:
• **Zwart, Simon**
1562 XK KROMMENIE (NL)
• **Peerdeman, Arnoud**
1671 MX MEDEMBLIK (NL)

(74) Representative: **Luten, Martin Haaije**
Arnold & Siedsma
Bezuidenhoutseweg 57
2594 AC The Hague (NL)

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(71) Applicant: **Pirson Refractories B.V.**
1951 MD Velsen-Noord (NL)

(54) **HEAT SHIELD ASSEMBLY**

(57) Heat shield assembly for use in a hot blast stove installation, wherein the shield assembly comprises a main body and at least one shield part which is movable with respect to the main body, wherein the heat shield assembly is movable from a compact position, wherein the main body and the shield parts substantially overlap, towards a deployed position, wherein the shield part and the main body extend substantially adjacently for forming a heat shielding surface, wherein the shield part is movable along a plane from the compact positions towards the deployed position.

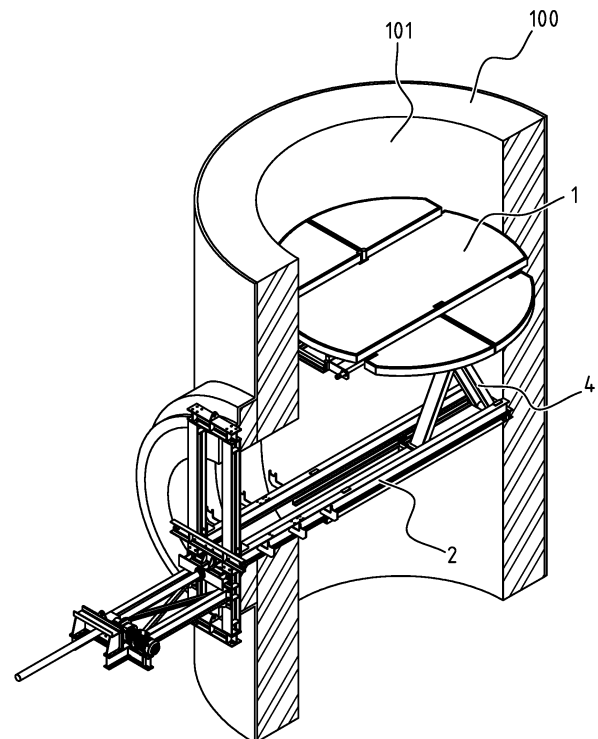


FIG. 6

Description

[0001] The present invention relates to a heat shield assembly for use in a hot blast stove installation. The invention further relates to a method for forming a heat shield, in particular in a hot blast stove installation. A heat shield according to the preamble of claim 1 is known from WO 2013/050522.

[0002] A metallurgical furnace installation is typically provided with a hot blast stove for supplying hot blast, i. e. heated air, to a blast furnace. These blast stoves are provided with heat sources (burners) and produce hot blast air with temperatures around 1200° which is supplied to the blast furnace. These hot blast stoves may be provided with an internal or external burner shaft, having a tubular or chimney like structure, which debouches in the top of the hot blast stove. The heat sources (burners) are typically located at or are connected to the bottom of burner shaft.

[0003] Shutting down a hot blast stove for maintenance of one the components of the installation is not preferred, as restarting a hot blast stove for operation takes considerable time and effort and can damage the existing refractories. Maintenance of for instance a hot blast stove thus preferably takes place while the hot blast stove is at operating temperature. It is therefore known to provide heat shields in a furnace installation, for instance in the burner shaft of the hot blast stoves thereof, to create a working environment for people and keep the upper section of the burner shaft at operational temperatures. In case of a burner shaft as mentioned above, these heat shields are installed in the burner shaft and are designed to substantially cover the cross sectional area of the burner shaft, such that the shield forms a heat and safety barrier in said burner shaft.

[0004] A known heat shield assembly is provided with a main body and shield parts which arranged pivotally with respect to the main body. In folded or compact position, the main body and the shield parts overlap such that the assembly can be inserted through the hot blast outlet opening into the burner shaft easily. After putting the assembly in place, the shield parts are unfolded such that the shield parts, together with the main body, substantially covers the cross section of the burner shaft, thereby forming a shield for personnel.

[0005] Unfolding the shield assembly to obtain a good shielding working is however difficult, in particular in the hot conditions of a burner shaft of a hot blast stove.

[0006] It is a goal of the present invention, next to other goals, to provide a heat shield assembly which is easily and/or efficiently deployable, while obtaining good heat shielding properties.

[0007] This goal, amongst other goals, is met by a method according to appended claim 1. More specifically, this goal, amongst other goals, is met by heat shield assembly for use in a hot blast stove installation, wherein the heat shield assembly comprises a main body and at least one shield part which is movable with respect to the

main body, wherein the shield assembly is movable from a compact position, wherein the main body and the shield part substantially overlap, towards a deployed position, wherein the shield part extend substantially adjacently to the main body for forming a heat shielding surface, wherein the shield part is movable along a plane from the compact positions towards the deployed position.

[0008] In the compact position, the heat shield assembly can be introduced into the tubular structure, or other environment needing a shield, easily. Thereto, at least one of the width or length of the heat shield assembly is smaller in the compact position than in the deployed position. This may be achieved as mentioned above by arranged the shield part and the main body in an overlapping configuration. In other words, the shield part preferably does not extend, or hardly extends, from the main body. Preferably less than 10%, more preferably less 5% and even more preferably no surface area of the shield parts extends beyond the perimeter of the main body. The shield part is hereby preferably contained within the perimeter of the main body in the compact position. The perimeter of the heat shield assembly is then preferably determined by the perimeter of the main body.

[0009] For moving the heat shield assembly to the deployed position, the shield part is moved along a plane, for instance by translation or rotation, with respect to the main body. The shield part and the main body may hereby be provided with connection means allowing said movement in the plane as mentioned above. In the deployed position, the shield part extends from the perimeter of the main body, thereby forming an increased perimeter for the heat shield assembly as a whole. By moving the shield part in a plane, an efficient movement towards the deployed position is made possible, while also a more accurate fit in the tubular structure can be obtained. The shield part is preferably only moved along a plane, i.e. without any movement outside the plane.

[0010] The shield part moves in a plane parallel to a plane of the main body. This in contrast to the heat shield of WO 2013/050522, wherein the shield parts are alleged pivotally with respect to the main body.

[0011] The heat shielding surface in the deployed position is preferably substantially closed, i.e. without holes. The shield part and the main body thereto extend adjacently, i.e. close next to each other with no, or substantially no, gap there between. It is also possible that the shield part and the main body slightly overlap, preferably less than 10% surface area, more preferably less than 5% body area of the shield part.

[0012] A more accurate fit, while still obtaining a compact configuration in the compact position is achieved when the assembly comprises a plurality of shield parts. Preferably, each of the shield parts extend within the perimeter of the main body in the compact position, to extend therefrom in the deployed position. It is then preferred that each of the shield parts are movable along a plane. More preferably, the shield parts are each movable along a plane parallel to the heat shielding surface.

[0013] A compact and robust configuration is obtained if, at least in the compact position, a first shield part extends along a top surface of the main body and wherein a second shield part extends along a bottom surface of the main body. In other words, the shield parts are arranged on either side of the main body, at least one at the top and at least one at the bottom. This allows an efficient connection of both shield parts to the main body.

[0014] For providing an efficient heat shield in a tubular structure having a circular cross section, it is preferred if the shield part substantially has the shape of a circular sector. An outer edge of the shield parts is hereby preferably arc shaped. An efficient closure is then obtained, such that preferably in deployed position, the heat shielding surface is substantially disk shaped. The diameter of the disk then substantially corresponds to the inner diameter of the tubular structure. Preferably, in the deployed position, the plurality of shield parts together form a substantially circular perimeter. Each of the shield parts then preferably has a arc shaped outer edge for defining the circular outer perimeter of the heat shield assembly in the deployed position.

[0015] It is however noted that is also possible that the heat shield assembly is to be used in a structure having another cross sectional shape than circular as mentioned above. Also in these cases, the heat shield assembly has a outer perimeter substantially corresponding to the diameter of the structure wherein the heat shield assembly is to be deployed. The outer edges of the shield parts are then shaped for defining said outer perimeter in the deployed position.

[0016] It is possible that only the shield parts have a heat shielding function, and are thereto for instance provided with a heat resistant layer or lining. In this variant, the heat shielding surface is formed only by the shield parts. However, according to a preferred embodiment, the main body and the shield part together form the heat shielding surface in the deployed position. Both the main body part and the shield part may then be provided with a heat resistance layer or lining.

[0017] According to a preferred embodiment, the main body may be provided with a frame member, or provided with connection means for connecting to a frame member, wherein the frame member is arranged for supporting the heat shield assembly. The main body then forms the central structure of the heat shield assembly, to which the shield part, preferably the plurality of shield parts, are connected. Preferably, the main body part hereby forms a central region of the heat shielding surface, wherein the shield part(s) at least partly define the heat shielding surface near the perimeter.

[0018] As an alternative, the main body may be similarly shaped as a shield part. In this embodiment, the two (or more) shield parts are movable with respect to each other along a plane for moving towards the deployed position.

[0019] According to a preferred embodiment, the shield part is arranged to translate along the plane with respect to the main body. The main body and the shield

part may for instance be provided with cooperating guiding means for guiding the movement of the shield part with respect to the main body.

[0020] According to a further preferred embodiment, the shield part is arranged to rotate within the plane with respect to the main body. This provides an efficient movement towards the deployed position. Preferably, the shield part is arranged to rotate around a rotation axis substantially perpendicular to the heat shielding surface. The shield part then rotates in a plane parallel to the heat shielding surface.

[0021] For achieving a compact configuration in the compact position while increasing the area of the heat shielding surface in the deployed position, it is preferred if a shield part is rotatable around a rotation axis near an edge of the main body. In the compact position the shield part is then preferably contained within the perimeter of the main body, while when moved towards the deployed position, the shield part extends adjacent the main body.

[0022] According to a further preferred embodiment, two shield parts are rotatable around respective rotation axes, wherein said axes extend adjacently. These two shield parts then preferably rotate from their position within the perimeter of the main body towards each other for forming a part of the heat shielding surface. Preferably, the rotation axes extend in a middle region of the main body, for instance the middle region in the length direction of the main body, at or near the edges, seen in the width direction.

[0023] A further preferred embodiment of a heat shield assembly comprises a first set of shield parts which form a first half of the shielding surface and a second set of shield parts forming a second half of the shielding surface. The main body then preferably extends there between. A relatively large heat shielding surface can thus be formed, while maintaining a relatively compact configuration in the compact position. Two adjacent shield parts preferably rotate in opposite directions. It is further preferred if the first set extends along the top surface of the main body and wherein the second set extends along a bottom surface of the main body as mentioned above.

[0024] Again here, it is preferred if the first set of shield parts rotate around axes near a first edge of the main body and wherein the second set of shield parts rotate around axes near a second, opposite edge of the main body. A relatively large heat shielding surface can thus be formed, while maintaining a relatively compact configuration in the compact position.

[0025] According to the invention, the heat shield assembly is movable from a compact position towards the deployed position. However, for easy removal of the assembly or reuse, it is preferred if the heat shield assembly is movable between the two positions, i.e. also back from the deployed position to the compact position.

[0026] For easy deployment, and possibly removal as mentioned above, it is preferred if, when the assembly comprises a plurality of shield parts, said shield parts can be moved using a single actuator. A further preferred

embodiment therefore comprises an actuator for moving the plurality of shield parts substantially synchronously to the deployed position. The actuator, or actuator mechanism, may be provided with a transfer machine for moving the plurality of the shield parts together. It is preferred if the actuator, and any related mechanisms such as the transfer mechanisms, are located at the side of the assembly, which is preferably disk shaped as mentioned above, at the side facing away from the heat to be shielded, for instance the side or surface provided with a heat resistant layer or lining.

[0027] The invention further relates to method for providing a heat shield in a tubular structure, such as a burner shaft of a hot blast stove as mentioned above, comprising the steps of:

- providing a heat shield assembly according to the invention in the compact position;
- inserting the heat shield assembly in the tubular structure;
- moving the heat shield assembly to the deployed position by moving the shield part along a plane, such that the heat shielding surface covers substantially the whole cross sectional area of the tubular structure.

[0028] As mentioned above, it is preferred if the shield part is rotated towards the deployed position. This provides an efficient movement towards the deployed position.

[0029] The present invention is further illustrated by the following Figures, which show a preferred embodiment of the device and method according to the invention, and are not intended to limit the scope of the invention in any way, wherein:

- figures 1a -c show the device in a first stage during deployment of the heat shield in cross section in a tube, perspective view and top view respectively;
- figures 2a,b show the device in a second stage during deployment of the heat shield in cross section in a tube, perspective view respectively;
- figure 3 show the device in a third stage during deployment of the heat shield in perspective view;
- figures 4a-c show the device in a fourth stage during deployment of the heat shield in cross section in a tube, perspective view and top view respectively;
- figures 5a-c show the device in a fifth stage during deployment of the heat shield in cross section in a tube, perspective view and top view respectively; and
- figure 6 shows the deployed heat shield in perspective view in the tube.

[0030] In figure 1a-c, the first stage of deploying a heat shield assembly 1 according to the invention in a hot stove 100, hereafter simply referred to as tube 100, is shown. The heat shield assembly 1 is to shield the heat

in the region B from the region indicated with A in figure 1a. The heat shield assembly 1, which is connected to a carrier frame 2, is thereto introduced in the tube 100 via an opening 103 provided with a flange 102. In order to arrange the system (the combination of the frame 2 and the heat shield assembly 1) near the opening 103, a hoisting frame 21 is provided. A counterweight 22 is thereto provided.

[0031] The heat shield assembly 1 is better visible in figures 1b and 1c and comprises a main body 11 having a planar shape with a top surface 11a and a bottom surface 11b. Outer edges 11c of the main body 11, seen in length direction L, are arc shaped in correspondence with the inner wall 101 of the tube 100 (figure 1a) as will be explained in greater detail below. The side edges 11d, seen in a width direction W, are rectilinear in this embodiment.

[0032] Provided on the top surface 11a are two shield parts 12a, b which have the shape of a circular sector with an arc shaped edge 14 and two rectilinear edges 15, 16. Also this edge 14 is shaped in accordance with the inner wall 101 of the tube 100. Edges 15 of the shield parts 12 extend parallel and are in this example aligned with the side edge 11d. The remaining edges 16 of the two shield parts 12a, b abut in the position as shown in figure 1c. The length W1 of the edge 16 of a shield part 12a-d in the direction W as shown in figure 1c roughly corresponds to the width in the direction W of the main body 11. This length W1 further corresponds to half of the length in the direction L of the side edge 11d of the main body 11. The shield parts 12a-d all extend within the perimeter of the main body 11, such that a compact and planar configuration is obtained.

[0033] The shield parts 12a, b are connected to the main body 11 via rotation axes 13a,b which extend along a side edge 11d in a middle region, seen along the direction L, of the main body 11. Underneath the main body 11, two similarly shaped shield parts 12c,d are provided (not visible) which are connected by rotation axes 13c, 13d on the opposite edge 11d.

[0034] In next stage, see figures 2a and 2b, an additional support frame 23 with counterweight 22b is connected to the frame 2, such that the system can rest in balance on the lower wall of the flange 102. The hoisting frame 21 and the first counterweight 22 are removed (indicated with dashed lines in figures 2a and b). In a next step (figure 3), the system is introduced (indicated with the arrow I) in the tube 100 and an upright frame member 24 is bolted to the flange 102 of the tube 100. The system is now carried by the bolted connection to the flange 102, such that the counterweight 22b can be removed (indicated with dashed lines in figure 3).

[0035] As shown in figures 4a-c, screw jack equipment 25 is connected to frame (as will be explained below) and actuators 26 are provided which operate to rotate the shield parts 12a-d around their respective axes 13a-d. Suitable transfers are thereto provided. The heat shield assembly 1 is now ready for deployment. Upon operating

the actuators 26, the shield parts 12a-d will rotate from out the perimeter of the main body 11 towards their deployed position. Parts 12b and c rotate in a clockwise direction, while parts 12a and d rotate in counterclockwise direction (figure 4c). The shield parts in the respective sets 12a,b and 12c,d hereby move in a butterfly manner. Indicated in figure 4c are two (of the four) rotation axes A to indicate that the rotation axes extend perpendicular to the surface 11a of the main body (and to the heat shielding surface to be formed as will be explained below).

[0036] The actuator 26 are operated until the edges 15 of shield parts 12a,b on the one hand and edges 15 of the shield parts 12c, d abut (figures 5a-c). The edges 16 of the shield parts 12a-d are then parallel and in this example substantially aligned with the edges 11d of the main body 11. The arc shaped outer edges 14 of the shield parts 12a-d together with the arc shaped edge 11c of the main body 11 then form a circular perimeter, which closely matches the inner diameter 101 of the tube 100. This is clearly visible in the top view including the tube 100 of figure 5c.

[0037] Also from figure 5b it is clear than upon moving the shield parts 12a-d outwardly with respect to the main body 11, their movement is along a plane which is parallel to the plane of (the surface 11a of) the main body 11. The edges 14 of the shield parts 12a-d thus approach the wall 101 of the tube 100 in a horizontal direction, i.e. parallel or along this plane. Any unevenness in the wall 101 is then less critical to the heat shielding properties.

[0038] During or after movement of the shield parts 12a-d, the heat shield assembly 1 can be raised. The main body 11 is thereto connected to the frame 2 by a scissor frame 4 comprising two legs 41, 42. By pushing leg 41 inwardly (arrow I in figure 5b) using screw jack equipment 25, the heat shield assembly 1 is raised, resulting in the situation as shown in figure 5a-c and 6.

[0039] The top surfaces of the shield parts 12a-d and the main body 11 are provided with a heat resistant layer, such that an effective heat shielding surface, generally indicated with 19 in figure 5b, is provided. The shield parts 12a-d and the main body 11 hereby extend adjacently such that the heat from region B (figure 5a) is effectively blocked from region A.

[0040] The present invention is not limited to the embodiment shown, but extends also to other embodiments falling within the scope of the appended claims.

Claims

1. Heat shield assembly for use in a hot blast stove installation, wherein the shield assembly comprises a main body and at least one shield part which is movable with respect to the main body, wherein the heat shield assembly is movable from a compact position, wherein the main body and the shield parts substantially overlap, towards a deployed position,

wherein the shield part and the main body extend substantially adjacently for forming a heat shielding surface, **characterized in that** the shield part is movable along a plane from the compact positions towards the deployed position.

2. Heat shield assembly according to claim 1, wherein the assembly comprises a plurality of shield parts, each movable along a plane.

3. Heat shield assembly according to claim 2, wherein the shield parts are each movable along a plane parallel to the heat shielding surface.

4. Heat shield assembly according to claim 2 or 3, wherein at least in the compact position, a first shield part extends along a top surface of the main body and wherein a second shield part extends along a bottom surface of the main body.

5. Heat shield assembly according to any of the preceding claims, wherein the shield part substantially has the shape of a circular sector, such that in deployed position, the heat shielding surface is substantially disk shaped.

6. Heat shield assembly according to any of the preceding claims, wherein the shield part is arranged to translate along the plane with respect to the main body.

7. Heat shield assembly according to any of the preceding claims, wherein the shield part is arranged to rotate within the plane with respect to the main body around a rotation axis substantially perpendicular to the heat shielding surface.

8. Heat shield assembly according to claim 7, wherein a shield part is rotatable around a rotation axis near an edge of the main body.

9. Heat shield assembly according to claim 8, wherein two shield parts are rotatable around respective rotation axes, wherein said axes extend adjacently.

10. Heat shield assembly according to any of the preceding claims, comprising a first set of shield parts which form a first half of the shielding surface and a second set of shield parts forming a second half of the shielding surface.

11. Heat shield assembly according to claims 9 and 10, wherein the first set of shield parts rotate around axes near a first edge of the main body and wherein the second set of shield parts rotate around axes near a second, opposite edge of the main body.

12. Heat shield assembly according to any of the claims

9 - 11, wherein two adjacent shield parts rotate in opposite directions.

13. Heat shield assembly according to any of the claims 2 - 4 or 9 - 12, further comprising a actuator for moving the plurality of shield parts substantially synchronously to the deployed position. 5
14. Method for providing a heat shield in a burner shaft of a hot blast stove, comprising the steps of: 10
- providing a heat shield assembly according to any of the preceding claims in the compact position; 15
 - inserting the heat shield assembly in the burner shaft; 15
 - moving the heat shield assembly to the deployed position by moving the shield part along a plane, such that the heat shielding surface covers substantially the whole cross sectional area of the burner shaft. 20
15. Method according to claim 14, wherein the shield part is rotated towards the deployed position. 25

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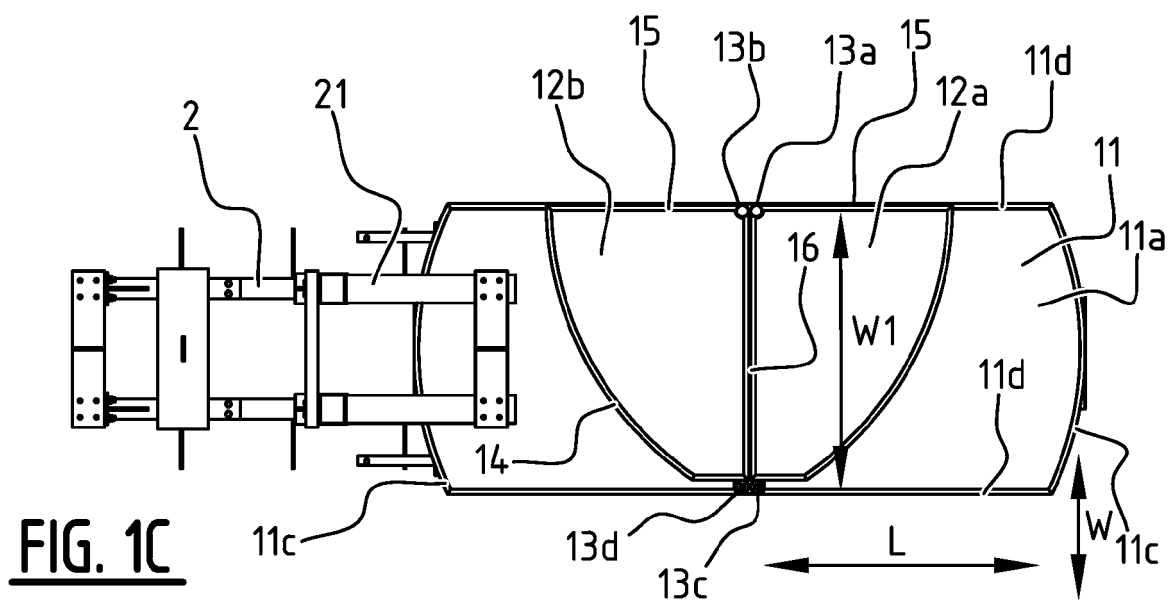
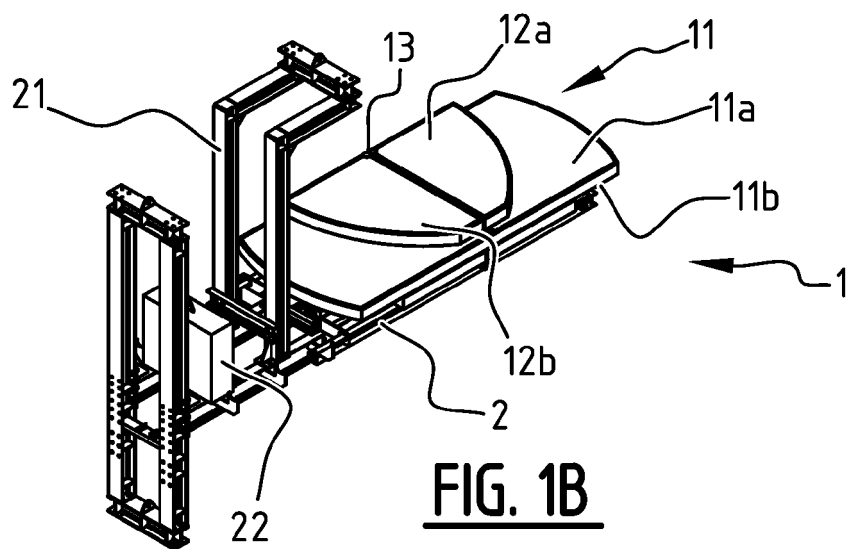
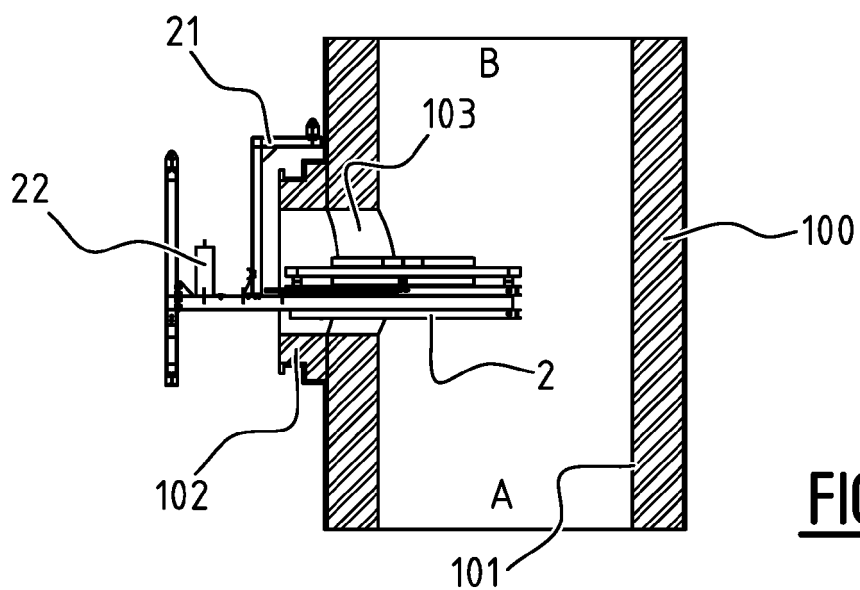
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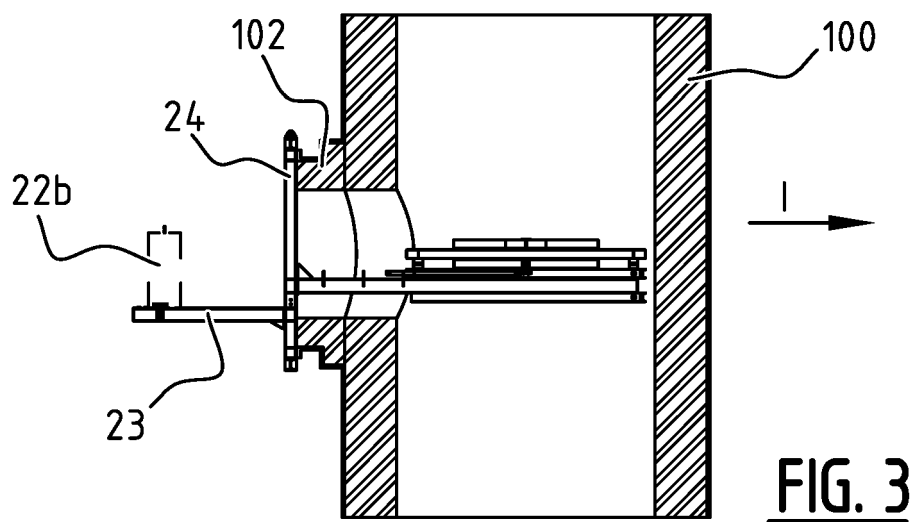
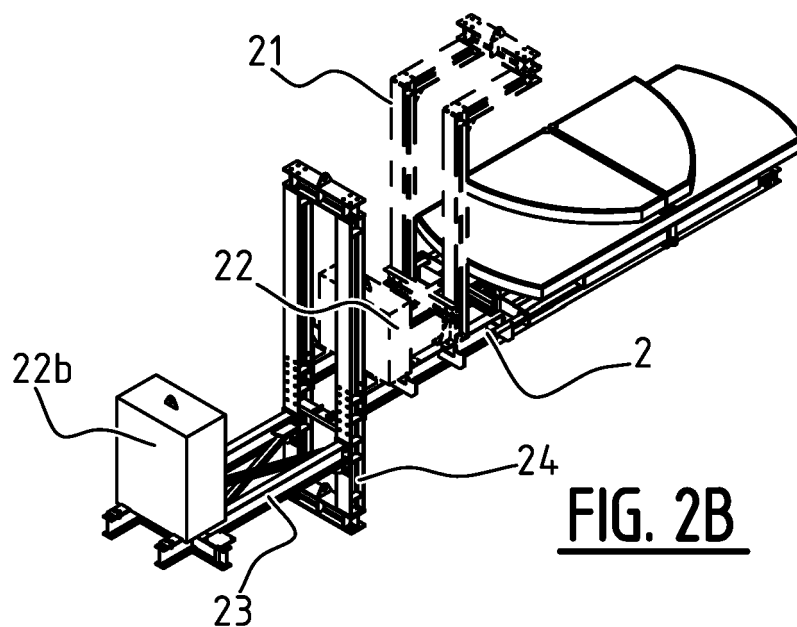
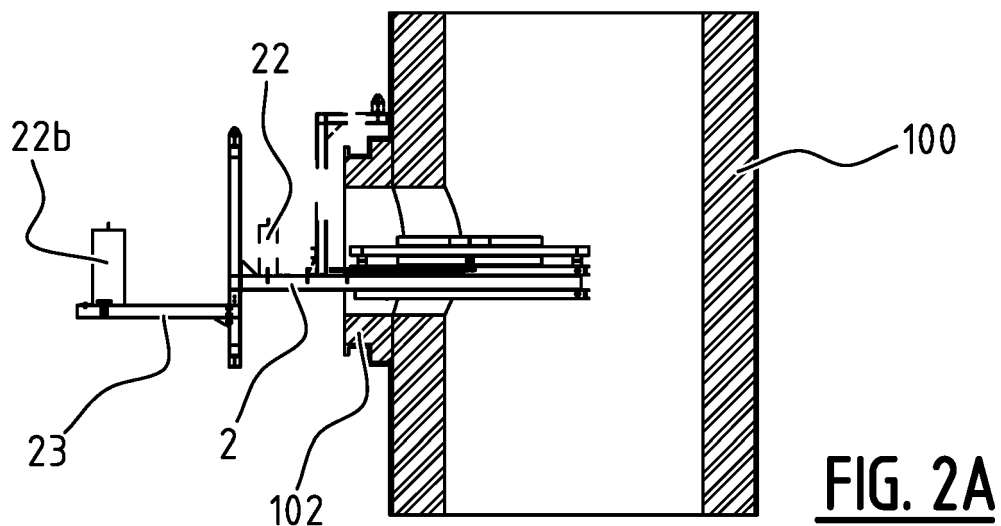
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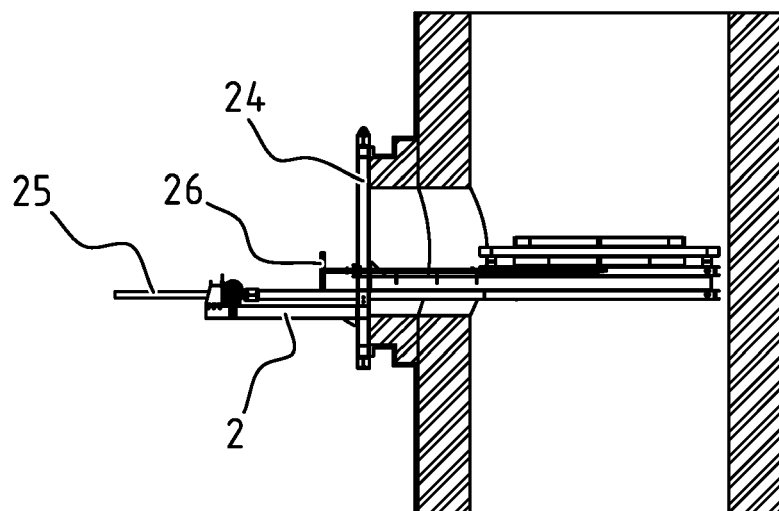


FIG. 4A

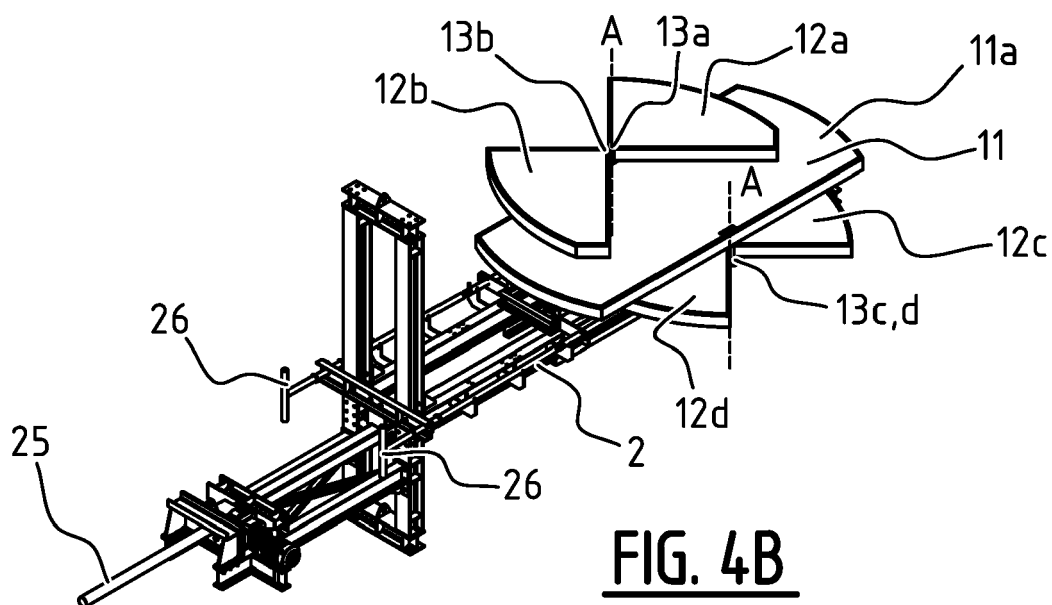


FIG. 4B

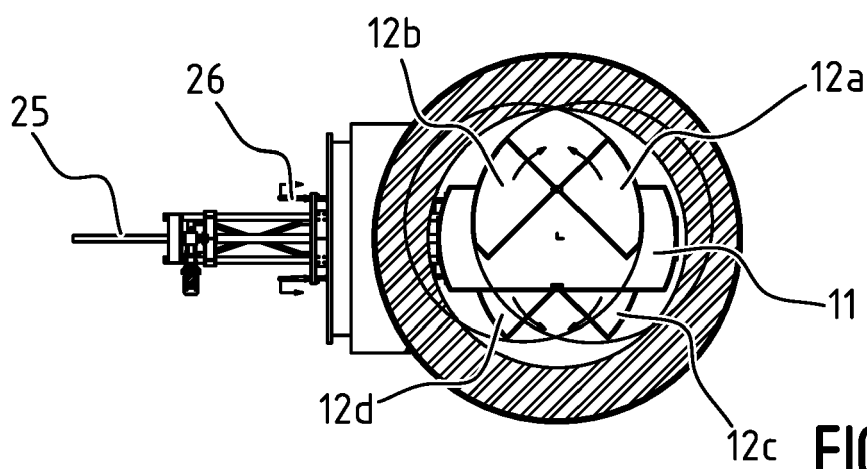
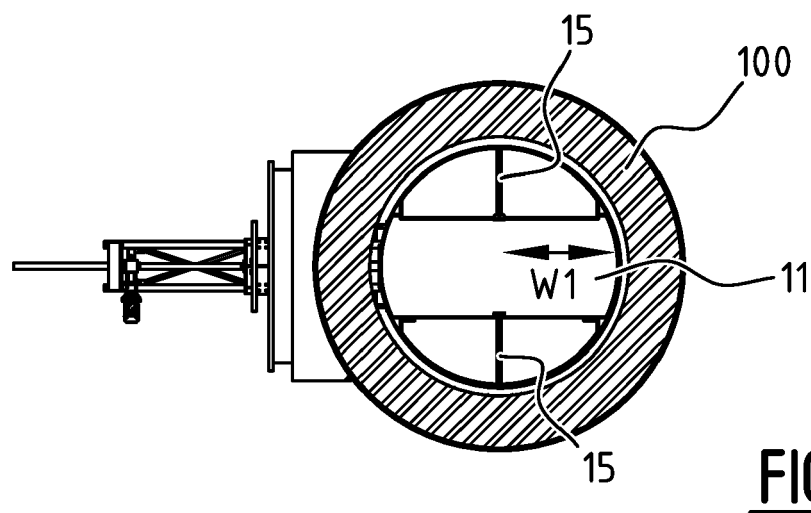
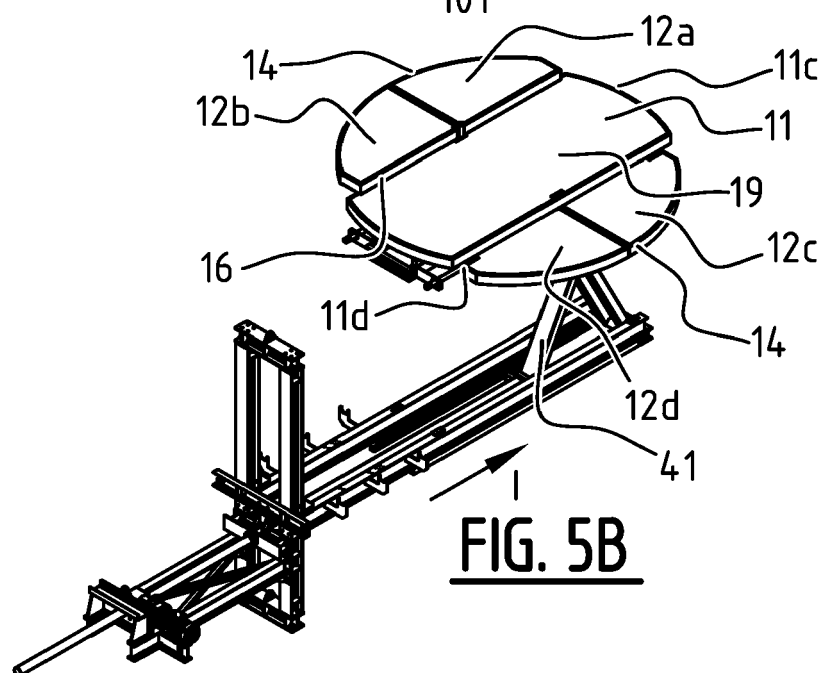
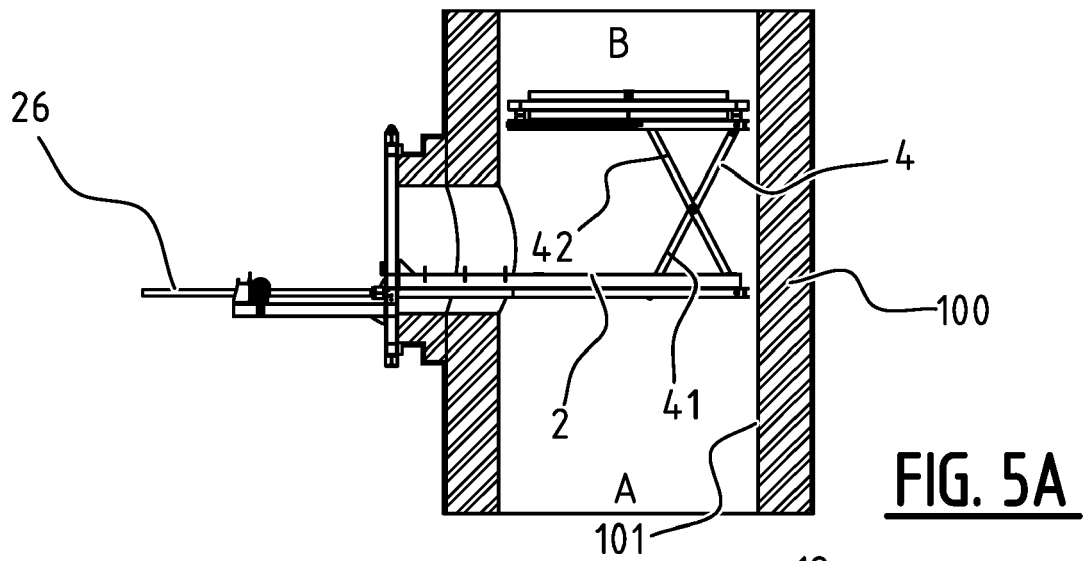


FIG. 4C



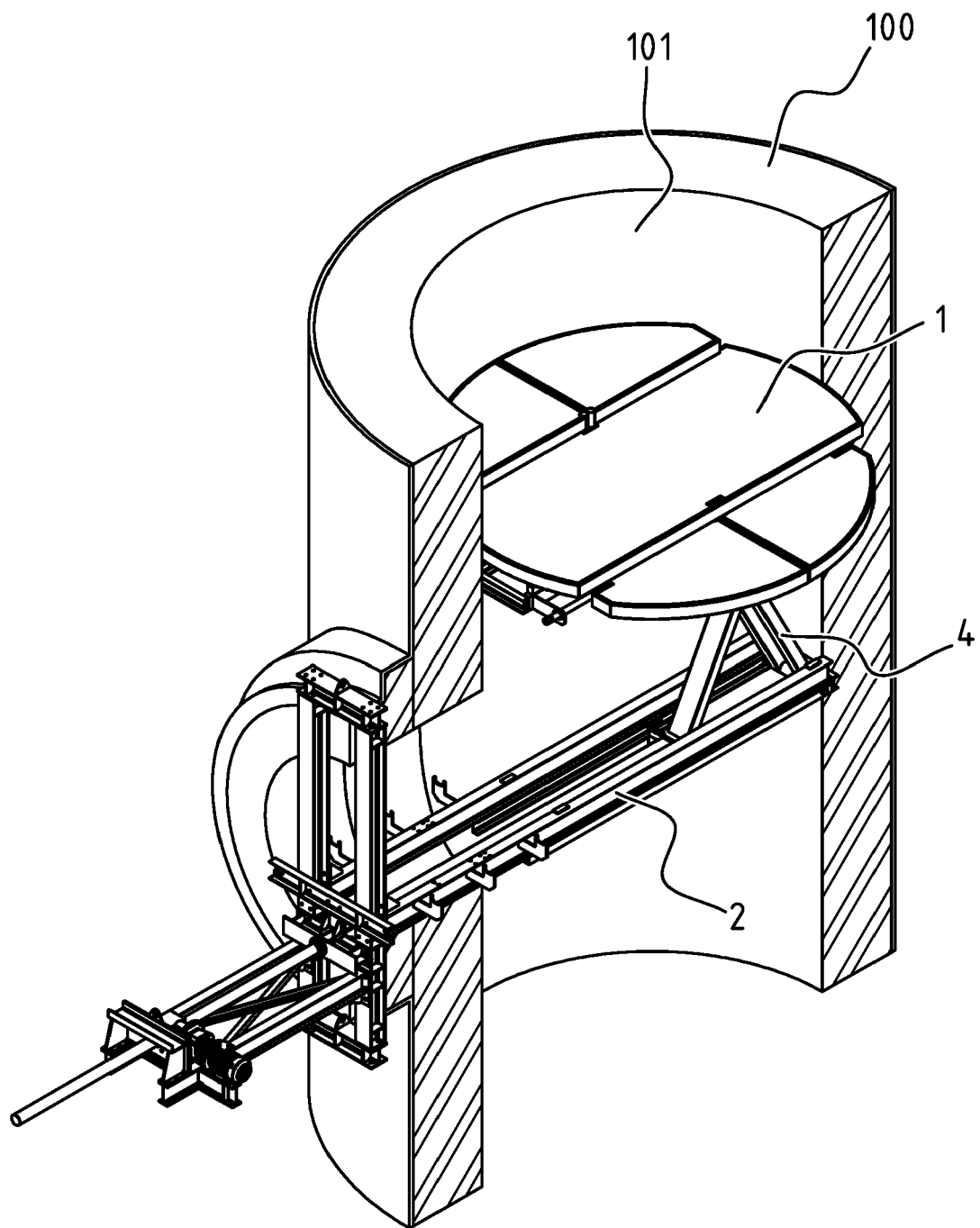


FIG. 6



EUROPEAN SEARCH REPORT

Application Number
EP 18 17 3101

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2013/050522 A1 (SIEMENS VAI METALS TECH LTD [GB]; KAPS GARETH [GB]; THOMSON JOSEPH [GB] 11 April 2013 (2013-04-11) * figures 3-6,9 * * page 1, line 3 - page 2, line 5 * -----	1-15	INV. C21B9/10 F27D1/16
			TECHNICAL FIELDS SEARCHED (IPC)
			C21B F27D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 27 July 2018	Examiner Peis, Stefano
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 18 17 3101

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

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