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(12) # EUROPEAN PATENT APPLICATION

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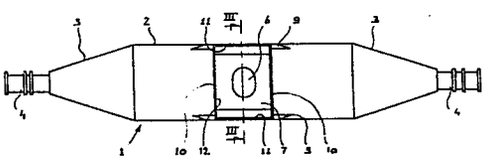
(54) **Transportable vessel for molten iron.**

(57) A transportable vessel 1 for molten iron has a cylindrical section 2 having an opening permitting access to the interior of the vessel 1. The opening is filled by a removable cover 7 held by flanges 11, 12 to flanges 9, 10 surrounding the opening in the vessel. The cover is provided with an opening 6 forming a spout. To pour molten iron from the vessel 1, the vessel is rotated about its ends 4 and the molten iron is poured from opening 6. An optional splash guard 22 may be provided over the cover 7. In this way a large opening (when the cover 7 is removed) is provided for easy access to the interior of the vessel 1 during e.g. lining replacement without weakening the vessel 1. The opening 6 in the cover may be made any suitable size to prevent excessive heat loss.



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"Transportable vessel for molten iron"

The present invention relates to a transportable vessel for molten iron, often called a torpedo car or mixer type hot metal car. Such a car is normally used for the transportation of molten pig iron between a blast furnace and a steel making plant.

A torpedo car usually consists of an elongate cylindrical vessel which is rotatably supported at its ends on wheel sets or bogies so that the vessel may be rotated about its longitudinal axis. The vessel is made of e.g. sheet steel and is lined with refractory material. The vessel is provided with a spout to enable molten pig iron to be poured into and removed from the vessel. To prevent excessive heat loss the spout must be small as possible and also must be shaped so that molten iron is not splashed or spilt onto the walls of the vessel when the molten iron is poured out of the spout.

After a period of use it usually becomes necessary to repair or replace the refractory lining. The spout is the only entrance to the interior of the vessel and it is through the spout that the old

refractory material must be demolished and removed and the new refractory material installed. The spout is usually too small to enable the necessary personnel and machinery to carry out these operations easily. The present invention therefore seeks to provide a transportable vessel for molten iron in which the vessel has a relatively large opening to enable easier access to the interior of the vessel, to simplify the removal and replacement of the refractory lining.

In UK Patent Application No. 2 041 184 there is shown a torpedo car in which removable wall sections are provided on either side of the spout. The vessel has a large aperture, the majority of which is covered by the removable wall sections so that only a part of the aperture forms the spout. The wall sections are removed for removal and replacement of the refractory lining. However, it is a disadvantage of this construction that the provision of a large aperture weakens the vessel.

The present invention seeks to provide a transportable vessel for molten iron in which a sufficiently large opening may be provided in the body of the vessel to enable lining replacement, but without weakening the walls of the vessel as occurs in the arrangement shown in GB-A-2 041 184. The

present invention proposes that an opening forming a spout for molten iron be provided in a removable cover which fits the opening in the body. When the cover is in place, the only opening in the body is that in the cover, which opening may be of any suitable size to prevent excessive heat loss. When the cover is removed, a much larger opening to the interior of the vessel is available for replacement of the lining.

The cover is mounted to flanges surrounding the opening in the body of the vessel to prevent structural weakness. Preferably this is achieved by securing the flanges around the opening to flanges bounding the cover.

In GB-A-2 041 184 the opening in the body of the vessel is approximately rectangular with a ratio of length/width of about 3. The opening in the body subtends an angle of approximately 90° at the longitudinal axis of the vessel. In the present invention the fact that the vessel is not weakened enables a larger, more square opening to be provided in the body with the opening preferably subtending an angle of approximately 120° at the longitudinal axis of the vessel.

A removable splash guard may be removably fitted over the cover, with an aperture which fits round the opening in the cover. The cover preferably extends beyond the edges of the cover at least in the longitudinal direction to prevent splashing of molten iron due to any mismatch between the dimensions of the cover and the opening in the body of the vessel.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is an elevation of an elongate vessel which forms part of a torpedo car;

Figure 2 is a side view of the vessel shown in Figure 1;

Figure 3 is a vertical transverse section through the spout of the vessel of Fig. 1;

Figure 4 is a vertical section, shown in shortened form, along the longitudinal axis of the vessel of Fig. 1;

Figure 5 shows in elevation a removable cover for the vessel of Fig. 1 with the mouth and pouring lips in it;

Figure 6 shows a transverse section along the line VI-VI in Figure 5;

Figure 7 is an elevation of the cover of Fig. 5 but now having a removable splash guard;

Figure 8 is a section through the cover incorporating the mouth and the separate splash guard fitted on that cover, along line VIII-VIII in Figure 7;

Figure 9 is a section along the line IX-IX in Figure 8; and

Figure 10 is a section along the line X-X in Figure 8.

A transportable vessel for molten iron, also known as a torpedo car or travelling type hot metal car is in the form of an elongate vessel 1, with a cylindrical central section 2, and two conical end sections 3. Each end section is provided with a pivot 4, by which the vessel may be supported on an associated bogie or wheel set (not shown). Both wheel sets or bogies are fitted with a plurality of wheels enabling the torpedo car to be moved on rails.

Drive mechanisms are fitted to one or both wheel sets or bogies so that vessel 1 may be rotated about a longitudinal axis, to enable it to be emptied, for example. The drive means comprise a motor and reduction gearing together with a speed and control panel.

The vessel is manufactured from sheet steel and, as shown in Figures 3 and 4, is lined with a refractory lining 8. The vessel shown in Figures

1 to 4 has a thickened bottom part 5. The purpose of this is both to strengthen the vessel and also to combat wear on the refractory lining which is greatest directly under the opening 6 through which molten pig iron enters and is removed from the vessel. The structure of the thickened bottom part is discussed in more detail in e.g. GB-A-1 241 507. The opening 6 which forms a spout for the molten iron is, according to the present invention provided in a removable cover 7. When this cover 7 is removed, an approximately square access opening is formed in the vessel, with sides which run parallel and perpendicular to the longitudinal axis of the vessel. This access opening is bounded by flanges 9, in the longitudinal direction of the vessel, and by curved transverse flanges 10 perpendicular to the axis. The cover 7 is reinforced round its periphery by flanges 11, parallel to the longitudinal axis of the vessel, and flanges 12 perpendicular to the axis. The longitudinal flanges 9 support the weight of the cover and are reinforced by triangular supports 14. The transverse flanges 10 are also reinforced by triangular supports 13.

The structure of the cover 7 is shown in more detail in Figures 5 and 6. The sides of the cover 7 extending parallel to the longitudinal axis

of the vessel are formed by spaced apart plates 15 and 16 which extend between longitudinal flanges 11 and a top plate 17 of the cover 7. Thus the cover has a box-shaped structure. At the middle of the cover 7, the plates 15 and 16 are approximately parallel but the inner plate 15 becomes increasingly curved towards either longitudinal end of the plate to approach the curve 19 of the walls of the vessel 1. The top plate 17 contains the opening 6 forming the spout for molten pig iron. The opening 6 is oval with its major axis perpendicular to the longitudinal axis of the vessel 1. Lips 21 are provided at the major ends of the opening 6 to guide the molten iron when it is poured from the vessel 1.

The flanges 11 of the cover 7 are secured to the flanges 9 of the vessel by means of a plurality of bolts 18. In the same way the flanges 12 are secured to flanges 10 of the vessel round the periphery of the cover 7. In order to reach the bolts 18 easily, oval fitting openings 20 are made in cover 7.

It is advantageous for the cover 7 to fit the opening in the vessel 1 as closely as possible. However, the length of the cover must be less than the distance between the transverse flanges 10 if the cover is to fit in place. Therefore, due to

engineering tolerances, the cover will normally be slightly shorter than the distance between the flanges 10 so there is a small gap between flanges 10 and 12, as shown in Figure 8. This gap is filled with filler plates.

When the flanges 11,12 of the cover 7 are secured by means of bolts to the flanges 9,10 respectively, a rigid seal for the access opening in the vessel wall is provided, which does not result in any structural weakening of the vessel. A composite splash guard 22 is then fitted over the cover, the details of which are shown in Figures 7,8,9 and 10. The splash guard 22 is provided with an aperture which fits round opening 6 and lips 21, but extends past the ends of the reinforcing supports 13 for the flanges 10, so that any gap between flanges 10 and 12 is safely covered by splash guard 22.

As shown in Figure 9, the bottom of the splash guard 23 is provided with supports 24, which support the guard above the wall 26 of the vessel. As shown in Figure 8, triangular reinforcements 27 are provided to support the splash guard 22 against the walls of the vessel.

The top plate 28 of the removable cover 7 is provided with anchors 23 to which refractory

concrete to be installed later can adhere. The top of splash guard 22 is also provided with such anchors, but these have been omitted from the Figures for simplicity. The lower edge 25 of the splash guard, which forms a support for the refractory material, is shown in Figure 10. The lower edge 25 of the splash guard 22 is provided on its inner surface with a mounting strip 29 which holds the splash guard 22 in place against longitudinal flange 9.

The angle λ which the opening subtends at the axis of the vessel 1 is shown in Figures 6 and 10. In practice, an angle λ of 120° is preferred. When splash guard 22 and cover 7 are removed, an almost square opening is formed, bounded by longitudinal flanges 9 and transverse flanges 10. This opening provides easy access to the inside of vessel 1 for personnel, tools and materials.

CLAIMS

1. A transportable vessel (1) for molten iron comprising an elongate hollow cylindrical body (2) adapted to be rotatably supported at its ends (3) and having an opening therein and a cover (7) removably secured to flanges (9,10) surrounding the opening in the body;

characterized in that:

the cover (7) substantially fills the opening in the body and has an opening (6) forming a spout for molten iron.

2. A vessel according to claim 1 wherein the cover (7) is bounded by flanges (11,12) removably secured to the flanges (9,10) surrounding the opening in the body (2).

3. A vessel according to claim 2 wherein the cover has two pairs of side walls (15,16) each pair being secured at one end to one (11) of the flanges bounding the cover (7) and at the other end to a top plate (17), with a space between the side walls (15,16) of each pair.

4. A vessel according to claim 3 wherein the pairs of side walls (15,16) extend longitudinally of the vessel.

5. A vessel according to any one of the preceding claims wherein the opening in the body (2) subtends an angle (λ) of approximately 120° at the longitudinal axis of the body (2) in a plane perpendicular to that axis.

6. A vessel according to any one of the preceding claims wherein the opening (6) in the cover is an oval with its major axis perpendicular to the longitudinal axis of the body (2), there being lips (21) at the ends of the major axis of the oval.

7. A vessel according to any one of the preceding claims having a splash guard (22) removably fitted over the cover (7).

8. A vessel according to claim 7 wherein the splash guard extends beyond the edges of the cover (7) at least in the direction longitudinally of the body (2).

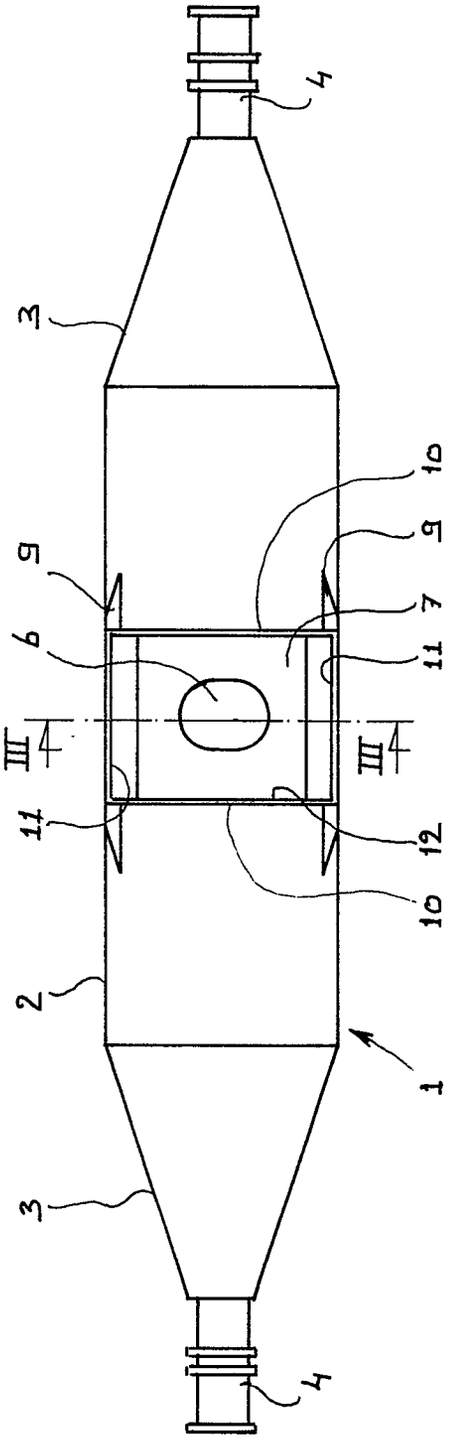

fig. 1

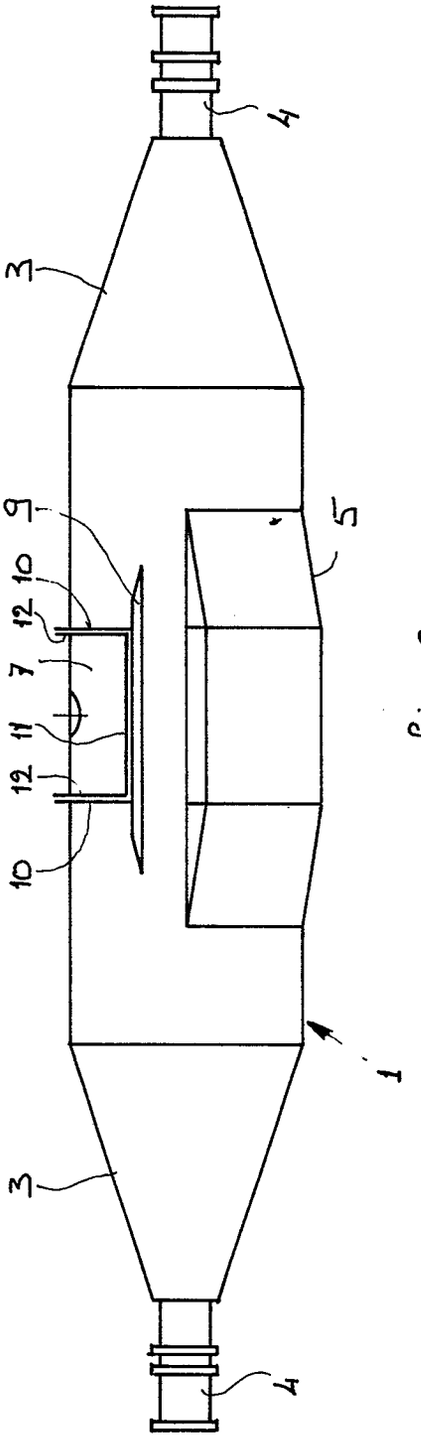

fig. 2

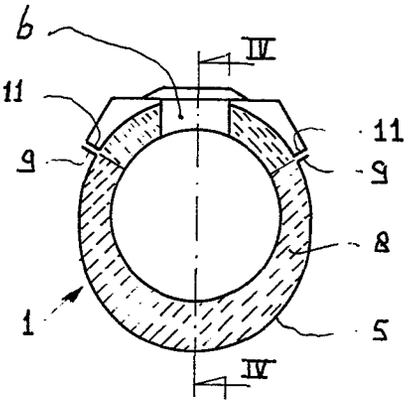

Fig. 3

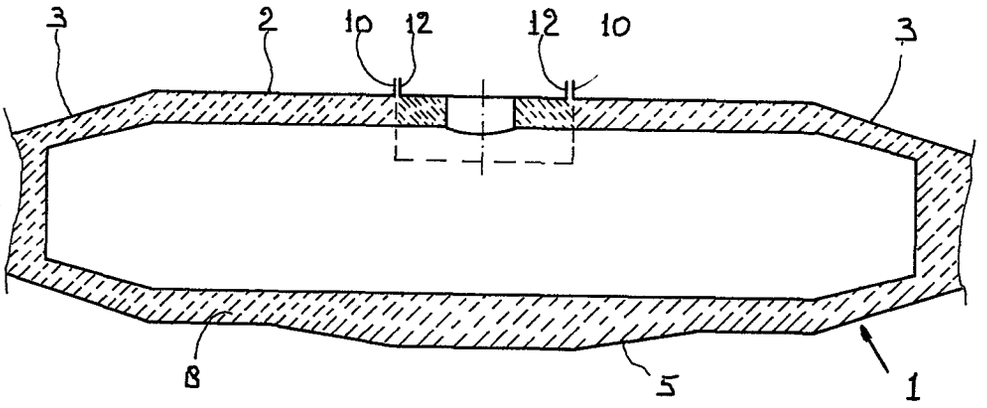

Fig 4

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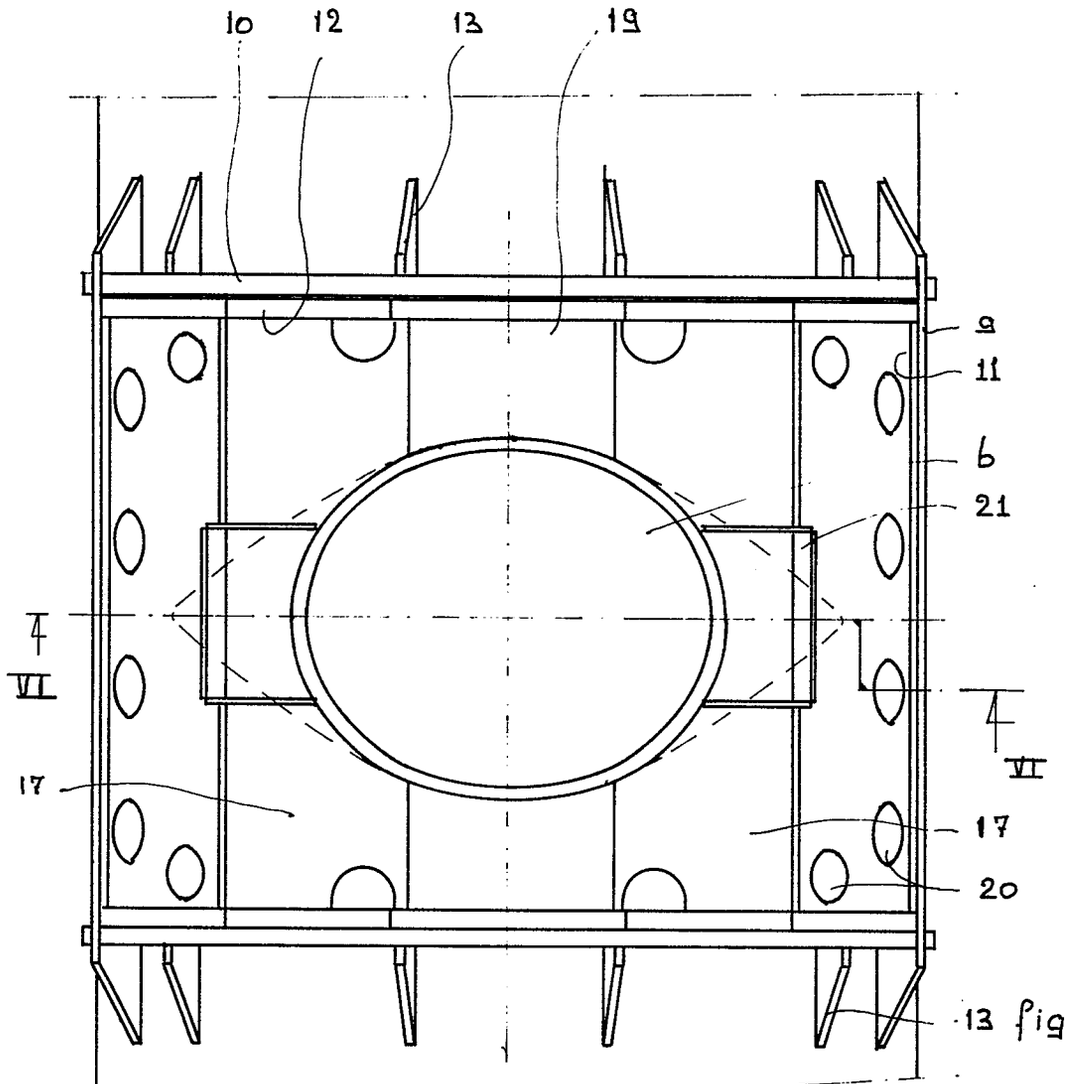

fig 5

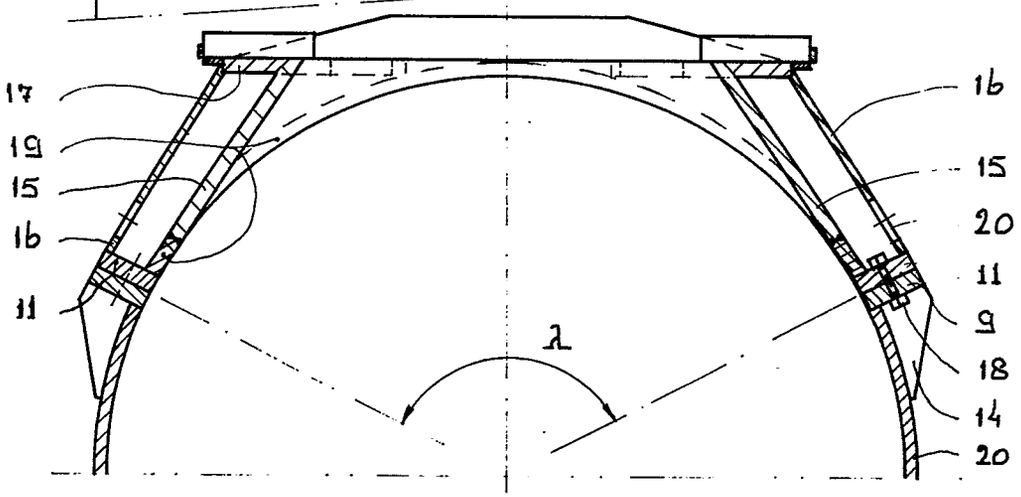

fig 6

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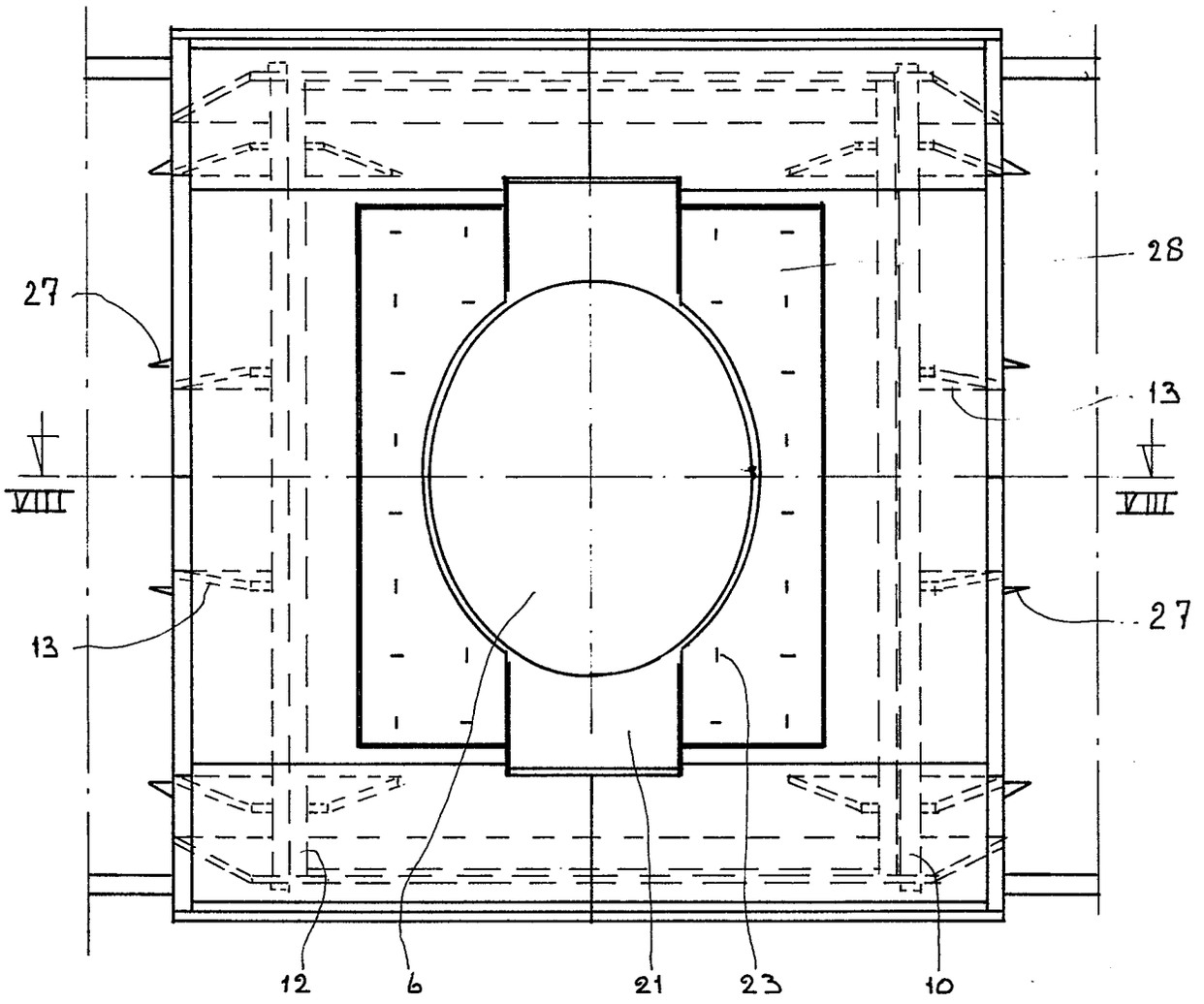

fig 7

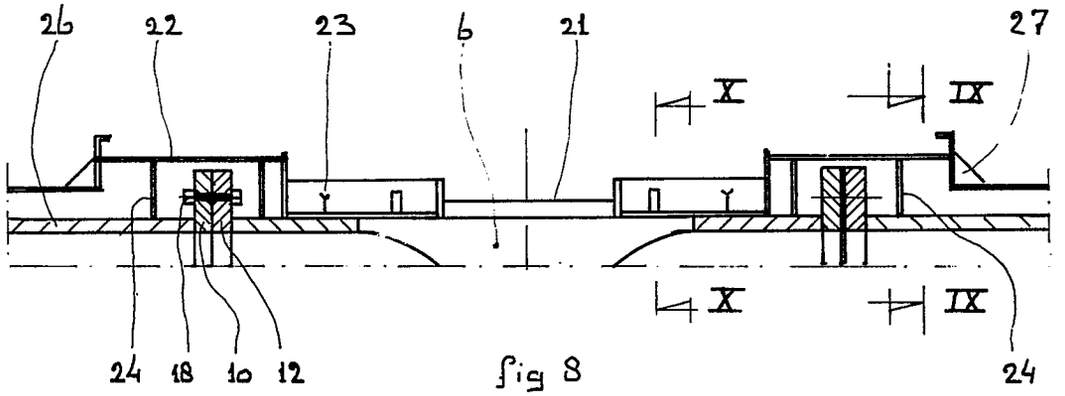

fig 8

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Fig. 9

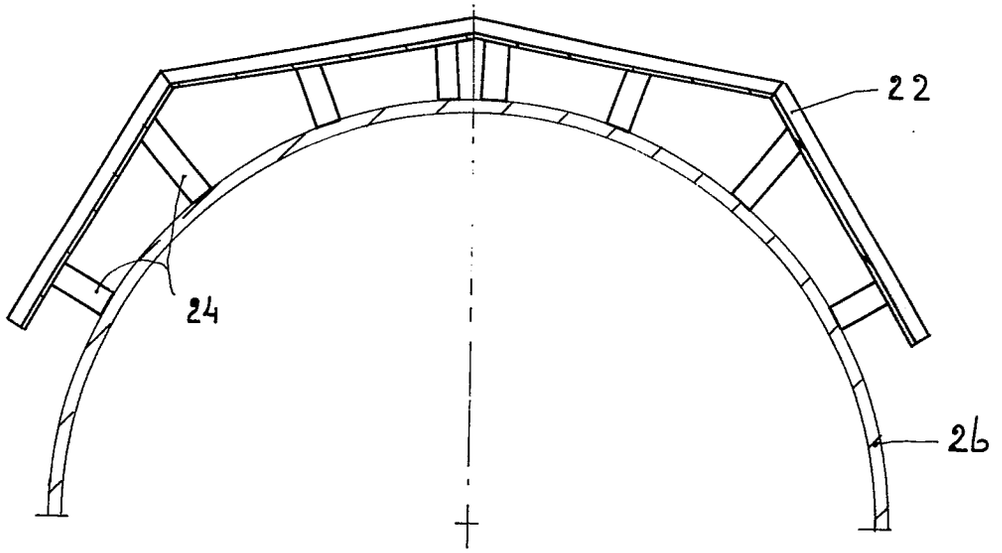
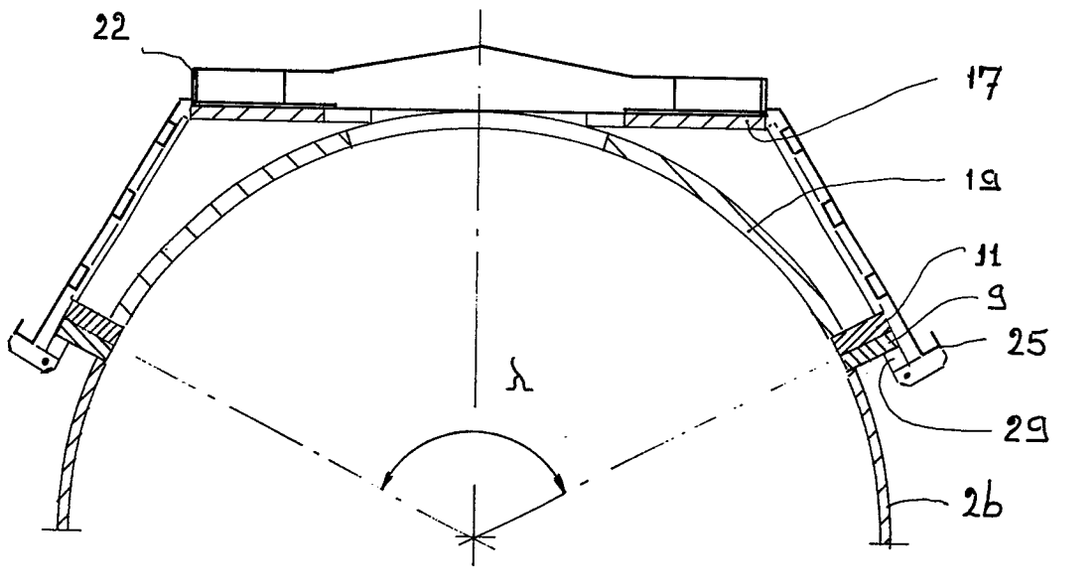


Fig. 10



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EUROPEAN SEARCH REPORT

0103313
Application number

EP 83 20 1063

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
A,D	GB-A-2 041 184 (DAVY INTERNATIONAL)		B 22 D 41/12 B 65 D 88/76
A	NL-A-6 814 343 (KONINKLIJKE NEDERLANDSCHE HOOGOVENS EN STAALFABRIKEN)		
A	US-A-3 838 650 (G. DUTKO et al.)		
A	US-A-2 341 054 (H.L. McFEATERS et al.)		
P,A	FR-A-2 505 219 (INDUSTRIAL MACHINE WORKS)		

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

B 22 D
B 65 D
C 21 C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	08-11-1983	STEIN K.K.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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