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(54) **SINTER COOLER WITH ADJUSTABLE COOLING GAS SEAL**

SINTERKÜHLER MIT EINSTELLBARER KÜHLGASDICHTUNG

DISPOSITIF POUR REFROIDIR AU GAZ DES AGGLOMÉRÉS FRITTÉS AVEC JOINT
D'ÉTANCHÉITÉ AJUSTABLE

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(56) References cited:
**EP-A1- 0 049 541 JP-A- 9 268 326
JP-A- 58 077 537 US-A- 4 238 120
US-A- 5 148 687**

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- **DATABASE WPI Week 198705 Thomson Scientific, London, GB; AN 1987-034985 XP002616489, -& JP 62 001459 B (MITSUBISHI HEAVY IND CO LTD) 13 January 1987 (1987-01-13)**
- **DATABASE WPI Week 200240 Thomson Scientific, London, GB; AN 2002-369701 XP002616556, -& KR 2001 060 851 A (POHANG IRON&STEEL CO LTD) 7 July 2001 (2001-07-07)**
- **DATABASE WPI Week 200876 Thomson Scientific, London, GB; AN 2008-M84006 XP002616555, & CN 201 032 376 Y (ZHONGYE CHANGTIAN INT ENG LTD CO) 5 March 2008 (2008-03-05)**

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Description

[0001] This invention relates to a sinter cooler for use in metallurgy, comprising a cooling-air chamber and a sinter cooling chamber including a perforated plate, which can travel over the same, and comprising a cooling gas seal between the upper surface of the cooling-air chamber and the lower surface of the sinter cooling chamber.

[0002] In such sinter coolers, external seals of cotton laminate (e.g. Laminex®), which are provided on the upper surface of rigid rubber strips, previously have been used to avoid cooling air losses. The rubber strips are arranged on adjustable angular brackets, which in turn are fixed on vertical stationary sealing plates. These seals wear relatively quickly and frequently must be re-adjusted by hand.

[0003] US 4 238 120 discloses a sinter cooler comprising a cooling-air chamber and a sintering cooling chamber and a cooling gas seal between the upper surface of the cooling-air chamber and the lower surface of the sintering cooling chamber.

[0004] It is the object of the present invention to equip a sinter cooler as mentioned above with a novel cooling gas seal, which with an improved durability safely reduces cooling air losses and hence the amount of required cooling air, without increasing the frictional resistance. This should lead to a saving of operating costs and improve the effectiveness of the cooler.

[0005] In a sinter cooler as mentioned above, this object in particular is solved in that the cooling gas seal as a stationary sealing support of the cooling-air chamber wall for sealing elements of elastomeric material carried along with the sinter cooling chamber includes a sealing strip with round, preferably circular cross-section.

[0006] "Round" in the sense of the present invention should cover all rounded, i.e. both circular and oval sealing strips, but also profiles with a substantially rectangular cross-section, which in any case on their side facing the sealing elements of the traveling sinter cooling chamber are distinctly rounded or at least beveled to reduce the contact surface with the sealing elements.

[0007] In such configuration of the cooling gas seal, dust deposits on the sealing surface are largely avoided and due to the "line contact" of the sealing elements of an elastomeric material with the stationary sealing support a high contact pressure and good tightness are achieved. As sealing strip, e.g. inexpensive commercially available metallic strand material can be used.

[0008] Preferably, the sealing strip is arranged on the upper surface of a stationary sealing plate of the cooling-air chamber wall and in particular provided to be replaceable.

[0009] In a development of the invention, it is provided that the part of the cooling gas seal carried along with the sinter cooling chamber includes sealing elements of a preferably heat-resistant elastomeric material, which are mounted with a vertical play such that they are seated

on the sealing strip and slide along the sealing strip during the travel of the sinter cooling chamber. Such seal is self-compensating, because in the case of the end-face wear of the sealing elements, the same automatically maintain their sealing function with respect to the sealing support by readjustment. In this way, the service life of the cooling gas seal is improved considerably.

[0010] To realize the self-adjusting sealing function, it is furthermore advantageous when the sealing elements are mounted in a vertically movable manner by means of a possibly weight-loaded holder and a guide pin. The weight load can provide a sufficient contact pressure of the sealing elements on the sealing strip of the stationary cooling-air chamber wall, without impairing the slidability.

[0011] For an easily replaceable assembly of the sealing elements, the guide pins can be received in possibly angular and releasable brackets of the sinter cooling chamber wall.

[0012] The respective, possibly two-part sealing element holder overlaps the associated sealing element e.g. in the manner of a framework, preferably in a roof-like manner with corresponding inclined surfaces, so that fine sinter dust easily can slip off downwards. In a development of the invention the end face of the sealing elements is formed with such a width that even in the case of lateral displacements of the traveling sinter cooling chamber they will always rest on the sealing strip.

[0013] In their lower region, the sealing elements preferably are made of a wear-resistant, creep-resistant polymer having good sliding properties, in particular of ultra-high molecular weight polyethylene, whereas in their upper region they are made of a polymer that bonds well to metal, in particular of ultra-high molecular weight polyethylene. The two polymer components should also be easily connectable with each other, e.g. by bonding or by co-extrusion.

[0014] Further developments, advantages and possible applications of the invention can be taken from the following description of an embodiment and the drawing. All features described and/or illustrated form the subject-matter of the invention per se or in any combination, also independent of their inclusion in individual claims and/or their back-reference.

[0015] In the drawing:

Fig. 1 shows a vertical section of a sinter cooler including the invention, and

Fig. 2 shows a slightly enlarged segment of such sinter cooler in a side view.

[0016] The embodiment of a sinter cooler including the invention as shown in the Figures is part of a sintering plant for use in metallurgy. It serves to cool the lumpy sintered ore to be supplied to a blast furnace by means of cooling air and to supply the recovered thermal energy of the hot waste air for example to another load.

[0017] The sinter cooler has a cooling-air chamber 1

and a sinter cooling chamber 3 for the hot sinter material accommodated therein, which for example by means of bogie wheels 9 can travel over the same on a rail track 17, 19 and includes a perforated or slotted plate 2 for the supply of cooling air. To minimize a loss of cooling air, a cooling gas seal 4 is provided between the upper surface of the cooling-air chamber 1 and the lower surface of the sinter cooling chamber 3. The upper portion of the cooling-air chamber wall 7 is formed by stationary sealing plates 18 on whose upper surface a sealing strip 5 with round, preferably circular cross-section is arranged as a stationary sealing support.

[0018] The part of the cooling gas seal 4 carried along with the sinter cooling chamber 3 includes sealing elements 6 of an elastomeric material. The sealing elements 6 are mounted with a vertical play such that they are seated on the upper surface of the sealing strip 5 substantially round in cross-section of the stationary vertical cooling-air chamber wall 7, and during travel of the sinter cooling chamber 3 slide along the sealing strip 5.

[0019] The sealing elements 6 are arranged behind a protective side wall 8 of the sinter cooling chamber 3 such that they are protected against sinter dust and heat. The sealing elements 6 are mounted in a vertically movable manner by means of a possibly weight-loaded holder 12 and a guide pin 10, so that they can compensate a possible wear by automatic readjustment. The upper head 21 of the guide pin 10 forms a stop when the sealing elements 6 have reached their maximum of admissible wear. In the illustrated embodiment, the guide pins 10 are received in angular, possibly releasable brackets 11 in a vertically movable manner, wherein the through holes through which the guide pins 10 are passed are large enough to provide for freely shifting the sealing elements 6 with respect to the sealing strip 5. The holders 12 overlap the associated sealing element 6 in a roof-like manner by forming corresponding inclined surfaces, so that sinter dust obtained is easily discharged downwards.

[0020] The end face 16 of the respective sealing elements 6 is formed with such a width that it will always rest on the sealing strip 5, even in the case of a lateral displacement of the traveling sinter cooling chamber 3 by e.g. ± 25 mm. Preferably, the end faces 16 have a width of about 4 to 12 cm.

[0021] For further improvement of a permanent operability of the cooling gas seal 4, the sealing elements 6 can be formed in their lower region of another wear-resistant, creep-resistant polymer having good sliding properties and in their upper region of a polymer that bonds well to metal. Furthermore, the polymers expediently should be selected such that they can easily be connected with each other, e.g. by bonding or by co-extrusion. It is, however, less expensive to use only one single material for the sealing elements. Preferably, ultra-

List of Reference Numerals:

[0022]

- | | | |
|----|----|----------------------------------|
| 5 | 1 | cooling-air chamber |
| | 2 | perforated plate |
| | 3 | sinter cooling chamber |
| | 4 | cooling gas seal |
| | 5 | sealing strip |
| 10 | 6 | sealing elements |
| | 7 | cooling-air chamber wall |
| | 8 | protective side wall |
| | 9 | bogie wheels |
| | 10 | guide pins |
| 15 | 11 | bracket |
| | 12 | holder |
| | 14 | sinter cooling chamber wall |
| | 16 | end face |
| | 17 | rail base |
| 20 | 18 | stationary sealing plates |
| | 19 | rails for sinter cooling chamber |
| | 20 | stationary sealing elements |
| | 21 | head |

Claims

1. A sinter cooler of a sintering plant for use in metallurgy, comprising a cooling-air chamber (1) and a sinter cooling chamber (3) including a perforated plate (2), which can travel over the same, and comprising a cooling gas seal (4) between the upper surface of the cooling-air chamber (1) and the lower surface of the sinter cooling chamber (3), **characterized in that** the cooling gas seal (4) as stationary sealing support of the cooling-air chamber wall (7) for sealing elements (6) of an elastomeric material carried along with the sinter cooling chamber (3) includes a sealing strip (5) with substantially round, preferably circular cross-section.
2. The sinter cooler according to claim 1, **characterized in that** the sealing strip (5) is arranged on the upper surface of a stationary sealing plate (18) of the cooling-air chamber wall (7).
3. The sinter cooler according to claim 1 or 2, **characterized in that** the part of the cooling gas seal (4) carried along with the sinter cooling chamber (3) includes sealing elements (6) of an elastomeric material, which are mounted with a vertical play such that they are seated on the sealing strip (5) and during travel of the sinter cooling chamber (3) slide along the sealing strip (5).
4. The sinter cooler according to any of the preceding claims, **characterized in that** the sealing elements (6) are mounted in a vertically movable manner by

means of a possibly weight-loaded holder (12) and a guide pin (10).

5. The sinter cooler according to any of the preceding claims, **characterized in that** the guide pins (10) are received in possibly angular brackets (11) on the sinter cooling chamber wall (14). 5
6. The sinter cooler according to any of the preceding claims, **characterized in that** the respective sealing element holder (12) overlaps the associated sealing element (6) in a roof-like manner with corresponding inclined surfaces. 10
7. The sinter cooler according to any of the preceding claims, **characterized in that** the end face (16) of the sealing elements (6) is formed with such a width that they will always rest on the sealing strip (5) even in the case of lateral displacements of the traveling sinter cooling chamber (3). 15
8. The sinter cooler according to any of the preceding claims, **characterized in that** in their lower region the sealing elements (6) are made of a wear-resistant, creep-resistant polymer having good sliding properties. 20
9. The sinter cooler according to any of the preceding claims, **characterized in that** in their upper region the sealing elements (6) are made of a polymer that bonds well to metal. 25

Patentansprüche

1. Sinterkühler einer Sinteranlage für den Einsatz in der Metallurgie, mit einer Kühlluftkammer (1) und einer über diese verfahrbaren, einen Lochboden (2) aufweisenden Sinterkühlkammer (3) sowie mit einer Kühlgasabdichtung (4) zwischen der Oberseite der Kühlluftkammer (1) und der Unterseite der Sinterkühlkammer (3), **dadurch gekennzeichnet, dass** die Kühlgasabdichtung (4) als stationäres Dichtauflager der Kühlluftkammerwand (7) für mit der Sinterkühlkammer (3) mitgeführte Dichtelemente (6) aus elastomerem Material eine Dichtleiste (5) mit im Wesentlichen rundem, vorzugsweise kreisrundem Querschnitt aufweist. 35
2. Sinterkühler nach Anspruch 1, **dadurch gekennzeichnet, dass** die Dichtleiste (5) auf der Oberseite einer stationären Dichtplatte (18) der Kühlluftkammerwand (7) angeordnet ist. 40
3. Sinterkühler nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der mit der Sinterkühlkammer (3) mitgeführte Teil der Kühlgasabdichtung (4) Dichtelemente (6) aus elastomerem Material aufweist, 45

welche so mit vertikalem Spiel gelagert sind, dass sie auf der Dichtleiste (5) aufsitzen und beim Verfahren der Sinterkühlkammer (3) auf der Dichtleiste (5) entlang gleiten.

4. Sinterkühler nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Dichtelemente (6) mittels eines ggf. gewichtbelasteten Halters (12) und eines Führungsbolzens (10) höhenverschieblich gelagert sind. 50
5. Sinterkühler nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Führungsbolzen (10) in ggf. winkelförmigen Trägern (11) an der Sinterkühlkammerwand (14) aufgenommen sind. 55
6. Sinterkühler nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der jeweilige Dichtelementhalter (12) das zugehörige Dichtelement (6) dachartig mit entsprechenden Schrägflächen übergreift.
7. Sinterkühler nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Stirnfläche (16) der Dichtelemente (6) so breit ausgebildet ist, dass sie auch bei seitlichen Ausweichungen der fahrenden Sinterkühlkammer (3) immer auf der Dichtleiste (5) aufliegen.
8. Sinterkühler nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Dichtelemente (6) in ihrem unteren Bereich aus einem verschleißfesten, kriechfesten und gute Gleiteigenschaften aufweisenden Polymer bestehen. 35
9. Sinterkühler nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Dichtelemente (6) in ihrem oberen Bereich aus einem mit Metall gut verbindbaren Polymer bestehen. 40

Revendications

1. Refroidisseur de métal fritté d'une unité de frittage destiné à être utilisé dans la métallurgie, comportant une chambre d'air de refroidissement (1) et une chambre de refroidissement de métal fritté (3) comprenant une plaque perforée (2), qui peut se déplacer sur celle-ci, et comportant un joint étanche au gaz de refroidissement (4) entre la surface supérieure de la chambre d'air de refroidissement (1) et la surface inférieure de la chambre de refroidissement de métal fritté (3), **caractérisé en ce que** le joint étanche au gaz de refroidissement (4) en tant que support d'étanchéité stationnaire de la paroi (7) de la chambre d'air de refroidissement pour les éléments d'étanchéité (6) en un matériau élastomère 45

transporté conjointement avec la chambre de refroidissement de métal fritté (3) comprend une bande d'étanchéité (5) avec une section transversale sensiblement arrondie, de préférence circulaire.

2. Refroidisseur de métal fritté selon la revendication 1, **caractérisé en ce que** la bande d'étanchéité (5) est disposée sur la surface supérieure d'une plaque d'étanchéité stationnaire (18) de la paroi (7) de chambre d'air de refroidissement. 10
3. Refroidisseur de métal fritté selon la revendication 1 ou 2, **caractérisé en ce que** la partie du joint étanche au gaz de refroidissement (4) transportée avec la chambre de refroidissement de métal fritté (3) comprend des éléments d'étanchéité (6) d'un matériau élastomère, qui sont montés avec un jeu vertical de telle sorte qu'ils reposent sur la bande d'étanchéité (5) et durant le déplacement de la chambre de refroidissement de métal fritté (3) coulissent le long de la bande d'étanchéité (5). 15 20
4. Refroidisseur de métal fritté selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les éléments d'étanchéité (6) sont montés de manière verticalement mobile au moyen d'un support éventuellement lesté (12) et d'une broche de guidage (10). 25
5. Refroidisseur de métal fritté selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les broches de guidage (10) sont reçues dans des fixations éventuellement angulaires (11) sur la paroi (14) de la chambre de refroidissement de métal fritté. 30 35
6. Refroidisseur de métal fritté selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le support d'élément d'étanchéité respectif (12) chevauche l'élément d'étanchéité associé (6) de manière similaire à un toit avec les surfaces inclinées correspondantes. 40
7. Refroidisseur de métal fritté selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la face terminale (16) des éléments d'étanchéité (6) est formée avec une largeur telle qu'ils reposent toujours sur la bande d'étanchéité (5) même dans le cas de déplacements latéraux de la chambre de refroidissement de métal fritté (3) se déplaçant. 45 50
8. Refroidisseur de métal fritté selon l'une quelconque des revendications précédentes, **caractérisé en ce que** dans leur région inférieure les éléments d'étanchéité (6) sont constitués d'un polymère résistant à l'usure et résistant au fluage ayant de bonnes propriétés de glissement. 55

9. Refroidisseur de métal fritté selon l'une quelconque des revendications précédentes, **caractérisé en ce que** dans leur région supérieure les éléments d'étanchéité (6) sont constitués d'un polymère qui se lie bien au métal.

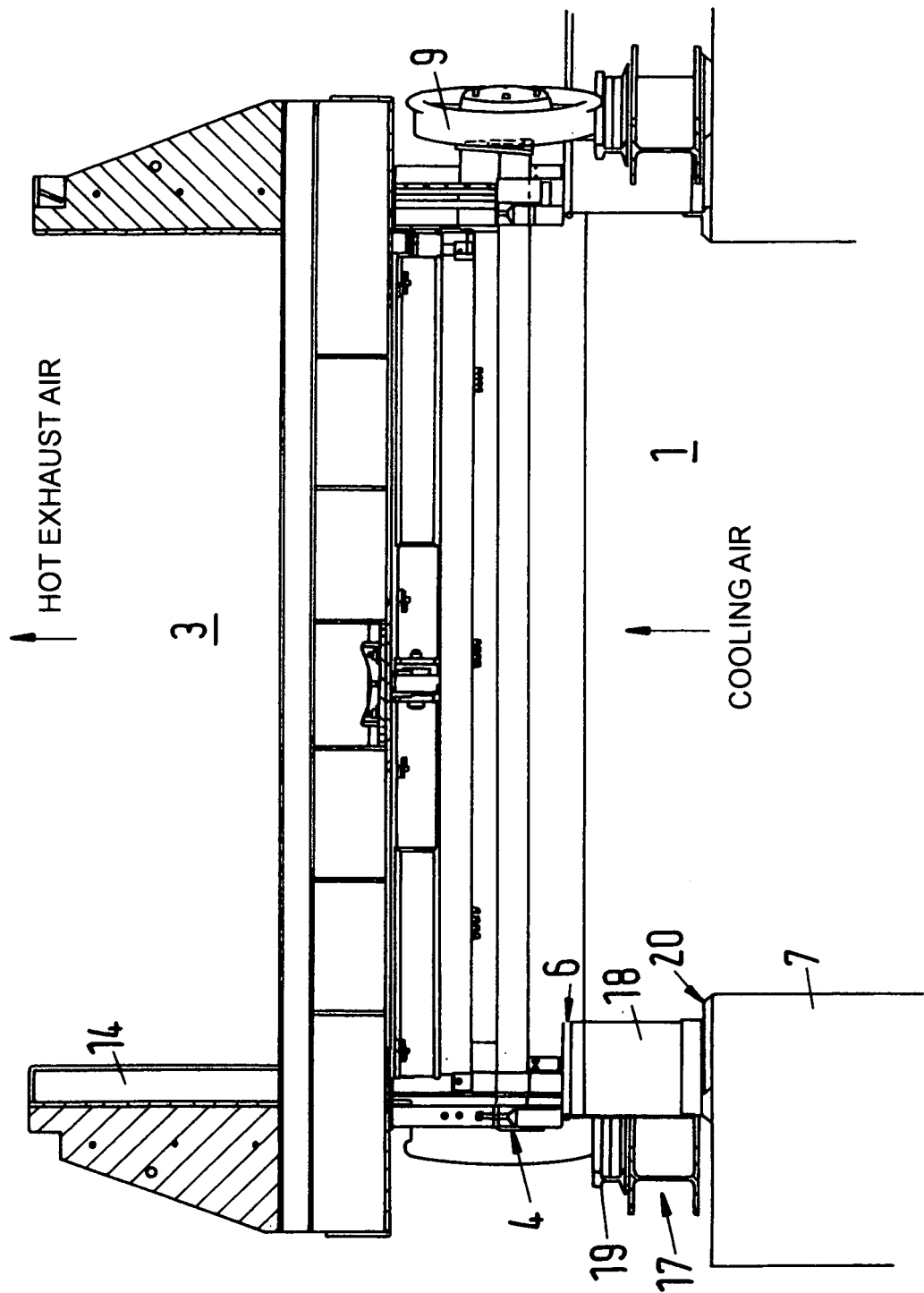


Fig.1

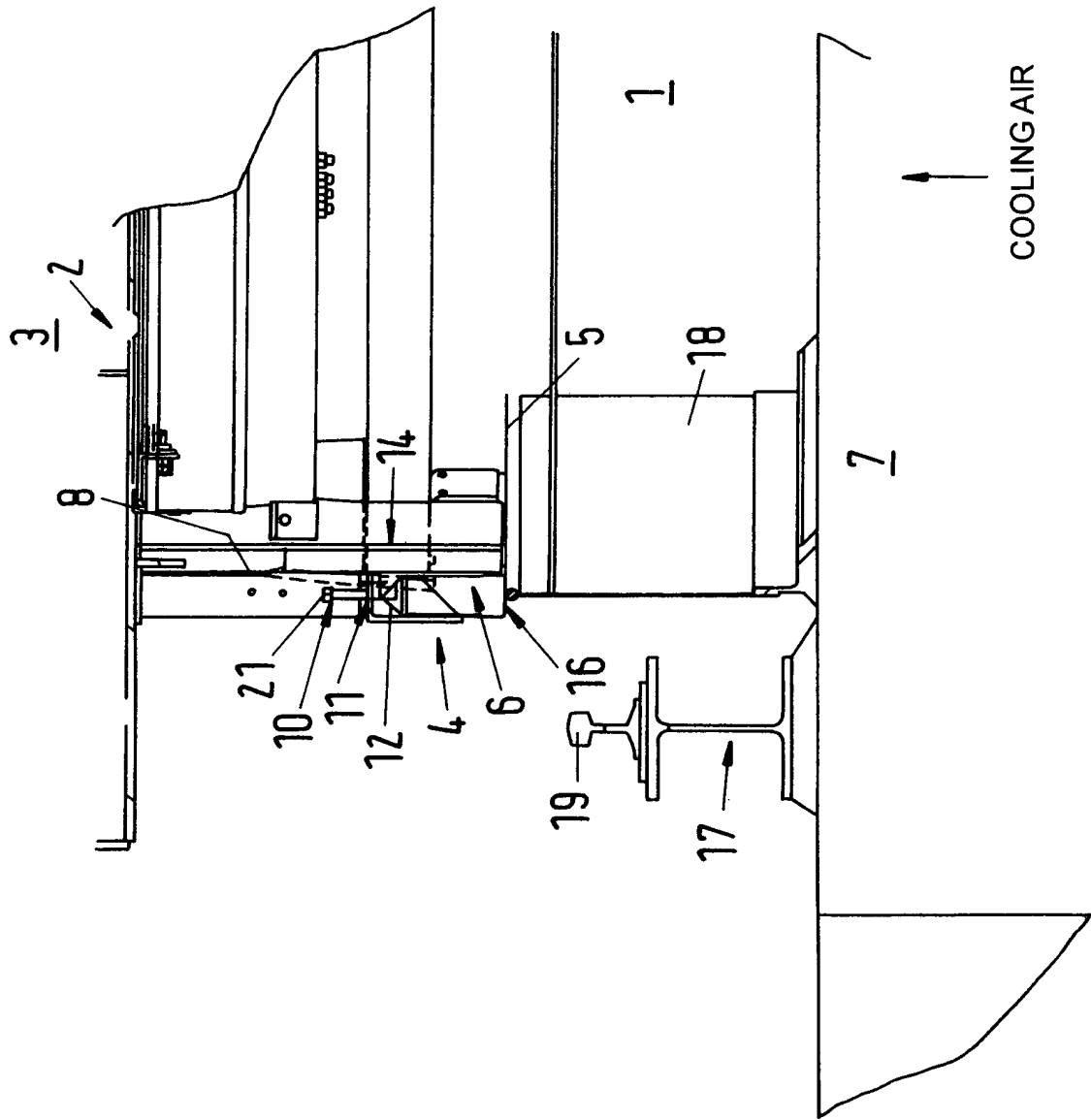


Fig.2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4238120 A [0003]