(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
10 June 2010 (10.06.2010)

PCT

(10) International Publication Number
WO 2010/063431 A1

(51) International Patent Classification:
B22D 11/10 (2006.01) *B22D 41/08* (2006.01)
B22D 41/00 (2006.01)

(21) International Application Number:
PCT/EP2009/008512

(22) International Filing Date:
30 November 2009 (30.11.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
08170497.5 2 December 2008 (02.12.2008) EP

(71) Applicant *(for all designated States except US)*: **FOSECO INTERNATIONAL LTD.** [GB/GB]; 2 Midland Way, Central Park, Barlborough Links S43 4XA Barlborough (GB).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **WAGNER, Thomas** [DE/DE]; Vesuvius GmbH, Gelsenkirchener Str. 10, 46325 Borken (DE). **LANGNER, Karsten** [DE/DE]; Dannenbaumstr. 40, 44803 Bochum (DE).

(74) Agent: **DEBLED, Thierry**; Vesuvius Group S.A., Intellectual Property Department, rue de Douvrain, 17, B-7011 Ghlin (BE).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
— *of inventorship (Rule 4.17(iv))*

Published:
— *with international search report (Art. 21(3))*

(54) Title: TUNDISH IMPACT PAD

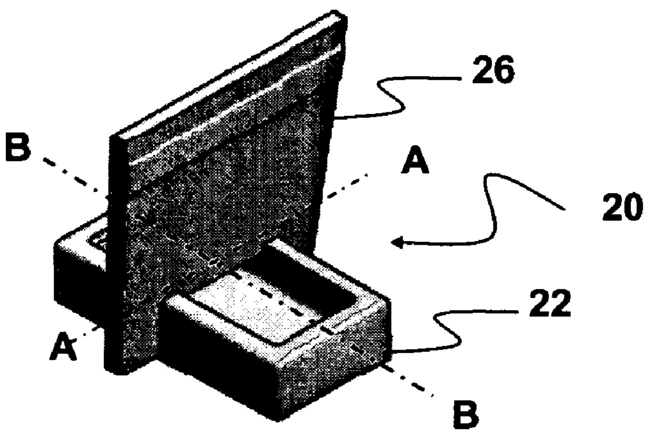

Fig. 5

(57) **Abstract**: The invention relates to an impact pad (20), for use in a T-shaped tundish (10), the pad (20) comprising a base (21) having an impact surface and an outer side wall (22) extending upwardly therefrom and defining an interior space having an upper opening (24) for receiving a stream of molten metal, the interior space is divided into two regions (25a, 25b) by a separating wall (26) provided with at least one passageway (27) for the molten metal stream. This pad is characterized in that the separating wall (26) is at least three times higher than the outer side wall (22) and is inclined with respect to the vertical. This impact pads increases the homogeneity of the molten steel cast from the different outlets of the T-shaped tundish and provides equal or relatively similar residence times of the molten steel discharged through the different outlets of the tundish. This impact pad also permits a fast transition of the steel quality at ladle change while retaining the advantages of conventional impact pads (low level of slag emulsification).

WO 2010/063431 A1

Tundish impact pad.

[0001] The present invention generally relates to the continuous casting of molten metal and in particular to the continuous casting of molten steel. In particular, the present invention relates to tundish vessels and, more particularly, to tundish impact pads designed to inhibit or reduce turbulent flow of molten metal within the tundish.

[0002] A process for the continuous casting of molten metal is well known in the art. This process will now be described with reference to steel, but it is to be understood that the present invention is not limited to the continuous casting of molten steel. In particular, the present invention can also be used with other alloys or molten metals such as iron or even non-ferrous metals. In this known process, molten steel is poured into a transport ladle that conveys the molten metal to the casting apparatus. The ladle is provided with a discharge orifice in its bottom wall. Generally a sliding gate arranged just below the discharge orifice is used to control the flow of molten steel towards a tundish. To prevent the oxidation of the molten steel discharged from the ladle into the tundish, a ladle shroud is generally connected to the sliding gate to transfer the molten steel sheltered from the surrounding atmosphere. The bottom end of the ladle shroud is normally immersed into the tundish steel bath.

[0003] The tundish is an intermediate metallurgical vessel receiving the molten steel discharged from the pouring ladle. In turn, the tundish distributes the molten steel into one or more casting molds arranged below the tundish. The tundish is used for separating slags and other contaminants from the molten steel. The molten steel flows along the tundish toward one or more outlets discharging the molten steel into the said one or more casting molds. The length of the tundish is selected to provide a time of residence of the metal in the tundish sufficient to allow separation of the inclusions as a floating slag layer. The flow of molten steel discharged from the tundish is generally controlled, most often with a stopper, and, as for the steel discharged from the ladle, is generally shrouded with a nozzle conveying the molten steel from the tundish into the casting mold.

[0004] The present invention is of particular value for a specific tundish design wherein the molten steel stream is introduced into the tundish in a pour area consisting in a side extension of the tundish main body. This side extension is in fluid connection with the tundish main body. Such a tundish is often called T-shaped tundish (when viewed in plan, the cross-bar or top of the "T" corresponds to the main body of the tundish and so is of greater length than the tail or vertical of the "T"). The area inside the tundish in the region of the tail of the "T" (the side extension) is usually the pour area where molten steel is introduced into the tundish. This region, therefore, normally has a special erosion-resistant impact pad on the floor. In a variant of the T-shaped tundish (sometime called h-shaped tundish), the tail or pour area is arranged obliquely (or even parallel) with respect to the tundish main body. In the context of the present invention, any such tundish will be designated as T-shaped tundish.

[0005] This type of tundish is generally provided with an even number of outlets which are symmetrically arranged in the bottom floor of the tundish with respect to the tundish center. For example, in the case of a bloom caster, four to six outlets are generally provided in the tundish floor.

[0006] One significant problem often encountered with this type of tundish is the difference of flow velocity of the streams discharged from the different outlets. In other words, the residence time of the molten steel in the tundish is significantly longer for the outlets further away from the tundish center than for the outlets which are closer to the tundish center. In turn, this gives rise to steel quality problems and more particularly to a significant difference of quality between the steel discharged from the different outlets.

[0007] Another problem is the speed of the transition at ladle change. Indeed, due to the different velocities of the streams discharged through the different outlets, the transition is much longer for the outer streams than for the center streams.

[0008] Pouring pads placed within tundishes have been widely used to prevent damage to the working and safety linings of a tundish by the force of the incoming stream of molten metal. The kinetic energy of the incoming stream of molten metal also creates turbulence which can spread throughout the tundish if the flow of molten metal is not properly controlled. Many times, this turbulence has a detrimental effect on the quality of cast products formed from metal taken from the tundish. More specifically, turbulent flow and high velocity flow within the tundish can, for example, have the following harmful effects:

- 1. excessive turbulence can disturb the steel surface and promote emulsification of the slag at ladle changes or during operation of the tundish with a relatively low level of molten metal;
- 2. high velocities produced by turbulent flow in the pouring area can cause erosion of the working lining of the tundish which is typically comprised of a refractory material having a much lower density than impact pads;
- 3. highly turbulent flow within the tundish can impede the separation of inclusions, especially inclusions less than 50 microns in size, due to the fluctuating nature of such turbulent flows;
- 4. high speed flows may also increase the possibility of slag being directed into a mold through increased vortexing of the molten metal in the tundish which draws slag downwardly toward the outlet;
- 5. turbulent flow within the tundish may result in disturbance of the slag/metal interface near the top of the metal bath and thereby promote slag entrainment as well as the possibility of opening up an "eye" or space within the slag layer which can be a source of reoxidation of the molten metal;
- 6. high levels of turbulence in the tundish can be carried down into the pouring stream between the tundish and the mold. This can cause "bugging" and "flaring" of the pouring stream which thereby lead to casting difficulties;
- 7. high velocity flow in the tundish has also been attributed to a condition known as "short circuiting". Short circuiting refers to the short path a stream of molten metal may take from the ladle to the impact pad to the nearest outlet in the tundish. This is undesirable since it reduces

the amount of time inclusions have to be dissipated within the bath. Instead, the high velocity flow sweeps relatively large inclusions down into the mold where they reduce the quality of the cast products.

[0009] A typical flat impact pad causes an incoming ladle stream to impact the top of the pad and travel quickly to the side or end walls of the tundish. When the stream reaches the side and/or end walls, it rebounds upward to the surface of the tundish where it changes direction toward the center of the tundish or, in other words, toward the incoming ladle stream. This creates undesirable inwardly directed circular flows in the tundish. The opposing flows on either side or end of the tundish travel toward the center of the tundish and carry with them slag or other impurities that have floated to the surface of the bath within the tundish. As a result, these impurities are drawn toward the incoming ladle stream and are then forced downwardly into the bath and toward the outlets of the tundish. This tends to cause more of these impurities to exit the tundish into the molds thereby decreasing the quality of the products produced within the molds. In addition, it has been observed that for T-shaped tundish, flat impact pads cause far too short residence time of the molten steel in the tundish so that the tundish cannot fulfils properly its function.

[0010] While numerous types of tundish pads have been proposed and used in the past, none of these fully address all of the problems noted above for T-shaped tundish. Examples of prior tundish pads are disclosed in the following European patents or patent applications: EP-B1-729393, EP-B1-790873, EP-B1-847313, EP-B1-894035, EP-B1-1198315, EP-B1-1490192 and EP-A1-1397221. In particular, even though the residence time of the steel in the tundish is significantly increased, short-circuiting is observed and the steel discharged through the center outlets is significantly faster than the other steel streams.

[0011] Therefore, an object of the present invention is to improve the quality of molten steel cast from a T-shaped tundishes and, in particular, to increase the homogeneity of the molten steel cast from the different outlets of a T-shaped tundish (quality at steady state). Another object of the present invention is to permit an improved control of the steel streams velocities in the tundish so as to provide equal or relatively similar residence times of the molten steel discharged through the different outlets of the T-shaped tundish. Yet another object is to permit a fast transition of the steel quality at ladle change. In particular, it would be desirable that the transition in steel quality occurs in a very short period of time amongst the different strands. It would also be desirable to provide these advantages while keeping the advantages of the conventional impact pads (low level of slag emulsification).

[0012] According to the invention, there is provided an impact pad as defined in claim 1.

[0013] EP-A1-847820 discloses an impact pad according to the preamble of claim 1. This impact pad is intended to be used in a conventional tundish with a raised portion. The molten steel is poured in a first region of the impact pad and flows towards a second region of the pad through an opening in a wall separating the two regions. Then, the molten metal flows back towards the first region by running over the separating wall. Thereby, the stream energy is dissipated. The separating wall is straight and at most as high as the outer side wall. There is no indication that such an impact pad could be modified or that it could be used in a T-shaped tundish.

[0014] It has been observed that the impact pad according to the invention solves most of the above mentioned problems. In particular, high quality at steady state, fast transition and low slag emulsification have been observed with this impact pad. Further, the impact pad according to the invention provides a better thermal stratification. This is because of the much faster flow to the outer strands compared to other impact pads.

[0015] According to the invention, the separating wall extends upwardly above the height of the outer wall of the impact pad by at least three times, preferably by at least four times. According to a preferred embodiment, the separating wall extends upwardly at least up to a height corresponding to the height of the molten metal level in the tundish. In this case, it is preferable to provide the upper portion of the wall with a thickened portion about the level of molten metal in the tundish so as to increase the slag resistance of the separating wall. This thickened portion will be located in the upper half, preferably, the upper quarter of the separating wall.

[0016] The separating wall is inclined with respect to the vertical, preferably of an angle corresponding to the inclination of the tundish walls in the main body of the tundish. Thereby, the operator can easily provide a tight joint between the separating wall and the tundish walls during the tundish set up. Typical angles range from 1 to 15°, say 6°.

[0017] According to another preferred variant, the separating wall has a width corresponding to the width of the tail of the tundish in the region of the junction between the main body and the tail of the tundish.

[0018] According to an extremely advantageous embodiment of the present invention, the separating wall extends upwardly at least up to a height corresponding to the height of the molten metal level in the tundish and the separating wall has a width corresponding to the width of the tail of the tundish in the region of the junction between the main body and the tail of the tundish. Thereby, the separating wall divides the tundish into a tail and a main body communicating mainly through the passageway of the separating wall.

[0019] It is to be understood that the passageway in the separating wall should preferably constitute the main passageway for the passage of molten metal from the tail towards the main body of the tundish. Nevertheless, the passage of a limited quantity (say less than 20%) of molten metal around or above the separating wall would also provide beneficial effects.

[0020] The base, outer wall and separating wall can be integral but, in order to facilitate the transportation and assembly, it is preferable to provide separately the separating wall on the one hand and the base and outer wall on the other hand. In this case, it is advantageous to provide the separating wall with at least one slot adapted for engagement with a corresponding portion of the outer wall. Similarly, the outer wall can be provided with at least one slot adapted for receiving at least a corresponding portion of the separating wall. In a variant, both the outer wall and the separating wall are provided with a slot adapted for engagement with a corresponding portion respectively of the separating wall and outer wall.

[0021] When the separating wall on the one hand and the base and outer wall on the other hand are provided separately, it might be advantageous to provide the base and outer wall component with at least one inclined slot adapted for receiving at least a corresponding portion of a separating wall.

[0022] According to another of its object, the invention relates to the assembly of a T-shaped tundish comprising a main body and a tail with an impact pad as above described wherein the impact pad has a separating wall extending upwardly at least up to a height corresponding to the height of the molten metal level in the tundish and having a width corresponding to the width of the tail of the tundish in the region of the junction between the main body and the tail of the tundish, the separating wall dividing the tundish into a tail and a main body communicating mainly through the passageway of the separating wall.

[0023] The invention will now be described on the basis of the accompanying figures, wherein:

Fig. 1 shows a top view of a T-shaped tundish;

Fig. 2 shows a cross-section of the tundish of Fig. 1;

Fig. 3 depicts the minimum residence time in the tundish for each strand at steady state;

Fig. 4 depicts the transition time in the tundish for each strand at ladle change;

Fig. 5 shows a perspective view of the impact pad according to the invention;

Fig. 6 shows a cross-section of the impact pad of Fig. 5 according to the direction A-A;

Fig. 7 shows a cross-section of the impact pad of Fig. 5 according to the direction B-B;

Fig. 8 shows a top view of an assembly according to the invention and

Fig. 9 shows a cross-section of the assembly of Fig. 8.

[0024] Fig. 1 and 2 show a conventional T-shaped tundish 10 comprising a main body 11 and a tail 12. The molten steel stream is discharged into the tail 12 of the tundish 10 from a ladle (not shown) through a ladle shroud 17. The tundish 10 is provided with four outlets (13-16) which are symmetrically arranged in the bottom floor of the tundish. The two outlets 14 and 15 are closer to the ladle shroud 17 and thus, closer to the incoming stream. The molten metal flow discharged from the tundish 10 is controlled with the stoppers 103-106.

[0025] Fig. 3 shows for each of the outlets 13-16, the minimum residence time (in second) of the molten metal measured on a tundish at steady state without any impact pad (▲), for a tundish with a conventional impact pad without separating wall (●) and for a tundish according to the invention (■). This chart indicates that the minimum residence time is advantageously increased with the provision of an impact pad. Also visible is the fact that when an impact pad according to the present invention is used, the residence time of the molten steel cast through all the outlets is much more homogeneous; i.e. the residence time of the molten steel discharged from the outer outlets (13, 16) is comparable to the residence time of the molten steel discharged from the center outlets (14, 15) while, in the same conditions, the residence time of the molten steel discharged from the outer outlets is from 3 to 6 times higher with no impact pad or with a conventional impact pad.

[0026] Fig. 4 shows for each of the outlets 13-16 the transition time (in second) of the molten metal at ladle change measured on a tundish without any impact pad (▲), for a tundish with a conventional impact pad without separating wall (●) and for a tundish according to the invention (■). This chart shows that for both the tundish without impact pad or with an impact pad according to the invention, the transition times for the different outlets (13-16) are comparable while for a tundish provided with a conventional impact pad, the transition time for the center outlets (14, 15) is almost the double of the transition time for outer outlets (13, 16). It is also visible that the transition time for the different outlets is generally lower for a tundish provided with an impact pad according to the invention.

[0027] Figs. 5 to 6 show the impact pad 20 according to the invention which comprises a base 21 and an outer side wall 22 defining an interior space having an upper opening 24. On these figures, the outer side wall 22 is provided with an overhang 23 extending above the interior space and the outer wall 22 is endless and continuous. It is to be understood that these features are not essential. I.e., the overhang can be absent or of a different shape and the outer wall can be provided with one or more orifices for the molten steel.

[0028] The interior space of the impact pad 20 is divided into two regions 25a, 25b by a separating wall 26 provided with a passageway 27 for the molten metal stream. In these figures, the separating wall extends upwardly beyond the outer side wall (about 4 times). The separating wall 26 is also provided with a thickened portion 28 about the level of molten metal in the tundish (i.e. in the upper quarter of the separating wall). Also visible on Fig. 7 is the inclination of the separating wall 26 of an angle α with respect to the vertical. In this figure, the angle α is of about 6° and corresponds to the tundish wall inclination.

[0029] The impact pad 20 and its position in the tundish 10 are also visible in the assembly of Figs. 8 and 9. These Figs. show the impact pad 20 arranged with the separating wall 26 extending upwardly up to a height corresponding to the height of the molten metal level in the tundish and having a width corresponding to the width of the tail 12 of the tundish in the region of the junction between the main body 11 and the tail 12 of the tundish so that the separating wall 26 divides the tundish into a tail 12 and a main body 11 communicating mainly through the passageway 27.

[0030] Thus, the molten metal is discharged from the ladle (not shown) through the ladle shroud 17 into the region 25b of the impact pad positioned in the tundish tail 12. The molten stream flows through the passageway 27 of the separating wall 26 and reaches first the region 25a of the impact pad 20 positioned in the tundish main body 11 and is distributed into the tundish main body 11. The molten steel is then discharged through the outlets 13-16.

[0031] It has been observed that the slag emulsification profile observed with an impact pad according to the invention is much more favorable than without any impact pad and is more favorable than with a conventional impact pad. The slag emulsification is observed by the so-called dye injection test which does not show wedges in the outer upper corners of the tundish which - typicaly for multi strand tundishes - stay clear for a very long time.

Claims.

1. Impact pad (20), for use in a T-shaped tundish (10) comprising a main body (11) and a tail (12), formed from a refractory composition capable of withstanding continuous contact with molten metal, the pad (20) comprising a base (21) having an impact surface and an outer side wall (22) extending upwardly therefrom and defining an interior space having an upper opening (24) for receiving a stream of molten metal, the interior space being divided into two regions (25a,25b) by a separating wall (26) provided with at least one passageway (27) for the molten metal stream, **characterized in that** the separating wall (26) is at least three times higher than the outer side wall (22) and is inclined with respect to the vertical.

2. Impact pad (20) according to claim 1, **wherein** the separating wall (26) comprises a thickened portion (28) arranged in the upper half, preferably, the upper quarter of the separating wall (26).

3. Impact pad (20) according to claim 1 or 2, **wherein** the separating wall (26) is provided with at least one slot adapted for engagement with a corresponding portion of the outer wall (22).

4. Impact pad (20) according to any one of the claims 1 to 3, **wherein** the outer wall (22) is provided with at least one slot adapted for receiving at least a corresponding portion of the separating wall (26).

5. Impact pad (20) according to claim 1 or 2, **wherein** the base (21), outer wall (22) and separating wall (26) are integral.

6. Impact pad component comprising a base (21) having an impact surface and an outer side wall (22) extending upwardly therefrom and defining an interior space having an upper opening (24) for receiving a stream of molten metal, **characterized in that** the outer wall (22) is provided with at least one inclined slot adapted for receiving at least a corresponding portion of a separating wall (26).

7. Assembly of a T-shaped tundish (10) comprising a main body (11) and a tail (12) with an impact pad (20) according to any one of the claims 1 to 6, **wherein** the impact pad (20) comprises a separating wall (26) extending upwardly at least up to a height corresponding to the height of the molten metal level in the tundish, the separating wall (26) dividing the tundish (10) into a tail (12) and a main body (11) communicating mainly through a passageway (27) of the separating wall (26).

8. Assembly according to claim 7, **wherein** the separating wall (26) has a width corresponding to the width of the tail (12) of the tundish (10) in the region of the junction between the main body (11) and the tail (12) of the tundish.

9. Assembly according to claim 7 or 8, **wherein** the separating wall (26) is inclined of an angle corresponding to the inclination of the tundish walls in the main body (11) of the tundish.

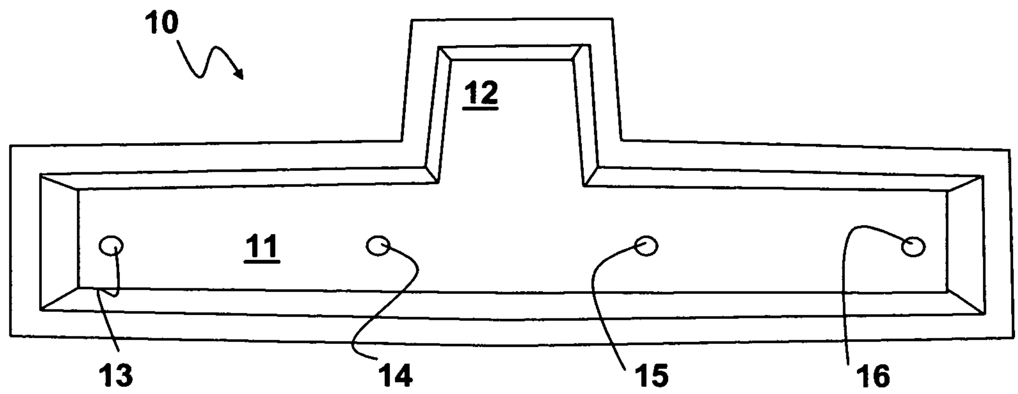

Fig. 1 (prior art)

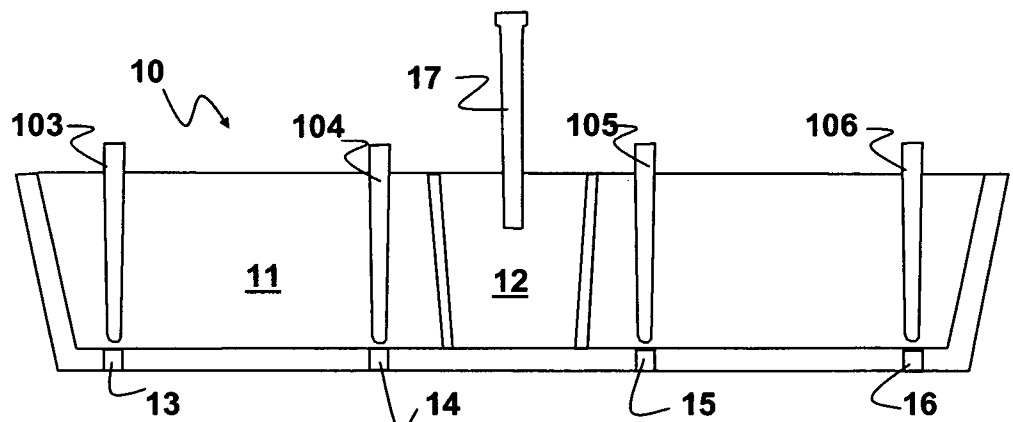

Fig. 2 (prior art)

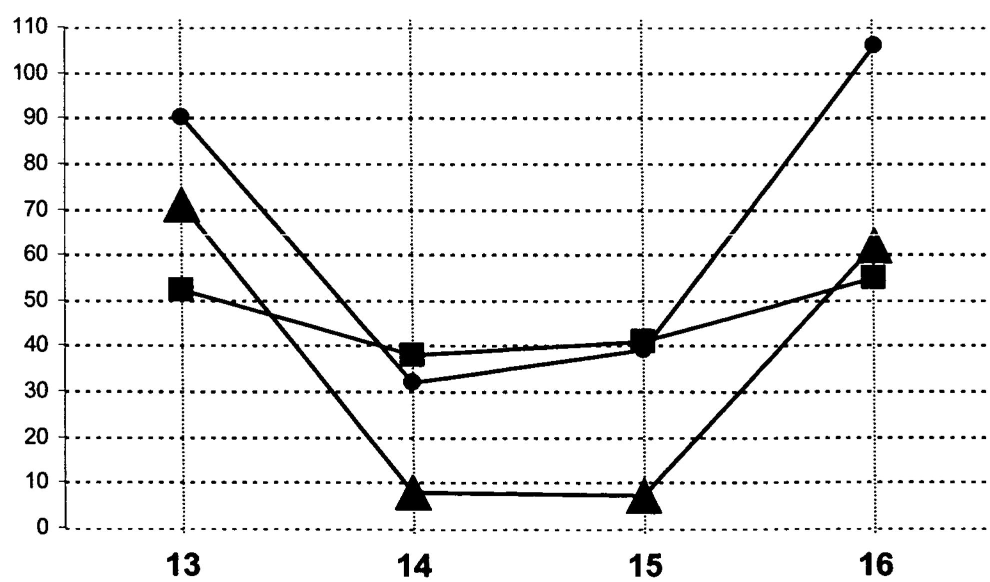

Fig. 3

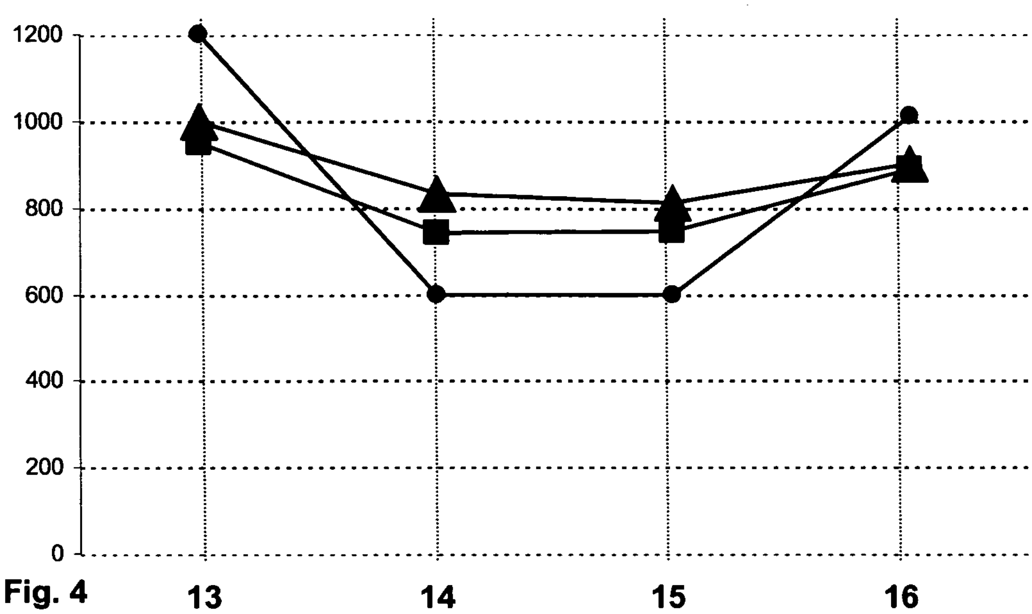

Fig. 4

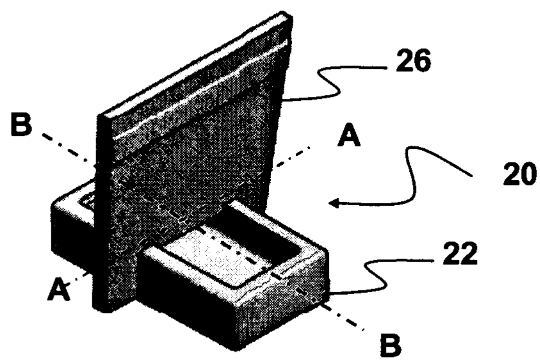

Fig. 5

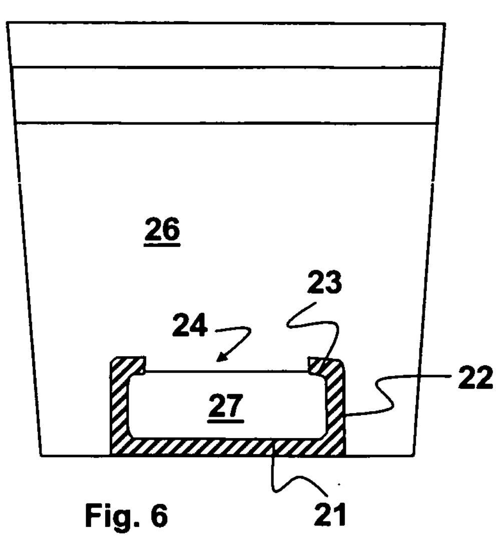

Fig. 6

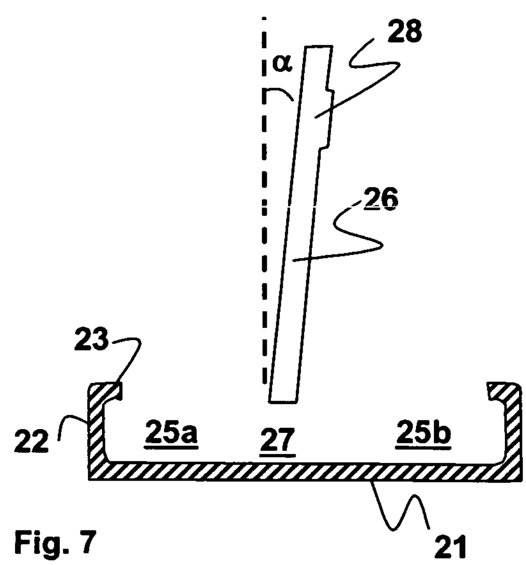

Fig. 7

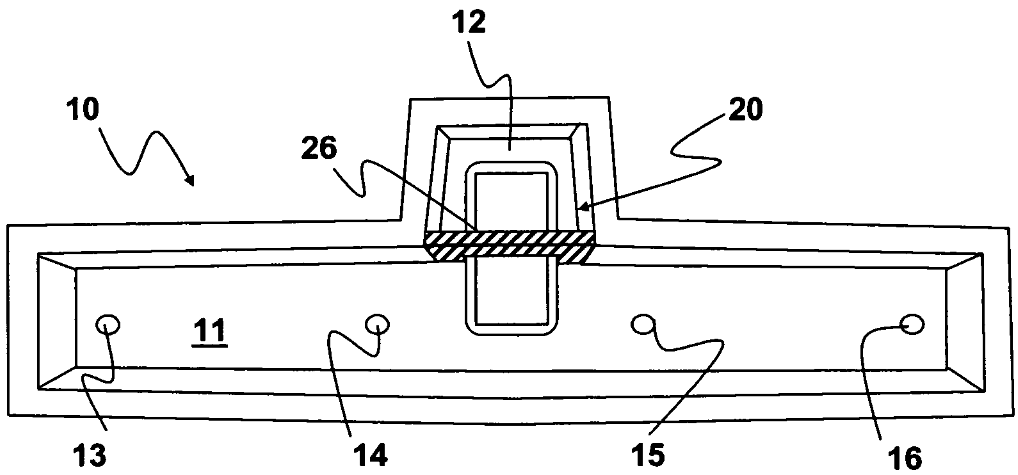

Fig. 8

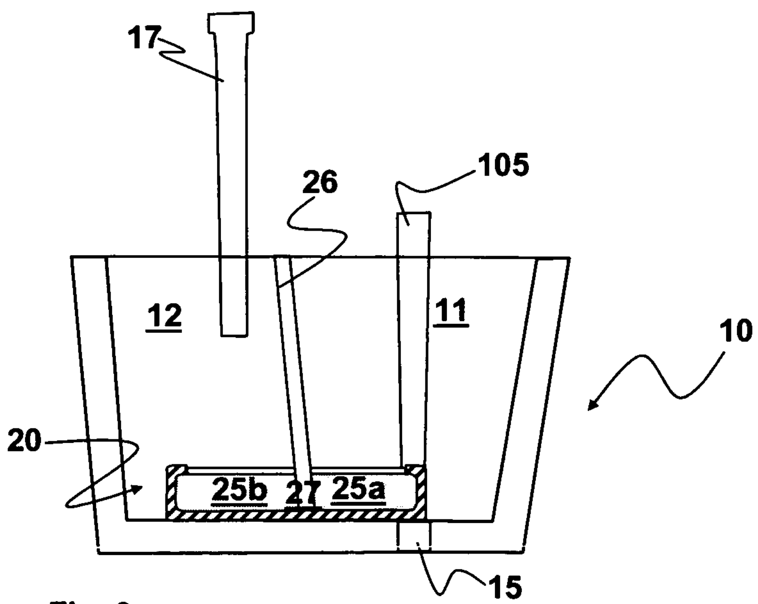

Fig. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2009/008512

A. CLASSIFICATION OF SUBJECT MATTER
INV. B22D11/10 B22D41/00 B22D41/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B22D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2008/093042 A1 (FOSECO INT [GB]; NITZL GERALD [DE]; MORRIS JOHN A [US]; ZACHARIAS DONA) 7 August 2008 (2008-08-07) figure 1	6
A	EP 0 847 820 A (UGINE SAVOIE SA [FR]; USINOR [FR]) 17 June 1998 (1998-06-17) cited in the application the whole document	1
A	US 5 110 096 A (ZACHARIAS DONALD R [US]) 5 May 1992 (1992-05-05) figure 9	7

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 March 2010	25/03/2010

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Fax: (+31–70) 340–3016	Scheid, Michael

4

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2009/008512

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2008093042 A1	07-08-2008	AR 065066 A1	13-05-2009
EP 0847820 A	17-06-1998	AU 732730 B2	26-04-2001
		AU 4526897 A	18-06-1998
		BR 9705632 A	09-03-1999
		CA 2223632 A1	11-06-1998
		CN 1190040 A	12-08-1998
		FR 2756761 A1	12-06-1998
		ID 18833 A	14-05-1998
		JP 10166112 A	23-06-1998
		TW 391900 B	01-06-2000
		US 5868955 A	09-02-1999
		ZA 9710809 A	12-06-1998
US 5110096 A	05-05-1992	DE 9201923 U1	30-04-1992
		GB 2253032 A	26-08-1992