(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 781 435 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
**16.06.2010 Bulletin 2010/24**

(21) Application number: **05758896.4**

(22) Date of filing: **13.07.2005**

(51) Int Cl.:
***B22D 5/04*** *(2006.01)* ***B22D 9/00*** *(2006.01)*
***B22D 35/04*** *(2006.01)*

(86) International application number:
**PCT/AU2005/001025**

(87) International publication number:
**WO 2006/005131 (19.01.2006 Gazette 2006/03)**

(54) **INGOT CASTING APPARATUS AND METHOD**

KOKILLENGUSSVORRICHTUNG UND -VERFAHREN

PROCEDE ET DISPOSITIF DE COULEE EN LINGOTIERE

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR**

(30) Priority: **14.07.2004 AU 2004903884**

(43) Date of publication of application:
**09.05.2007 Bulletin 2007/19**

(73) Proprietor: **Cast Centre Pty., Ltd.**
**Saint Lucia, QLD 4072 (AU)**

(72) Inventors:
- **ALGUINE, Vladimir**
  **Moscow, 121357 (RU)**
- **CLEARY, Paul, William**
  **Burwood East, VIC 3151 (AU)**
- **GRANDFIELD, John**
  **West Brunswick, VIC 3055 (AU)**
- **NGUYEN, Vu**
  **Springvale, VIC 3171 (AU)**
- **PRAKASH, Mahesh**
  **Narre Warren, VIC 3805 (AU)**
- **ROHAN, Patrick**
  **East Geelong, VIC 3219 (AU)**
- **SINNOTT, Mathew**
  **Fairfield, VIC 3078 (AU)**

(74) Representative: **Cabinet Plasseraud**
**52, rue de la Victoire**
**75440 Paris Cedex 09 (FR)**

(56) References cited:
**AU-B2- 717 796**
**CA-C- 2 209 588**
**DE-U1- 20 003 977**
**US-B1- 6 276 435**
**US-B1- 6 276 435**

- **PATENT ABSTRACTS OF JAPAN & JP 04 033 748 A (JAPAN METALS AND CHEM CO) 05 February 1992**
- **PATENT ABSTRACTS OF JAPAN & JP 61 078 555 A (FUSO LIGHT ALLOYS CO LTD) 22 April 1986**
- **DATABASE WPI Week 1998, Derwent Publications Ltd., London, GB; Class M22, AN 1998-270093, XP008097764 & RU 2 093 307 C1 (SIBE ALUMINIUM ELECTRODE IND RES INST) 20 October 1997**



EP 1 781 435 B1

## Description

### Field of the invention

**[0001]** This invention concerns the use of casting wheels to fill ingot moulds of an ingot casting line.

### Background of the invention

**[0002]** The chain conveyor ingot casting process is widely used to cast non-ferrous metals including aluminium, zinc, magnesium and lead. The chain conveyor process has a series of open cast iron moulds for casting ingots which are, usually of trapezoidal cross section on a conveyor system. The conveyor may be straight or circular and is generally up to 20m long. The moulds are filled at one end of the conveyor and as they progress along the conveyor, the ingot cools (by way of air or water cooling) and at the end of the conveyor the solid ingot is ejected.

**[0003]** Casting wheels (or rotating launders) are commonly used in the non ferrous metals industries to transfer molten metal from a launder to the mould in equal quantities. The general construction of a casting wheel includes a number of spouts positioned on the perimeter of the wheel is designed to rotate about its axis. The casting wheel is usually arranged relative to the mould conveyor such that each spout on the casting wheel indexes with a corresponding mould to allow filling of the mould with the molten metal from the spout.

**[0004]** Document AU 717 796 B2 discloses a casting wheel according to the preamble of claim 1.

**[0005]** A problem associated with known casting wheels is that during the filling process the melt surface exposed to air oxidises. This oxide becomes partially entrained in the liquid or floats on the top surface of the ingot. Automatic skimming may be used to remove the top layer but this represents a loss of material and does not remove entrained material.

The amount of dross is a function of the area of metal in the filling system exposed to air which, in turn, depends on the nature of the flow.

**[0006]** This problem is compounded when consideration is given to running the casting machine at a higher production rate. This is often accomplished by increasing the length of the conveyor system, in order to increase the length available for exposing the ingot moulds to cooling water or air, and then running the conveyor at a higher linear speed.

This means that for higher production rates, each ingot must be filled in a shorter time. However, shorter filling times result in greater fluid velocities and kinetic energy in the fluid in the filling spout and in the ingot. This results in an increase in the spreading of fluid against the solid surfaces of the filling system and mould thereby increasing the surface area of fluid and the degree of oxidation and dross formation.

**[0007]** In order to provide for less dross formation during casting at normal and higher conveyor speeds, it is desirable to reduce the surface area of the fluid in the flowing molten metal and thus reduce the amount of oxide formation.

### Summary of the invention

**[0008]** In order to solve the above mentioned problem, according to the invention, the casting wheel further has the features mentioned in the characterising portion of claim 1. The applicants have found that by having the plane of the initial section of the side wall extending from the open edge substantially parallel to the initial section of an adjacent spout, a smaller contact angle is presented to the incoming molten metal resulting in less spreading and fanning out of the molten metal entering the spout of the casting wheel. In a preferred form of this embodiment, the spouts are equally spaced around the annular member with the side walls of each spout abutting the side wall of an adjacent spout. In this way, the abutting side wall of adjacent spouts act as a flow divider to direct flow of molten metal entering the casting wheel to the respective spouts. After the initial section of the side wall, the side wall is concave shaped as it extends towards the base of the spout. The concave shape of the base or section of the side wall, allows the direction of flow of the molten metal to be changed without causing excess spreading. The absence of a defined joining wall between the side wall or edge and the base contributes to this lessening of fluid spreading.

**[0009]** To assist with this redirection of flow and to minimise spreading of the fluid, the side walls and the base wall may be provided with flow directors, preferably in the form of ribs, protrusions or grooves, extending towards the outlet of the spout.

**[0010]** The outlet end of the spout may further be provided with a cover so that the outlet from the spout forms a closed conduit. This enables the molten metal to flow into the ingot mould in a more controlled manner, thereby further reducing the energy of the fluid entering the mould and subsequent spreading of the fluid in the mould. The base of the spout may converge towards the cover of the spout.

**[0011]** In order to minimise the disturbance of the molten metal stream exiting from the launder into the wheel, the slope of the spout in the region of contact with the molten metal stream is given a specific parabolic shape. Hence in another form of this embodiment of the invention, the base section of the spout may be provided with a convex section which produces an undulation in the base to more smoothly direct the flow of the molten metal entering the spout towards the exit. This convex section is preferably in the initial contact area of the base with the incoming molten metal.

**[0012]** Additionally, by providing a spout with a construction in accordance with the invention, the adjoining wall between adjacent sprouts formed by abutting initial sections of the adjacent side walls, can be lower relative

to the outlet of the spout. This enables the launder outlet to the spout to be lowered relative to the outlet of the spout and the ingots mould thereby reducing the head loss from the launder feeder to the bottom of the mould. This reduction in head loss reduces the possible kinetic energy gained by the flowing metal entering the mould and subsequent spreading of the fluid.

**[0013]** In a second aspect, the invention provides an ingot casting system.

**[0014]** Document AU 717 796 B2 discloses an ingot casting system according to the preamble of claim 11. According to the invention, the ingot casting system further bas the features mentioned in the characterising portion of claim 11.

**[0015]** Other features of the spout described above, may also apply to the casting wheel defined in the second and third aspect of the invention.

**[0016]** In a third aspect, the invention provides a use of the ingot casting system according to claim 16.

**[0017]** Preferably, in one form of the invention, each spout includes two side walls and a base, each side wall having an open edge for contacting molten metal from a launder, the initial section of the side wall extending from the open edge, being shaped so as to be substantially parallel to the initial section of side wall extending from the open edge of an adjacent spout.

**[0018]** Further features, objects and advantages will become apparent from the following description of the preferred embodiment and accompanying drawings:

**Brief description of the drawings and preferred embodiments**

**[0019]**

Figure 1 is a schematic side view of a casting apparatus of general type used for the present invention;

Figure 2 is a schematic view of a typical ingot moulding operation;

Figure 3 is a perspective view looking down from the rear of a casting apparatus according to a first embodiment of the present invention;

Figure 4 is a detailed view of a portion of apparatus i Figure 3 but with the angle of use slightly changed;

Figure 5 is a perspective view of an embodiment of a spout used in the apparatus shown in Figure 3;

Figure 6 is a perspective view of the spout shown in Figure 5;

Figure 7 is a further perspective view of the spout shown in Figure 5;

Figure 8 is a view from below of a second embodiment of a spout used in an apparatus of the invention;

Figure 9 is a perspective view of the spout of Figure 8; and

Figure 10 is a plan view of the spout of Figure 8.

**[0020]** Referring now to Figures 1 and 2, a casting wheel 10 rotates about a horizontal axis 12. The wheel has a annular member 14 with a plurality of spouts 16, fixed around its perimeter. Twelve spouts are shown for illustrative purposes in Figure 3, although any suitable number may be employed provided it complies within the constraints of the ingot mould. A feed launder 18 carries molten metal (not shown) to the wheel 10. A single uninterrupted flow stream of molten metal emerges from the discharge tip 20 of the feed launder into the open edge 22 of the annular member 14. The spouts 16 each form an opening in the rim of the wheel and direct the metal down into an ingot mould 24. The wheel and spouts are preferably integrally formed as a single piece cast iron casting. Alternatively, the wheel and spouts are produced separately and secured together to facilitate ease of replacement and repair.

**[0021]** The mould 24 is one of a train of like ingot moulds which are carried by a chain conveyor past the casting wheel 10. As the casting wheel rotates, the spouts index with the moulds 24 as they move along the conveyor. The speed of rotation of the wheel and the linear speed of the conveyor are matched so that each casting spout 16 tracks a respective mould 24 as it passes beneath the wheel. When a mould is directly beneath the axis 12 of the wheel, a spout 16 extends well into its associated mould 24. The rate that molten metal is supplied to the casting wheel, the speed of the conveyor and the rotational speed of the wheel are all controlled so that the molten metal reaches the desired depth in the moulds, and thus ingots of constant height are produced, no matter what the feed rate of molten metal.

**[0022]** Referring now to Figures 3 to 7, the annular member 114 of casting wheel 110 carries twelve spouts 116 which are bolted to the annular member 114 so their contact face 126 presses against the annular member 114. If worn or damaged, the spouts 116 are readily replaced either individually or as a set by means of the bolted fastening system.

**[0023]** Whereas most casting wheels in the prior art use a wheel body which has a drum structure with the spouts attached to the perimeter of the drum between opposite ends of the drum, the present invention prefers to have the drum body comprise a substantially flat annulus from which the spouts protrude from one side/face of the annulus.

**[0024]** Each spout is arranged around the periphery of the annular member and shaped to provide for filling of the mould with the molten metal from the launder without increasing the fluid velocity and exposed surface area of molten metal as the molten metal passes through the

spout from the launder to the mould.

**[0025]** A spout 116 will now be described using the terms upper, lower and the like in the context of the orientation seen in Figures 5 and 6, i.e. with the spout oriented as for spout 117 (in Figure 4) at the bottom of the casting wheel and positioned for discharge for molten metal therethrough.

**[0026]** Each spout 116 has a sloping base 128 and a pair of side walls 130. The side walls 130 carry the face 126 which is fastened into contact with the annular member 114 of the wheel. The side walls 130 each have an open edge 135 for contacting molten metal from the launder, the initial section 137 of the side wall being shaped so that when positioned on the wheel, the initial sections 137 of adjacent side walls are substantially parallel. In this way, the adjacent and abutting side walls have an initial section which has a minimal contact angle with the flow of metal from the launder. In this way, the abutting side walls of adjacent spouts act as a flow divider to direct flow entering the casting wheel to the respective spouts.

**[0027]** The side walls 130 of the spout are concave shaped as they extend towards the base 128 of the spout. The concave shape of the side wall allows the base and side wall to be joined without a defined joining edge between the side wall and base, thereby lessening the turbulence in the molten metal as it enters the spout. The side walls 130 are tapered towards each other from the open edge 135 to the outlet end 134 (i.e. from the top to the bottom).

**[0028]** To minimise the disturbance of the molten metal stream exiting from the launder into the wheel, the slope of the spout in the region of contact with the molten metal steam is given a specific parabolic shape. The base of the spout is preferably provided with a convex curvature section in the upper portion 138 and a concave curvature section in its lower section 140. This produces an undulating shape in the base to more smoothly direct the flow of the molten metal entering the spout This convex section 138 preferably extends from the initial contact area of the base with the incoming molten metal.

**[0029]** Hence, the base wall 128 commences at its inlet end (top) 132 with a slope of about 45° to the horizontal (preferably within the range 35°-55°). The base wall then curves downwards towards the vertical until it reaches about 70° to the horizontal (preferably within the range 60°-80°) about midway along the base wall of the spout; and the base wall then curves towards the horizontal until it is substantially horizontal at its outlet end. (bottom) 134.

**[0030]** The convex shaped upper portion 138 of the base or rear wall has an approximately parabolic shape which matches the natural curvature of a freely falling stream of the molten metal pouring from the launder. The position of the launder is not shown in Figures 3 or 4. The horizontal component of the velocity of the metal issuing from the launder during normal casting rates is used to determine the curvature of the upper portion 138.

**[0031]** The concavely shaped lower portion 140 of the base wall 128 of the spout has a shape which smoothly redirects the metal to a horizontal flow. Horizontal flow is advantageous because it minimises splashing of the metal, exposure of more liquid metal to air, turbulence and oxidation and dross formation in the mould.

**[0032]** The spout is positioned as far as possible into the end of the mould from which the metal flows into the mould.

**[0033]** In this embodiment, in order to minimise the disturbance in the falling metal, the kinetic energy transferred to the liquid metal by way of the change in potential energy as the stream flows down is minimized. As the bottom of the launder feed trough sits lower than launder troughs in relation to conventional spouts, the height difference between the bottom of the mould and the bottom of the launder feed trough is minimised in order to minimise kinetic energy imparted to the falling metal. The metal falling into the spout is redirected along one approximately parabolic curve and then an oppositely curved approximately parabolic curve, to issue from the spout in an approximate horizontal direction. This minimizes the turbulence as the molten metal enters the mould. Rather than allowing a radial outlet ejecting fluid directly into the mould, so causing flow disruption and turbulence as the fluid jets against the mould walls, the flow is redirected to a horizontal outlet such that the liquid metal exits approximately horizontally into the mould and thus minimises the flow disturbance as it enters the mould. The spout is positioned close to one end of the mould and the liquid metal flows into the mould away from the end of the mould closest to the spout so that there is a maximum distance for the liquid metal to flow and there is minimum backwash of the molten metal.

**[0034]** The edge 135 (Figures 3 and 4) between spouts is reduced to be as sharp an edge as possible in order to obtain as clean a split of streams as possible when the edge 135 is passing through the flow of molten metal issuing from the launder.

**[0035]** Figures 8-10 illustrate a further embodiment of a spout 300 for use in the invention. As with the embodiments of Figures 5-7, each spout has a sloping base wall 328 and a pair of side walls 330. The side walls 330 carry facing edges 326 which are fastened into contact with the annular member 114 (in Figure 3) of the wheel. The side walls 330 each have an open edge 335 for contacting, dividing and directing a stream of molten metal from a launder as the casting wheel rotates. This initial section of the side wall is shaped so that when positioned on the casting wheel, the initial section of adjacent side walls (not shown) abut and are substantially parallel. Hence the initial section of the side wall in a vertical plane perpendicular to molten metal and the side wall, the side wall is substantially parallel to the flow has a minimum initial contact angle with the flow of molten metal.

**[0036]** The side walls 330 of the spout are concave shaped as they extend from the initial section to the base 328 of the spout. The concave shape of the side wall allows the base 328 and side walls to be joined without a defined joining edge thereby lessening turbulence in

the molten metal as it enters the spout.

**[0037]** The base 328 has a similar shape to that described in the embodiment of Figures 5-7.

**[0038]** In the embodiment of Figures 9 and 10, the interior of the spout is provided with flow directing ribs 320, 322 in the base and side walls respectively which further assist in directing flow towards the outlet of the spout. These ribs are shown as distinct raised curve from the surface of the base 328 and side walls 330 but may also be a line of dimples which trace a curve. The flow directing ribs extend from the entry end of the spout towards the outlet 334.

**[0039]** The spout is also provided with a cover 332 extending from the outlet 334 to the facing edges 326 of the side walls. This cover prevents molten metal introduced into the spout from splashing over the top of the side walls, enabling the molten metal to be introduced into the mould in a more controlled manner. During the filling of the mould the spout outlet falls below the rising surface of the liquid metal in the mould creating an under pour situation where the turbulence is dissipated below the surface without creating additional surface thus reducing oxidation.

**[0040]** The area of the inlet to each spout is such that it is not choked by liquid which would cause a backup of liquid in the wheel. This also minimises the velocity of the molten metal exiting the spout. It should not be so small as to cause metal to overflow on the inlet side of the wheel for the desired flow rate.

**[0041]** There are no spaces between adjacent spouts in the perimeter of the wheel so that there is minimal disruption of the flow stream from the feed launder.

**[0042]** The casting apparatus of the invention minimises oxide generation during filling of the moulds at high production rates. The head loss from the launder feeder to the bottom of the mould is reduced and thus the kinetic energy gained by the falling molten metal is reduced. The flow stream from the feed launder directly enters the opening in the spouts due to the sharp flow divider between them.

**[0043]** The molten metal is delivered to the wheel through a radial opening but the downward flow of molten metal is diverted so that it exits from the spout and in an approximately horizontal direction.

**[0044]** Whilst the above description includes the preferred embodiments of the invention, it is to be understood that many variations, alterations, modifications and or additions may be introduced into the constructions and arrangements of parts previously described with departing from the essential features of the spirit or ambit of the invention.

**[0045]** It will also be understood that where the word "comprises" (or its grammatical variants) are used in this specification is equivalent to the term "includes" and should not be taken as excluding the presence of other elements or features.

## Claims

1. A casting wheel (10, 110) for use in filling ingot moulds (24, 124) In an Ingot casting line, including

   an annular member (14, 114) arranged to be mounted for rotation, and
   a plurality of spouts (18, 116, 300) arranged around the periphery of the annular member (14, 114), each spout having two side walls (130, 330) and a base (128, 328), each side wall having an open edge (135, 335) for contacting molten metal from a molten metal source,
   the casting wheel (10, 110) being **characterised In that** the initial section (137) of the side wall (130, 330) extending from the open edge (135, 335) being shaped to be substantially parallel to the initial section (137) of the side wall (130, 330) extending from the open edge (136, 335) of an adjacent spout (16, 116, 300) such that the initial section (137) of the side wall (130, 330) abuts the initial section (137) of the side wall (130, 330) of the adjacent spout.

2. The casting wheel of claim 1 wherein the spouts (16, 116, 300) are equally spaced around the annular member (14, 114).

3. The casting wheel of claim 1 wherein the side wall (130, 330) is concave shaped as It extends from the initial section (137) of the side wall (130, 330) towards the base (128, 328).

4. The casting wheel of claim 1 wherein the base wall (128, 328) is provided with flow directors (320) extending towards the outlet (134, 334) of the spout (16, 116, 300).

5. The casting wheel of claim 1 or 4 wherein the side walls (130, 330) are provided with flow directors (322) extending towards the outlet (134, 334) of the spout (16, 116, 300).

6. The casting wheel of claim 5 wherein the flow directors are in the form of ribs, protrusions (322) or grooves.

7. The casting wheel of claim 1 wherein the spout further includes a cover (332) extending from the outlet end (334) of the spout (300).

8. The casting wheel of claim 1 wherein the base (328) of the spout (300) converges towards the cover (332) of the outlet end (334) of the spout.

9. The casting wheel of claim 1 wherein the base section (128) of the spout is provided with a convex section (138) and a concave section (140) in the base

In the initial contact area of the base with the molten metal entering the spout.

**10.** The casting wheel of claim 1 wherein the direction of flow of molten metal contacting the upper edges of abutting side walls Is within the plane of the initial sections (137) of the side walls (130, 330).

**11.** An Ingot casting system including

a feed system for delivering molten metal;
a casting wheel (10, 110) and a launder (18, 118) feeding the molten metal from the feed system to the casting wheel, the casting wheel being mounted to index with ingot moulds (24, 124) of a casting conveyor; the casting wheel comprising
an annular member (14, 114) arranged to be mounted for rotation, and
a plurality of spouts (16, 116, 300) arranged around the periphery of the annular member (14, 114), each spout having two side walls (130, 330) and a base (128, 328), each side wall having an open edge (135, 335) for contacting molten metal from a molten metal source,
the ingot casting system being **characterised** the initial section (137) of the side wall (130, 330) extending from the open edge (135, 335) being shaped to be substantially parallel to the initial section (137) of the side wall (130, 330) extending from the open edge (135, 335) of an adjacent spout (18, 116, 300) such that the initial section (137) of the side wall (130, 330) abuts the initial section (137) of the side wall (130, 330) of the adjacent spout.

**12.** The Ingot casting system of claim 11 wherein the spouts (16, 116, 300) are equally spaced around the annular member (14, 114).

**13.** The Ingot casting system of claim 11 wherein the base wall (128, 328) is provided with flow directors (320) extending towards the outlet (134, 334) of the spout (16, 118, 300).

**14.** The Ingot casting system of claim 11 or 13 wherein the side walls (130, 330) are provided with flow directors (322) extending towards the outlet (134, 334) of the spout (16, 116, 300).

**15.** The Ingot casting system of claim 14 wherein the flow directors are In the form of ribs protrusions (322) or grooves.

**16.** Use of the Ingot casting system according to any one of claims 11 to 15 for casting metal ingots including the steps of:

delivering molten metal from the launder (18, 118) to the casting wheel (10, 110), and
delivering the molten metal through each casting spout (16, 118, 300) to an ingot mould (24, 124) beneath the respective casting spout (16, 116, 300).

**17.** The use of claim 18 wherein the spouts (16, 116, 300) are equally spaced around the annular member (14, 114) with the side walls (130, 330) of each spout (16, 116, 300) abutting the side wall (130, 330) of an adjacent spout (16, 116, 300), and the direction of flow of molten metal contacting the upper edges of abutting walls is within the plane of the initial sections (137) of the side walls (130, 330).

**Patentansprüche**

**1.** Gießrad (10, 110) für den Einsatz beim Füllen von Blockkokillen (24, 124) in einer Blockgussstraße mit

einem ringförmigen Element (14, 114), das zur Drehung montiert ist, und
mehreren Gießschnauzen (16, 116, 300), die um den Umfang des ringförmigen Elements (14, 114) angeordnet sind und jeweils zwei Seitenwände (130, 330) und eine Basis (128, 328) haben, wobei jede Seitenwand einen offenen Rand (135, 335) zum Kontaktieren von Metallschmelze von einer Metallschmelzenquelle hat, **dadurch gekennzeichnet, dass** der sich vom offenen Rand (135, 335) erstreckende Anfangsabschnitt (137) der Seitenwand (130, 330) so geformt ist, dass er im Wesentlichen parallel zu dem sich vom offenen Rand (135, 335) einer benachbarten Gießschnauze (16, 116, 300) erstreckenden Anfangsabschnitt (137) der Seitenwand (130, 330) verläuft, so dass der Anfangsabschnitt (137) der Seitenwand (130, 330) an den Anfangsabschnitt (137) der Seitenwand (130, 330) der benachbarten Gießschnauze anstößt.

**2.** Gießrad nach Anspruch 1, wobei die Gießschnauzen (16, 116, 300) gleichmäßig um das ringförmige Element (14, 114) herum beabstandet sind.

**3.** Gießrad nach Anspruch 1, wobei die Seitenwand (130, 330) konkav ist, während sie sich vom Anfangsabschnitt (137) der Seitenwand (130, 330) zur Basis (128, 328) erstreckt.

**4.** Gießrad nach Anspruch 1, wobei die Basis (128, 328) mit Flussrichtungsgebern (320) versehen ist, die sich zum Auslass (134, 334) der Gießschnauze (16, 116, 300) erstrecken.

**5.** Gießrad nach Anspruch 1 oder 4, wobei die Seitenwände (130, 330) mit Flussrichtungsgebern (322) versehen sind, die sich zum Auslass (134, 334) der Gießschnauze (16, 116, 300) erstrecken.

**6.** Gießrad nach Anspruch 5, wobei die Flussrichtungsgeber die Form von Rippen, Vorsprüngen (322) oder Nuten haben.

**7.** Gießrad nach Anspruch 1, wobei die Gießschnauze ferner eine Abdeckung (332) aufweist, die sich vom Auslassende (334) der Gießschnauze (300) erstreckt.

**8.** Gießrad nach Anspruch 1, wobei die Basis (328) der Gießschnauze (300) zur Abdeckung (332) des Auslassendes (334) der Gießschnauze hin konvergiert.

**9.** Gießrad nach Anspruch 1, wobei der Basisabschnitt (128) der Gießschnauze mit einem konvexen Abschnitt (138) und einem konkaven Abschnitt (140) in der Basis im Anfangskontaktbereich der Basis mit der in die Gießschnauze eintretenden Metallschmelze versehen ist.

**10.** Gießrad nach Anspruch 1, wobei sich die Fließrichtung der die oberen Ränder von aneinander anstoßenden Seitenwänden kontaktierenden Metallschmelze in der Ebene der Anfangsabschnitte (137) der Seitenwände (130, 330) befindet.

**11.** Blockgusssystem mit

einem Zufuhrsystem zur Lieferung von Metallschmelze,
einem Gießrad (10, 110) und einer Gießrinne (18, 118), die die Metallschmelze vom Zufuhrsystem dem Gießrad zuführt, das so montiert ist, dass es mit Blockkokillen (24, 124) eines Gießförderers weiterschaltet, wobei das Gießrad Folgendes umfasst:
ein ringförmiges Element (14, 114), das zur Drehung montiert ist, und
mehrere Gießschnauzen (16, 116, 300), die um den Umfang des ringförmigen Elements (14, 114) angeordnet sind und jeweils zwei Seitenwände (130, 330) und eine Basis (128, 328) haben, wobei jede Seitenwand einen offenen Rand (135, 335) zum Kontaktieren von Metallschmelze von einer Metallschmelzenquelle hat,

**dadurch gekennzeichnet, dass** der sich vom offenen Rand (135, 335) erstreckende Anfangsabschnitt (137) der Seitenwand (130, 330) so geformt ist, dass er im Wesentlichen parallel zu dem sich vom offenen Rand (135, 335) einer benachbarten Gießschnauze (16, 116, 300) erstreckenden Anfangsabschnitt (137) der Seitenwand (130, 330) verläuft, so dass der Anfangsabschnitt (137) der Seitenwand (130, 330) an den Anfangsabschnitt (137) der Seitenwand (130, 330) der benachbarten Gießschnauze anstößt.

**12.** Blockgusssystem nach Anspruch 11, wobei die Gießschnauzen (16, 116, 300) gleichmäßig um das ringförmige Element (14, 114) herum beabstandet sind.

**13.** Blockgusssystem nach Anspruch 11, wobei die Basis (128, 328) mit Flussrichtungsgebern (320) versehen ist, die sich zum Auslass (134, 334) der Gießschnauze (16, 116, 300) erstrecken.

**14.** Blockgusssystem nach Anspruch 11 oder 13, wobei die Seitenwände (130, 330) mit Flussrichtungsgebern (322) versehen sind, die sich zum Auslass (134, 334) der Gießschnauze (16, 116, 300) erstrecken.

**15.** Blockgusssystem nach Anspruch 14, wobei die Flussrichtungsgeber die Form von Rippen, Vorsprüngen (322) oder Nuten haben.

**16.** Verwendung des Blockgusssystems nach einem der Ansprüche 11 bis 15 zum Gießen von Metallblöcken mit folgenden Schritten:

Liefern von Metallschmelze von der Gießrinne (18, 118) zum Gießrad (10, 110) und
Liefern der Metallschmelze durch jede Gießschnauze (16, 116, 300) zu einer Blockkokille (24, 124) unter der jeweiligen Gießschnauze (16, 116, 300).

**17.** Verwendung nach Anspruch 16, wobei die Gießschnauzen (16, 116, 300) gleichmäßig um das ringförmige Element (14, 114) herum beabstandet sind, wobei die Seitenwände (130, 330) jeder Gießschnauze (16, 116, 300) an der Seitenwand (130, 330) einer benachbarten Gießschnauze (16, 116, 300) anstoßen und sich die Fließrichtung der die oberen Ränder von aneinander anstoßenden Wänden kontaktierenden Metallschmelze in der Ebene der Anfangsabschnitte (137) der Seitenwände (130, 330) befindet.

**Revendications**

**1.** Roue de coulée (10, 110) destinée à être utilisée pour remplir des lingotières (24, 124) dans une ligne de coulée de lingot, comprenant :

un élément annulaire (14, 114) agencé pour être monté à rotation, et
une pluralité de becs de coulée (16, 116, 300) agencés autour de la périphérie de l'élément an-

nulaire (14, 114), chaque bec de coulée ayant deux parois latérales (130, 330) et une base (128, 328), chaque paroi latérale ayant un bord ouvert (135, 335) pour entrer en contact avec du métal en fusion provenant d'une source de métal en fusion,
la roue de coulée (10, 110) étant **caractérisée en ce que** la section initiale (137) de la paroi latérale (130, 330) s'étend à partir du bord ouvert (135, 335) qui est formé pour être sensiblement parallèle à la section initiale (137) de la paroi latérale (130, 330) s'étendant à partir du bord ouvert (135, 335) d'un bec de coulée (16, 116, 300) adjacent, de sorte que la section initiale (137) de la paroi latérale (130, 330) vient en butée contre la section initiale (137) de la paroi latérale (130, 330) du bec de coulée adjacent.

**2.** Roue de coulée selon la revendication 1, dans laquelle les becs de coulée (16, 116, 300) qui espacés à égale distance autour de l'élément annulaire (14, 114).

**3.** Roue de coulée selon la revendication 1, dans laquelle la paroi latérale (130, 330) est de forme concave lorsqu'elle s'étend à partir de la section initiale (137) de la paroi latérale (130, 330) vers la base (128, 328).

**4.** Roue de coulée selon la revendication 1, dans laquelle la paroi de base (128, 328) est prévue avec des dispositifs de direction de flux (320) s'étendant vers la sortie (134, 334) du bec de coulée (16, 116, 300).

**5.** Roue de coulée selon la revendication 1 ou 4, dans laquelle les parois latérales (130, 330) sont prévues avec des dispositifs de direction de flux (322) s'étendant vers la sortie (134, 334) du bec de coulée (16, 116, 300).

**6.** Roue de coulée selon la revendication 5, dans laquelle les dispositifs de direction de flux se présentent sous la forme de nervures, de saillies (322) ou de rainures.

**7.** Roue de coulée selon la revendication 1, dans laquelle le bec de coulée comprend en outre un couvercle (332) s'étendant à partir de l'extrémité de sortie (334) du bec de coulée (300).

**8.** Roue de coulée selon la revendication 1, dans laquelle la base (328) du bec de coulée (300) converge vers le couvercle (332) de l'extrémité de sortie (334) du bec de coulée.

**9.** Roue de coulée selon la revendication 1, dans laquelle la section de base (128) du bec de coulée est prévue avec une section convexe (138) et une section concave (140) dans la base dans la zone de contact initiale de la base avec le métal en fusion qui pénètre dans le bec de coulée.

**10.** Roue de coulée selon la revendication 1, dans laquelle la direction du flux de métal en fusion en contact avec les bords supérieurs des parois latérales de butée est dans le plan des sections initiales (137) des parois latérales (130, 330).

**11.** Système de coulée de lingot comprenant :

un système d'alimentation pour délivrer du métal en fusion ;
une roue de coulée (10, 110) et un canal de coulée (18, 118) pour alimenter le métal en fusion du système d'alimentation à la roue de coulée, la roue de coulée étant montée pour s'indexer avec les lingotières (24, 124) d'un convoyeur de coulée ; la roue de coulée comprenant :

un élément annulaire (14, 114) agencé pour être monté à rotation, et
une pluralité de becs de coulée (16, 116, 300) agencés autour de la périphérie de l'élément annulaire (14, 114), chaque bec de coulée ayant deux parois latérales (130, 330) et une base (128, 328), chaque paroi latérale ayant un bord ouvert (135, 335) pour entrer en contact avec le métal en fusion provenant d'une source de métal en fusion,
le système de coulée de lingot étant **caractérisé en ce que** la section initiale (137) de la paroi latérale (130, 330) s'étend à partir du bord ouvert (135, 335) qui est formé pour être sensiblement parallèle à la section initiale (137) de la paroi latérale (130, 330) s'étendant à partir du bord ouvert (135, 335) d'un bec de coulée (16, 116, 300) adjacent de sorte que la section initiale (137) de la paroi latérale (130, 330) vient en butée contre la section initiale (137) de la paroi latérale (130, 330) du bec de coulée adjacent.

**12.** Système de coulée de lingot selon la revendication 11, dans lequel les becs de coulée (16, 116, 300) sont espacés à égale distance autour de l'élément annulaire (14, 114).

**13.** Système de coulée de lingot selon la revendication 11, dans lequel la paroi de base (128, 328) est prévue avec des dispositifs de direction de flux (320) s'étendant vers la sortie (134, 334) du bec de coulée (16, 116, 300).

**14.** Système de coulée de lingot selon la revendication

11 ou 13, dans lequel les parois latérales (130, 330) sont prévues avec des dispositifs de direction de flux (322) s'étendant vers la sortie (134, 334) du bec verseur (16, 116, 300).

**15.** Système de coulée de lingot selon la revendication 14, dans lequel les dispositifs de direction de flux se présentent sous la forme de nervures, de saillies (322) ou de rainures.

**16.** Utilisation du système de coulée de lingot selon l'une quelconque des revendications 11 à 15 pour couler des lingots en métal, comprenant les étapes consistant à :

délivrer le métal en fusion du canal de coulée (18, 118) à la roue de coulée (10, 110), et
délivrer le métal en fusion en passant par chaque bec de coulée (16, 116, 300) jusqu'à une lingotière (24, 124) au-dessous du bec de coulée (16, 116, 300) respectif.

**17.** Utilisation selon la revendication 16, dans laquelle les becs de coulée (16, 116, 300) sont espacés à égale distance autour de l'élément annulaire (14, 114) avec les parois latérales (130, 330) de chaque bec de coulée (16, 116, 300) qui viennent en butée contre la paroi latérale (130, 330) d'un bec de coulée (16, 116, 300) adjacent et la direction du flux de métal en fusion en contact avec les bords supérieurs des parois de butée est dans le plan des sections initiales (137) des parois latérales (130, 330).

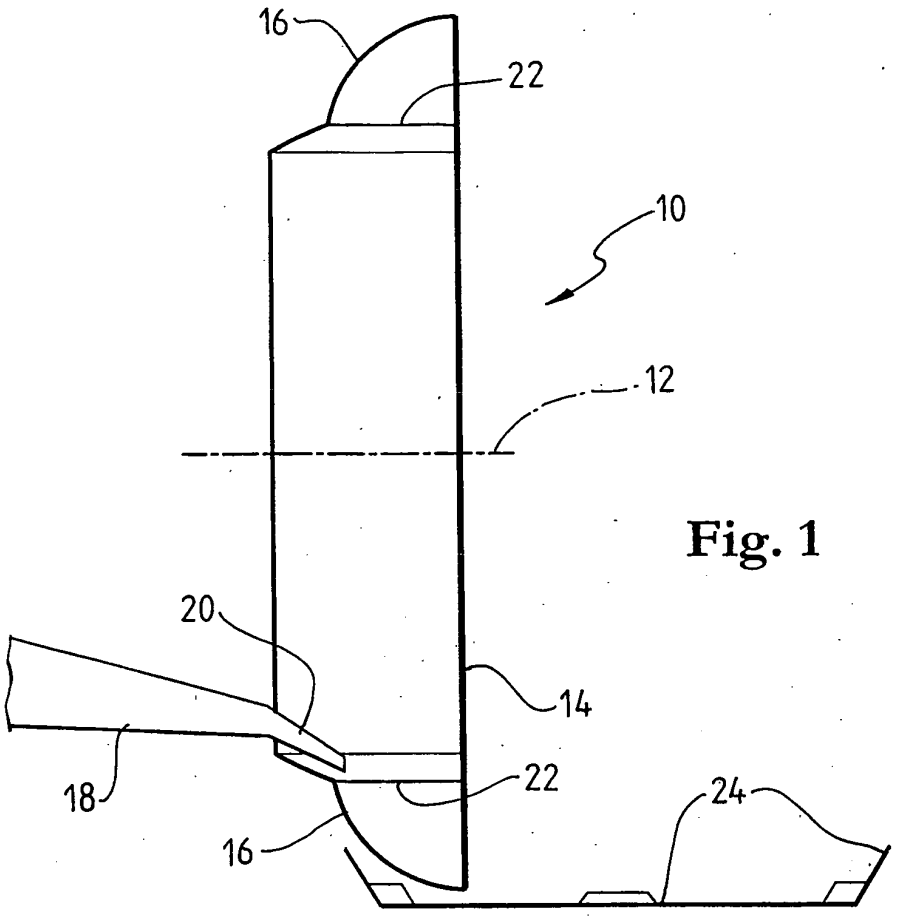
16
22
10
12
20
14
18
22
24
16

Fig. 1

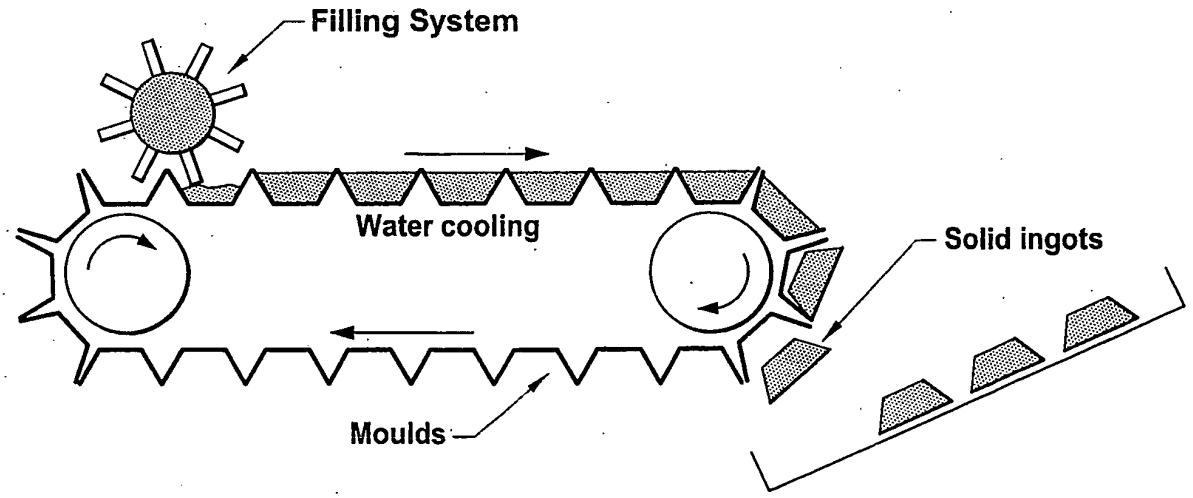
Filling System
Water cooling
Solid ingots
Moulds

Fig. 2

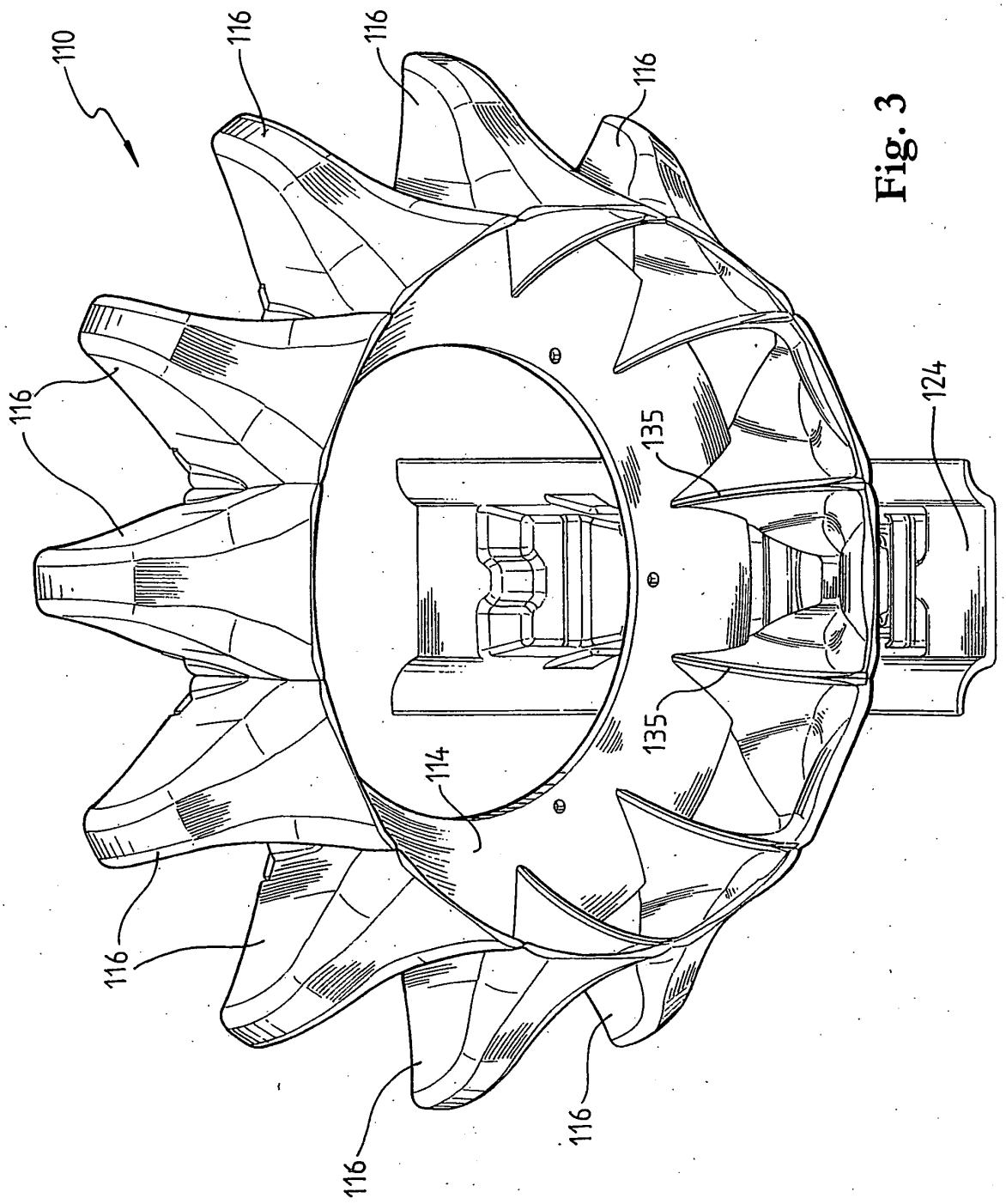


Fig. 3

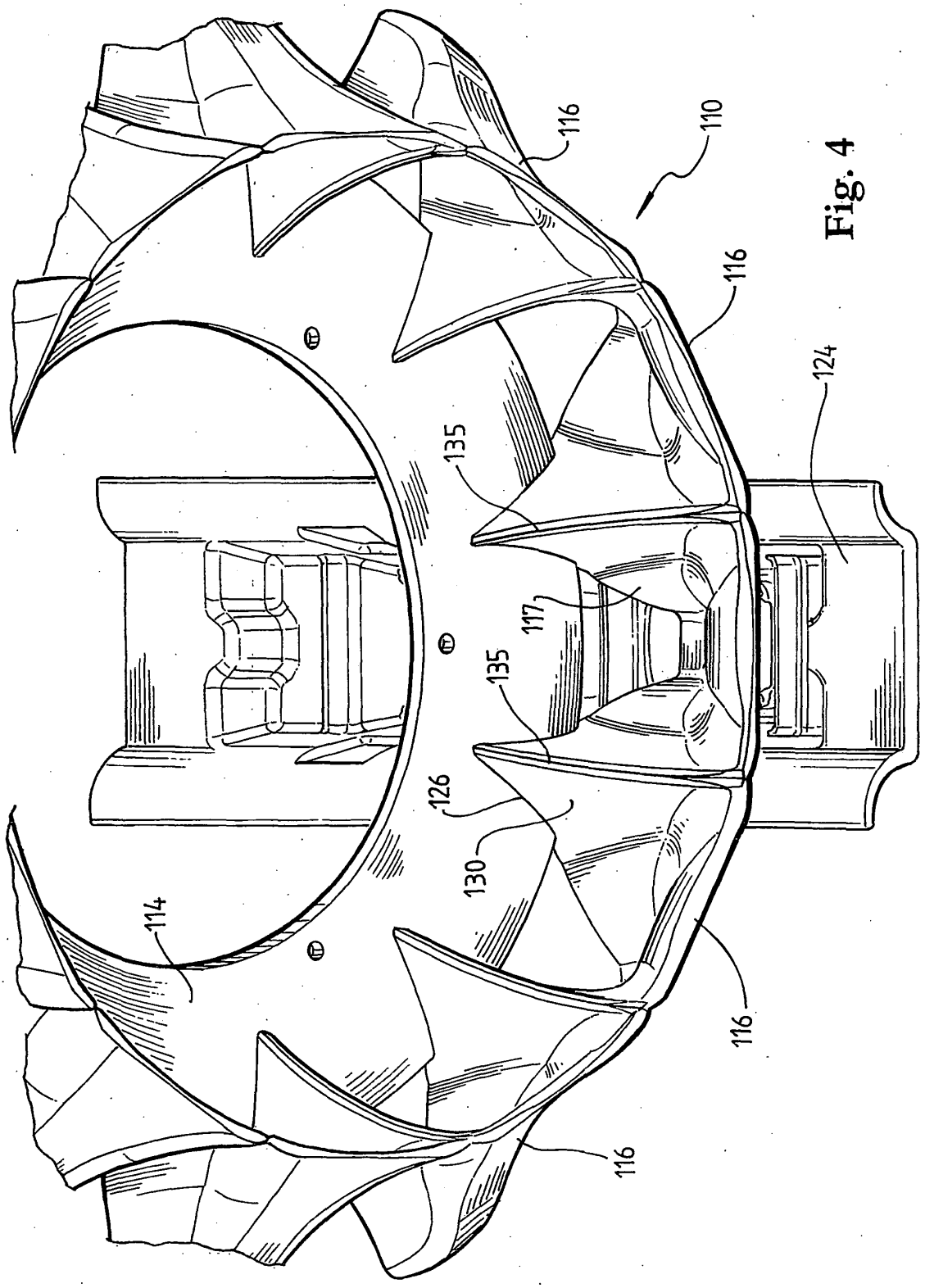


Fig. 4

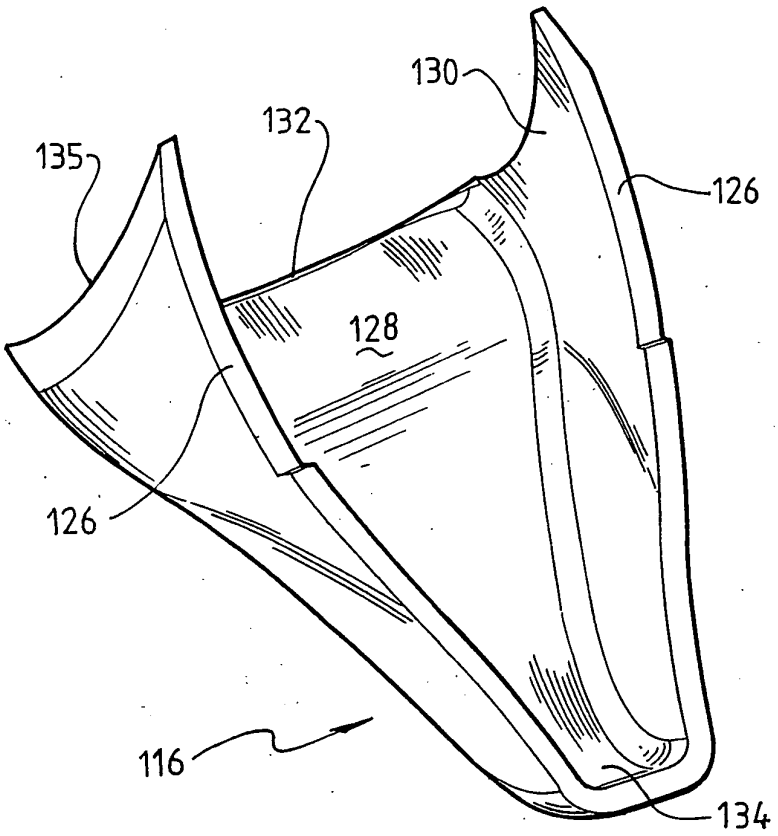
130
132
135
126
128
126
116
134

Fig. 5

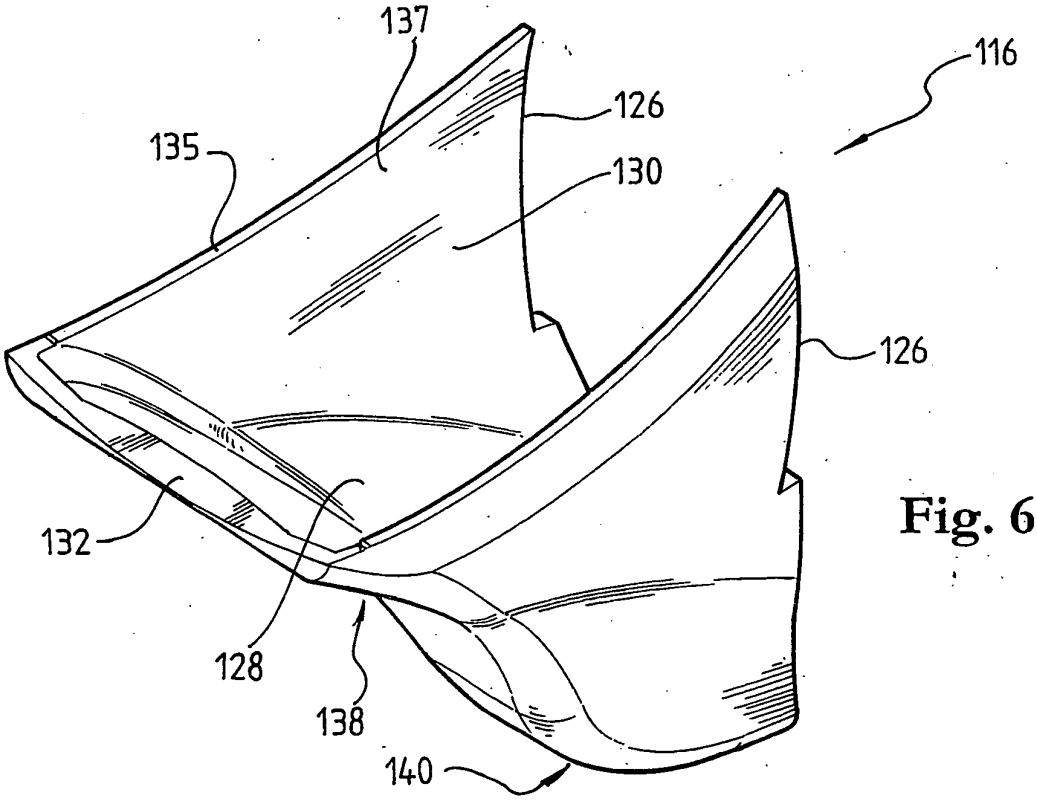
137
116
126
135
130
126
132
128
138
140

Fig. 6

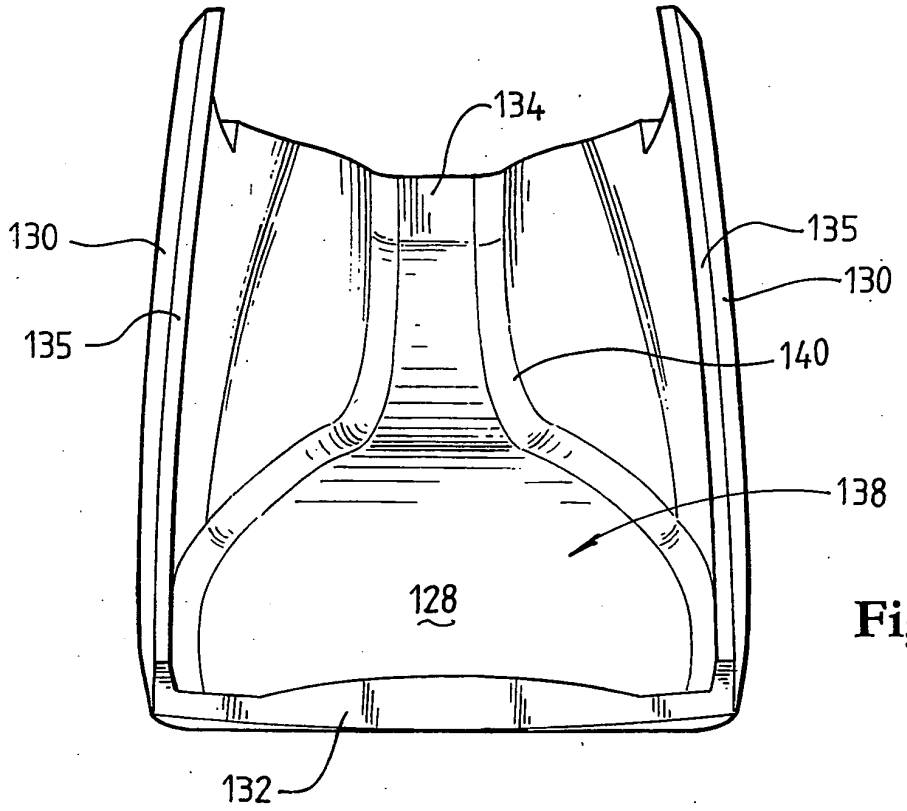


Fig. 7

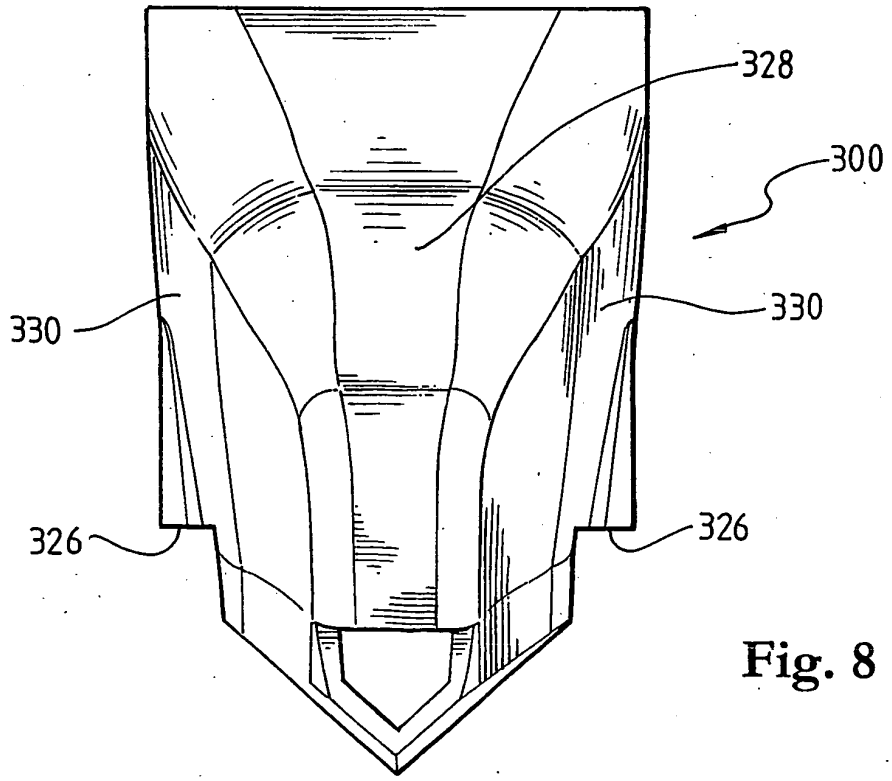


Fig. 8

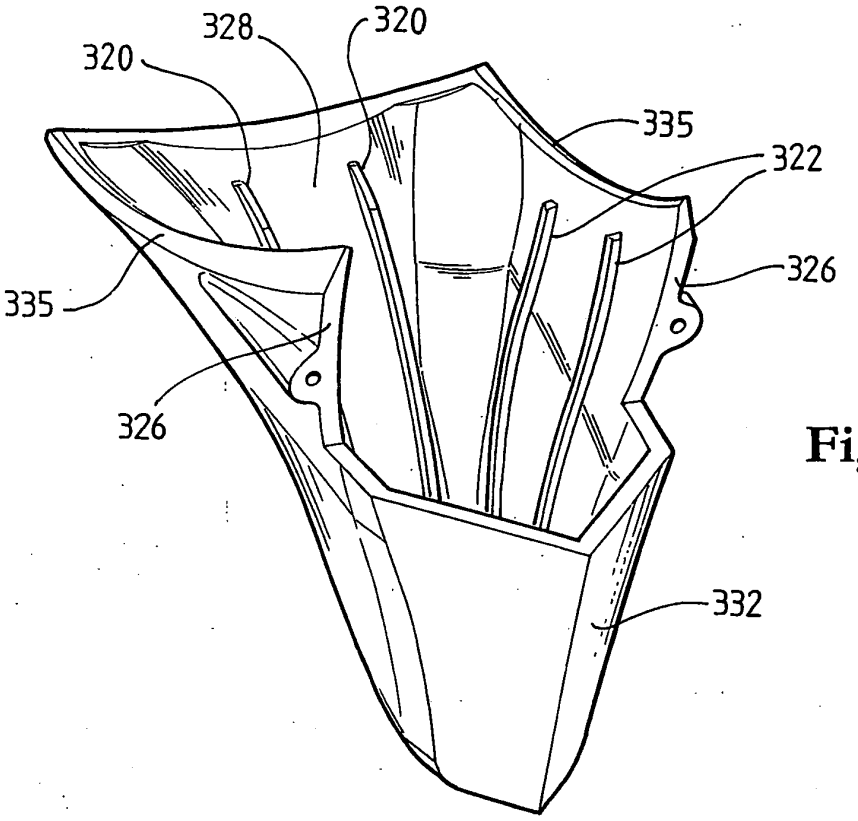


Fig. 9

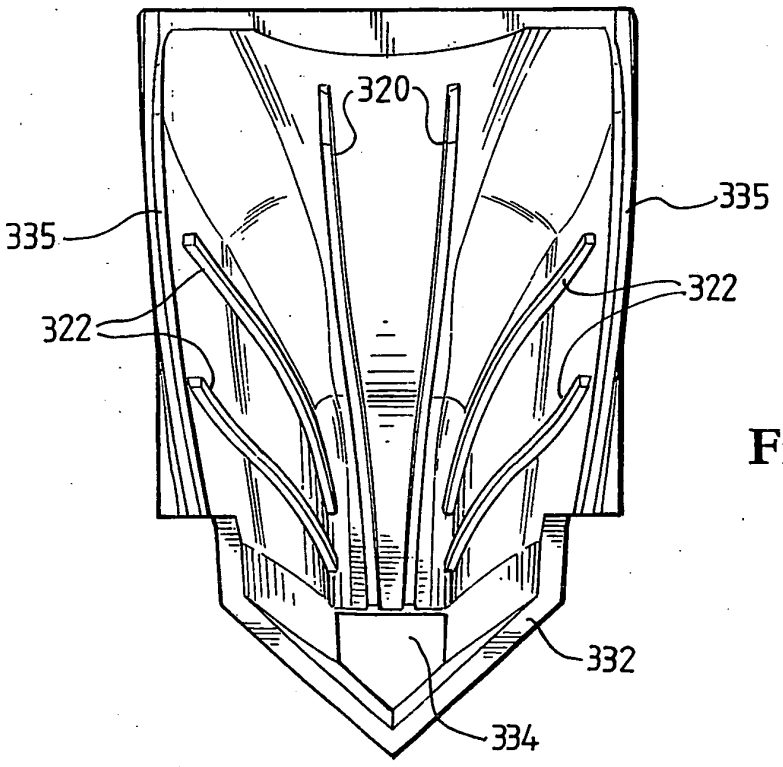


Fig. 10

## REFERENCES CITED IN THE DESCRIPTION

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

### Patent documents cited in the description


- AU 717796 B2 **[0004] [0014]**