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54 Improvements to crystallisers employed for almost horizontal continuous casting, and crystallisers thus improved.

57 Improvements to crystallisers employed for continuous casting, of which the taper in relation to the axis of the casting line (17) is differentiated as between its intrados or interior curve (11) and its extrados or exterior curve (12).

Crystalliser employed for continuous casting which incorporates the above improvements.

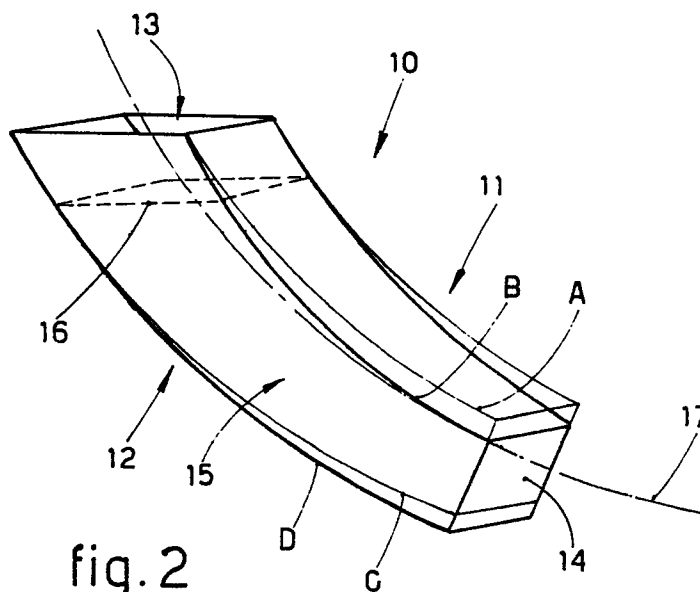


fig. 2

**"IMPROVEMENTS TO CRYSTALLISERS EMPLOYED FOR ALMOST HORIZONTAL CONTINUOUS CASTING,
AND CRYSTALLISERS THUS IMPROVED"**

This invention concerns improvements to crystallisers employed for almost horizontal continuous casting and also concerns crystallisers employed for continuous casting which incorporate such improvements.

Crystallisers employed for continuous casting and, in particular crystallisers employed for almost horizontal continuous casting are known.

During continuous reasearch to eliminate the faults in blooms and billets leaving the ingot moulds the present applicant has undertaken a thorough investigation into ingot moulds.

The traditional curved ingot moulds are included in DE-B-1.025.578, FR-A-1.479.946 and US-A-3.623.533.

The applicant has led to the conclusion that the ferrostatic pressure in ingot moulds of continuous casting machines and, in particular, in ingot moulds for almost horizontal continuous casting has an increased value on the side having the interior curve of the mould and a reduced value on the side having the exterior curve. In particular, such difference in ferrostatic pressure may even reach 30% in ingot moulds for almost horizontal continuous casting.

Moreover, the lengthwise contact surface of the exterior curve is greater than that of the interior curve, and such contact surface varies considerably according to the shapes and dimensions. The cooling conditions, therefore, differ as between the interior curve and exterior curve.

It has also been determined that the contact between steel in its solidification phase and the interior curved side of the ingot mould takes place during a rather short time and causes a relatively small growth of skin, such growth being, in any event, less than that which occurs against the lateral faces and the exterior curved side of the ingot mould.

So as to obviate these drawbacks, the present applicant has examined, tested and verified improvements to crystallisers employed for continuous casting and , advantageously, for almost horizontal continuous casting, and has embodied crystallisers for continuous casting which incorporate such improvements.

The improvements of the invention consist in creating a suitable taper as between the face of the interior curve and the face of the exterior curve of the ingot mould in relation to the axis of the casting line.

In particular, according to the invention, such taper will be dissymmetrical as between the interior curved side and exterior curved side of the ingot mould in relation to the axis of the casting line.

In particular, the taper will be greater in the interior curved side and smaller in the exterior curved side, depending on the degree to which the machine is positioned below the horizontal, such degree being defined by the angle between the horizontal and the radius of curvature of the casting line running from the centre of curvature to the top of the ingot mould. The lateral faces of the ingot mould will retain their normal taper.

According to the invention, therefore, the new crystallisers incorporating the improvements will possess on their exterior curved side, in relation to the axis of the casting line understood as being the lengthwise axis of the ingot mould with a constant curvature, a taper which will be less than or, at the most, the same as those of the exterior curved sides of known embodiments.

Such taper will preferably be nil, that is to say, in a preferred embodiment the exterior curved side will have the same curvature as the axis of the casting line.

The lateral faces of the mould will be embodied as at present, whereas the inner curved side will be provided with an increased taper, which will vary progressively until it reaches a value which may even be twice the normal value.

The invention is therefore obtained with improvements to crystallisers employed for continuous casting, the improvements being characterized in that their taper in relation to the axis of the casting line is differentiated as between their intrados or interior curve and extrados or exterior curve.

The invention is also embodied with a crystalliser employed for continuous casting which is characterized in that it incorporates the above improvements.

The attached figures are given as a non-restrictive example and illustrate the following:-

Fig.1 shows a diagrammatic casting line that makes plain the lay-out of the invention;

Fig.2 shows a traditional crystalliser for almost horizontal continuous casting and a crystalliser according to the invention for such type of casting.

Fig.1 shows a continuous casting ingot mould 10 for almost horizontal continuous casting. The axis of the casting line 17 possesses a constant curvature; the angle providing the degree to which the continuous casting is performed below the horizontal is indicated with "alpha".

Fig.2 shows a comparison between the geometry of a traditional crystalliser and the geometry of the crystalliser of the invention.

An ingot mould or crystalliser 10 in its traditional form has a conformation according to the lines A and C; the interior curved side is referenced with 11, the exterior curved side with 12 and the lateral faces with 15.

The inlet and outlet are referenced with 13 and 14 respectively, while 16 is the level of molten material.

In this embodiment, whereas the taper of the exterior curved side is substantially reduced progressively (depending on the angle "alpha" of the degree to which the machine is positioned below the horizontal; please see Fig.1), the taper of the interior curved side is substantially increased by an equal value.

Such tapers are respectively those of the interior curved side and exterior curved side in relation to the axis 17 of the casting line.

The actual line of the interior curved side according to the invention, therefore, takes up a development according to the conformation B instead of the conformation A whereas the exterior curved side in turn takes up a development according to the conformation D instead of the conformation C.

In this way, if it is desired to convert a traditional ingot mould or crystalliser into an improved crystalliser, the taper which is created progressively between the interior curved side 11 and casting line axis 17 is increased, whereas the taper between the exterior curved side 12 and casting line axis 17 becomes progressively reduced or even becomes nil.

The taper of the exterior curved side 12 is shown as nil in the example of Fig.2, that is to say, the exterior curved side 12 is parallel to the casting line axis 17 and has a constant curvature.

Claims

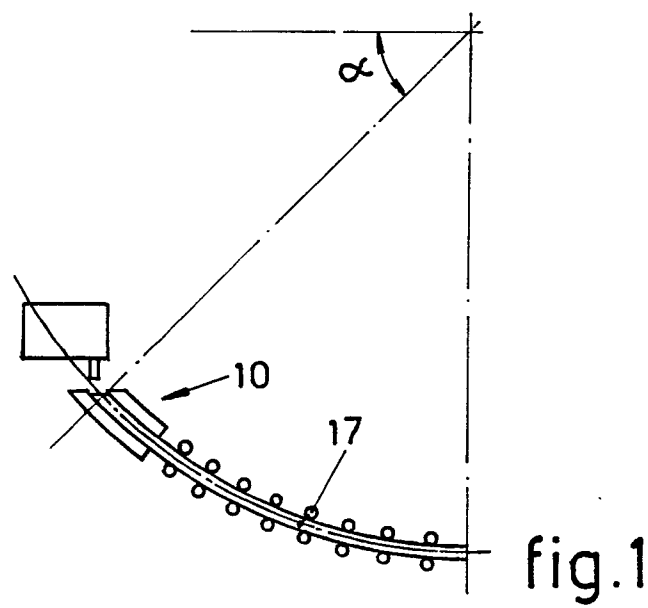
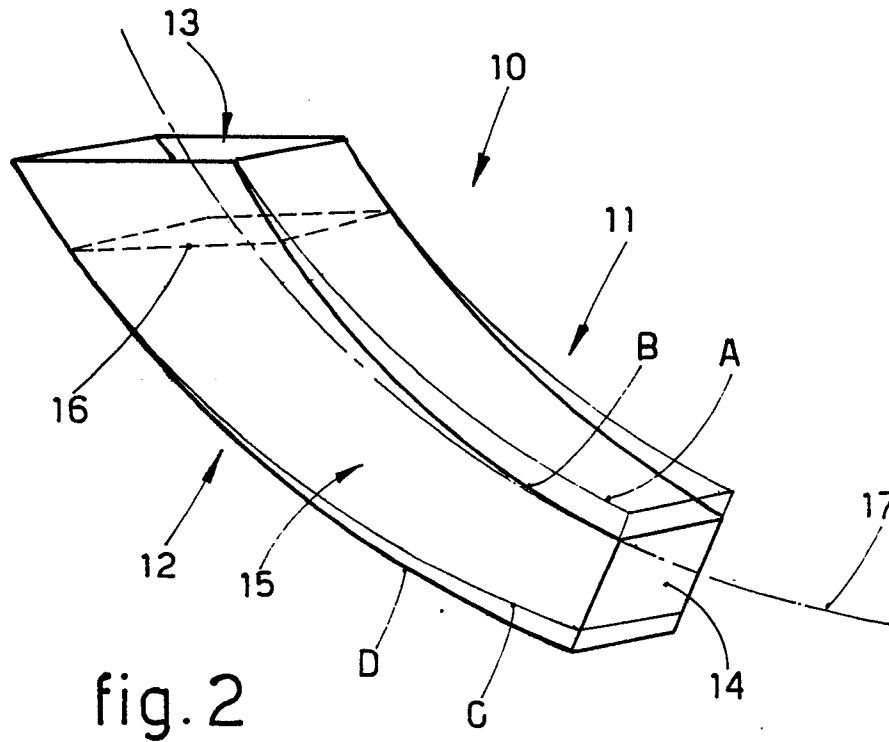
1 -Improvements to crystallisers employed for continuous casting, the improvements being characterised in that their taper in relation to the axis (17) of the casting line is differentiated as between their intrados or interior curve (11) and extrados or exterior curve (12).

2 -Improvements to crystallisers employed for continuous casting as claimed in Claim 1, by which the taper of the interior curved side (11) is greater than the taper of the exterior curved side (12).

3 -Improvements to crystallisers employed for continuous casting as claimed in Claim 1 or 2, by which the taper of the exterior curved side is other than nil.

4 -Improvements to crystallisers employed for continuous casting as claimed in any claim hereinbefore, by which the taper of the exterior curved side is nil.

5 -Crystalliser employed for continuous casting, which is characterized in that it incorporates one or another of the improvements of the claims hereinbefore.



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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
A	DE-B-1 025 578 (VEREINIGTE LEICHTMETALL-WERKE)		B 22 D 11/04

A	FR-A-1 479 946 (MANNESMANN)		

A	US-A-3 623 533 (V.N. KHOREV et al.)		

			TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
			B 22 D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 01-04-1987	Examiner MAILLIARD A.M.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	