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EUROPEAN PATENT APPLICATION

⑲ Application number: **87302023.4**

⑤① Int. Cl.⁴: **B 22 D 11/06**

⑳ Date of filing: **10.03.87**

③① Priority: **10.03.86 JP 34254/86**

④③ Date of publication of application:
16.09.87 Bulletin 87/38

⑧④ Designated Contracting States: **DE FR GB IT**

⑦① Applicant: **ISHIKAWAJIMA-HARIMA JUKOGYO**
KABUSHIKI KAISHA
2-1, Ote-machi 2-chome
Chiyoda-ku Tokyo 100 (JP)

NIPPON KOKAN KABUSHIKI KAISHA
1-2 Marunouchi, 1-chome Chiyoda-ku
Tokyo-to (JP)

⑦② Inventor: **Tsuchida, Yutaka**
No. 3-64-13, Kamoi
Yokosuka-shi Kanagawa-ken (JP)

Takahashi, Shuzo
No. 6-1-8-504 Konandai Konan-ku
Yokohama-shi Kanagawa-ken (JP)

Fukase, Hisahiko
No. 1-1-1-501 Meguro
Meguro-ku Tokyo-to (JP)

Matsui, Kunio
No. 1-16-5-401 Namiki Kanazawa-ku
Yokohama-shi Kanagawa-ken (JP)

Nomura, Akihiro
No. 673, Noba-cho Konan-ku
Yokohama-shi Kanagawa-ken (JP)

Hasebe, Nobuhisa
No. 2703-9 Iijima-cho Sakae-ku
Yokohama-shi Kanagawa-ken (JP)

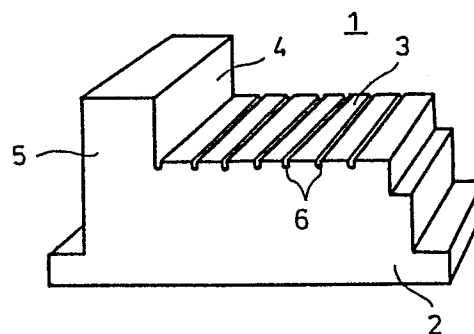
Sako, Katsuyuki
No. 5-4-17 Fujisawa
Fujisawa-shi Kanagawa-ken (JP)

⑦④ Representative: **Rees, David Christopher et al**
Kilburn & Strode 30 John Street
London WC1N 2DD (GB)

⑤④ **Mould for endless track type continuous casting installation.**

⑤⑦ A mould element (1) for use in an endless tract type of continuous casting installation, comprising a main casting surface (3) on the mould element base (2) and a side casting surface (4) on the mould element side wall (5), the two casting surfaces (3,4) together defining part of a mould cavity. A series of slits (6) are formed in the main casting surface (3) extending generally parallel with the side casting surface. This reduces thermal deformations, especially permanent thermal deformations due to variations in temperature of the mould.

Fig.2



Description

MOULD FOR ENDLESS TRACK TYPE CONTINUOUS CASTING INSTALLATION

The present invention relates to a mould for an endless track type of continuous casting installation, in which the tracks are made up of a plurality of blocks.

In general, this type of continuous casting installation comprises a plurality of block moulds endlessly connected to one another to define a pair of moving moulds. These moving mould pairs interact to define a mould cavity between them which is open at both ends. Molten metal is charged through a nozzle into one open end of the mould cavity and moves towards the other open end during which time it solidifies. Thus, continuous casting is carried out.

Figure 1 shows a conventional pair of moulds b and b' used in a continuous casting installation. These define a mould cavity and each have a unitary construction comprising a bottom c and a side wall e. The bottom c and the side wall e have respectively a level-surface casting portion d and a side-surface casting portion f which are flat. Lugs g are clamped to maintain the moulds b and b' securely at their respective predetermined positions.

In a mould of this type, the casting portions d and f are subjected to thermal deformations (elongation) at the high operating temperatures (for instance, 1550°C or more experienced when molten metal is charged into the mould cavity a when the continuous casting operation is started. The side-surface casting portions f are thus forced to curve outwardly as indicated by broken lines since the distortions are not restricted. As a result, a problem arises in that a gap is produced in the mould cavity a between the upper and lower moulds b and b' and molten metal leaks through the gap.

Furthermore, when the upper and lower moulds b and b' cool, the casting portions d and f will shrink freely and the side walls e will curve inwardly. Thus, it is very difficult to design and construct the upper and lower moulds b and b' because the difference between the outward expansion when heated and the inward shrinkage when cooled must be taken into consideration.

It is an object of the present invention to overcome the above and other problems encountered in conventional moulds used in continuous casting installations. More specifically, it is an object of the present invention to minimise thermal deformations and especially permanent deformations of the moulds caused by temperature fluctuations so that leakage of molten metal can be prevented and the design and construction of moulds can be simplified.

According to the present invention there is provided a mould element for use in an endless track type of continuous casting installation, comprising a main casting surface on the mould element base and a side casting surface on the mould element side wall, the two casting surfaces together defining part of a mould cavity, characterised by a plurality of slits, formed in the main casting surface, extending generally in parallel with the side casting surface.

Preferably, the block includes a plurality of subblocks arranged generally in parallel with the side casting surface, the sub-blocks together defining the main casting surface. Preferably, at least one of the opposing surfaces of adjacent sub-blocks is formed with a cut-out portion to define one or more of the slits. The sub-blocks may be assembled together and attached to the mould side wall by means of a tie bolt.

With a mould element according to the present invention for use in an endless track type continuous casting installation, elongation or expansion of the level surface casting portion caused by heating can be absorbed by the plurality of slits in the level surface so that thermal deformations can be reduced to a minimum. Furthermore, the slits can absorb shrinkage caused when the mould is cooled. Therefore, leakage of a molten metal can be prevented and design of moulds can be simplified.

The invention may be carried into practice in various ways and some embodiments will be described by way of example with reference to the accompanying drawings in which:-

Figure 1 is a schematic view illustrating the conventional arrangement of moulds in an endless track type continuous casting installation;

Figure 2 is a perspective view of a first embodiment of a mould in accordance with the present invention; and

Figure 3 is a view similar to Figure 2 showing a second embodiment of the present invention.

Figure 2 shows a single block or mould element 1 forming part of the end endless track mould. The block 1 has a base 2 having a level surface casting portion 3 and a side wall 5 having a side surface casting portion 4. These two surfaces co-operate with corresponding surfaces 3,4 on an interacting block (not shown) to define a mould cavity. The level surface 3 is formed with a plurality of slits 6 which extend in parallel with the side wall 5.

The maximum width of each slit 6 is so selected that no molten metal flows into the slits 6 (the maximum width preferably being of the order of 0.01 - 0.1 mm) and the depth of each slit 6 is suitably selected. These slits 6 may be formed or machined by any suitable means e.g. by electric discharge machining or by using a knurling tool.

When the level-surface casting portion 3 of the block 1 is formed with a plurality of slits 6 in parallel with the side-surface casting portion 4 as described above, the compressive force produced by the elongation in the widthwise direction in the mould cavity of the level-surface casting portion 3 when heat can be absorbed by the slits 6. Furthermore, the tensile force produced by shrinkage of the level-surface casting portion when the block 1 is cooled can be also absorbed by the slits 6.

As a result, thermal deformation of the side wall 5 can be reduced to a minimum so that leakage of molten metal from the mould cavity can be

prevented when blocks 1 of the type described above are used. In addition, the provision of the slits 6 will cause not only an inflow of air but also a reduction of the contact area between the blocks 1 and the solidifying metal and therefore decrease the heat dissipation effect of the mould. Thus, heating of the mold is decreased and consequently thermal deformations can be further prevented.

As described above, thermal deformations of the blocks 1 can be reduced, so that the design of the blocks 1 in which thermal deformations must be taken into consideration can be simplified.

Figure 3 shows a second embodiment of a mould element 1 in accordance with the present invention. The side wall 5 and the base 2 are separate units and the base 2 is divided into a plurality of sub-blocks 2a, 2b, 2c and 2d which extend in parallel with the side wall 5. The side wall 5 and the sub-blocks 2a, 2b, 2c and 2d are assembled as a single unitary unit by means of a coupling bolt 7. At least one opposing surface of the sub-blocks 2a, 2b, 2c and 2d are partially cut off to define the slits 6 between the side wall 5 and the blocks 2a, 2b, 2c and 2d when they are assembled. The second embodiment can attain substantially the same effects and features as the first embodiment described above.

It is to be understood that various variations, alternations and/or modifications may be resorted to without departing from the spirit of the present invention. For instance, the slits 6 may have various shape.

Claims

1. A mould element (1) for use in an endless tract type of continuous casting installation, comprising a main casting surface (3) on the mould element base (2) and a side casting surface (4) on the mould element side wall (5), the two casting surfaces (3,4) together defining part of a mould cavity, characterised by a plurality of slits (6), formed in the main casting surface (3), extending generally in parallel with the side casting surface (4).

2. A mould element as claimed in Claim 1 characterised in that the block (1) includes a plurality of sub-blocks (2a,2b,2c,2d) arranged generally in parallel with the side casting surface (4), the sub-blocks (2a-2d) together defining the main casting surface (3).

3. A mould element as claimed in Claim 2 characterised in that at least one of the opposing surfaces of adjacent sub-blocks is formed with a cut-out portion to define one or more of the slits.

4. A mould element as claimed in Claim 2 or Claim 3 characterised in that the sub-blocks (2a,2b,2c,2d) are assembled together and attached to the mould side wall (5) by means of a tie bolt (7).

5. A mould element as claimed in any preceding claim characterised in that the slits are from 0.01 to 0.1 mm in width.

Fig.1

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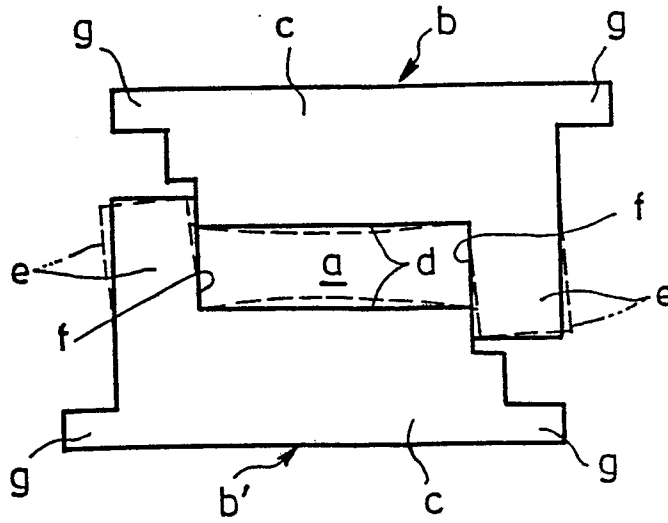


Fig.2

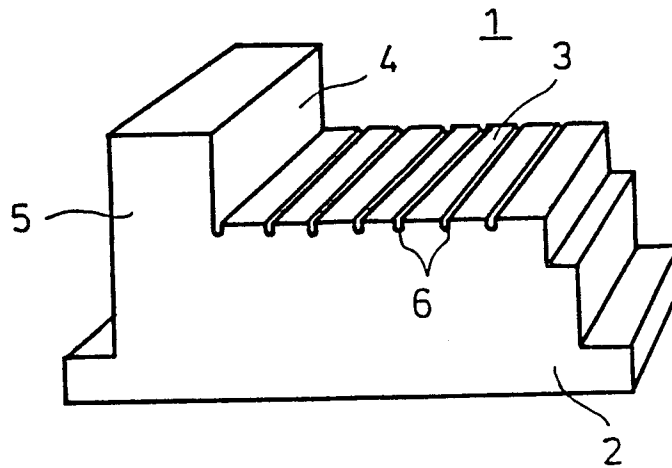


Fig.3

