

A&A Ref: **149443**

PUBLICATION PARTICULARS AND ABSTRACT
(Section 32(3)(a) - Regulations 22(1)(g) and 31)

21	01	PATENT APPLICATION NO	22	LODGING DATE	43	ACCEPTANCE DATE
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4/207

12 January 2004

12-10-04

51	INTERNATIONAL CLASSIFICATION	NOT FOR PUBLICATION
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B22D C25D

CLASSIFIED BY: **ISA**

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EARLIEST PRIORITY CLAIMED	COUNTRY	NUMBER	DATE
	33 DE	31 101 34 074.5	32 13 July 2001

NOTE: The country must be indicated by its International Abbreviation - see schedule 4 of the Regulations

54	TITLE OF INVENTION
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Continuous casting roll for casting molten baths and method for producing one such continuous casting roll

57	ABSTRACT (NOT MORE THAN 150 WORDS)
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NUMBER OF SHEETS	30
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The sheet(s) containing the abstract is/are attached.

If no classification is furnished, Form P.9 should accompany this form.
The figure of the drawing to which the abstract refers is attached.

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES
PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro



(43) Internationales Veröffentlichungsdatum
23. Januar 2003 (23.01.2003)

PCT

(10) Internationale Veröffentlichungsnummer
WO 03/006193 A1

(51) Internationale Patentklassifikation⁷: **B22D 11/06**,
C25D 5/14, 21/12

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(21) Internationales Aktenzeichen: PCT/EP02/06533

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(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

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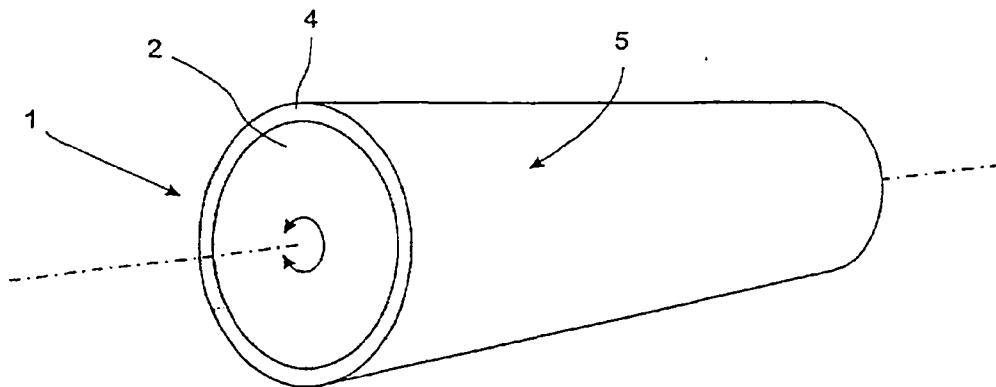
(30) Angaben zur Priorität:
101 34 074.5 13. Juli 2001 (13.07.2001) DE

(81) Bestimmungsstaaten (national): AE, AG, AL, AM, AT,
AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR,

[Fortsetzung auf der nächsten Seite]

(54) Title: CONTINUOUS CASTING ROLL FOR CASTING MOLTEN BATHS AND METHOD FOR PRODUCING ONE SUCH
CONTINUOUS CASTING ROLL

(54) Bezeichnung: GIESSWALZE FÜR DAS VERGIEßEN VON METALLSCHMELZE UND VERFAHREN ZUR HERSTEL-
LUNG EINER SOLCHEN GIESSWALZE



(57) Abstract: The invention relates to a continuous casting roll for casting molten baths, especially steel molten baths. Said casting roll comprises a roll barrel (2) consisting of a metallic material, to which a layer (4) of metallic material is applied, the metallic material of the layer having a higher hardness than that of the roll barrel (2). The inventive continuous casting roll has a longer service life and improved properties for use. This is achieved by providing the layer (4) with lower hardness over its thickness in its region adjacent to the roll barrel (2) than in the region of its free surface (5).

(57) Zusammenfassung: Die vorliegende Erfindung betrifft eine Gießwalze für das Vergießen von Metallschmelze, insbesondere Stahlschmelze, mit einem aus einem metallischen Werkstoff bestehenden Walzenkörper (2), auf den eine Schicht (4) aufgebracht ist, welche aus einem Metallwerkstoff gebildet ist, der eine höhere Härte aufweist als der Werkstoff des Walzenkörpers (2). Die erfindungsgemäße Gießwalze weist eine erhöhte Lebensdauer und verbesserte Gebrauchseigenschaften auf. Dies wird dadurch erreicht, daß die Schicht (4) über ihre Dicke (D) betrachtet in ihrem an den Walzenkörper (2) grenzenden Bereich eine geringere Härte aufweist als im Bereich ihrer freien Oberfläche (5).



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CASTING ROLLER FOR CASTING MOLTEN METAL AND METHOD OF
MANUFACTURING SUCH A CASTING ROLLER

The invention relates to a casting roller for casting molten metal, particularly molten steel, having a roller body made of a metallic material, onto which a coating is applied which is made of a metal material having a greater hardness than the material of the roller body. Casting rollers of this type are used in machines for continuous casting of molten steel into cast strip.

For strip casting of steel in such devices, which are also referred to as "double-roller casting machines", two casting rollers are provided, which counter rotate during the casting process, are positioned with their axes parallel, are internally cooled, and which delimit the long sides of a casting gap implemented between them. Sufficient liquid molten metal is poured into this casting gap each time so that a molten metal pool forms above the casting gap. The molten metal which reaches the casting rollers from this molten metal pool solidifies and is conveyed by the casting rollers into the casting gap. In the casting gap, the cast strip, which is subsequently drawn off and supplied for further processing, is shaped from the shells thus formed on the casting rollers and the still free-flowing molten metal.

In order to ensure good thermal conductivity of the casting rollers, they are typically made, at least in the region of their lateral surfaces, of a copper alloy. In this way, good dissipation of the heat is achieved. However, in practical operation the casting rollers are subject to strong mechanical and thermal strains, which lead to significant wear in the copper material used for manufacturing the casting rollers.

coating, starting from the roller body, the coating has increased ductility in the region adjoining the roller body, so that it may absorb the deformations of the copper jacket of the roller body in this region and good adhesion of the coating on the roller body is ensured. The danger of the coating detaching from the roller body in operation is prevented in this way, so that long-lasting, reliable operation of the casting roller is ensured. Simultaneously, the hardness at the circumference of the casting roller is so high that the surface of a casting roller according to the invention has good wear resistance and therefore has an elevated service life.

The varying hardness trend in the coating applied to the roller body may be produced in that the coating has a different composition in its region adjoining the roller body than in the region of its free surface. Thus, for example, in the course of the coating, the proportions of those elements in the particular electrolytes used may be increased, which lead to elevation of the hardness of the particular material deposited. In this way, a composition of the alloy which varies over the thickness of the coating is obtained. Its distribution is implemented in such a way that it is less hard and simultaneously more ductile in the region adjoining the roller body than at the circumference of the casting roller. In this context, sodium citrate or sulfur, for example, are suitable as hardness-increasing elements, which may preferably be used if the coating is produced on the basis of a nickel alloy.

Alternatively or additionally to influence the hardness trend by changing the composition, the coating process may also be controlled in such a way that the coating has a softer microstructure in its region bordering the

roller body than in the region of its free external surface. This may be achieved in that the depositing current is increased in the course of the coating process, starting from a minimum value. Through a low depositing current strength at the beginning of the coating, a fine-grained coating thickness region is first implemented, which has increased ductility. Through subsequent increase of the depositing current strength, the microstructure becomes coarser and the hardness of the coating rises with increasing thickness.

The coating process is to be controlled in each case such that a homogeneous coating structure is obtained, which has the particular optimum material properties in the particular problem zones (boundary layer between the roller body and the coating; external surface of the coating). This may be ensured by adding the hardness-increasing elements to the electrolyte or changing the depositing current in each case such that the hardness increases continuously over the thickness of the coating. Depending on the particular coating material used, its thickness, and the particular operating influences, it may be expedient in this case if the hardness has a linearly or progressively increasing trend starting from the circumference of the roller body.

Practical experiments have shown that casting rollers according to the present invention reliably meet the demands posed on them when the hardness of the coating is 150 HV to 250 HV in the region boarding the roller body and is 400 HV to 500 HV in the region of the free surface. This is particularly true if the coating is produced based on a nickel material.

Further advantageous embodiments of the invention are specified in the dependent claims and are described in

greater detail in connection with the following exemplary embodiment, which is described on the basis of a drawing.

Figure 1 shows a casting roller in a perspective view,

Figure 2 shows the casting roller in cross-section in an enlarged detail.

The casting roller 1 has a roller body 2, in which at least the outer lateral surface 3 is made of a copper material. Inside, the roller body 2 is equipped with cooling devices (not shown), via which it is cooled in casting operation.

A coating 4, which is based on a nickel alloy, is applied to the lateral surface 3 of the roller body 2 through electrolytic deposition. In order to produce a hardness trend in the coating 4 which increases linearly starting from the lateral surface 3 over the thickness D of the coating 4, indicated by horizontally running dashes in Figure 2, the strength of the depositing current has been increased continuously during the coating process. In this way, the coating 4 was formed slowly at the beginning of the coating process, so that in its region which comes into contact with the lateral surface 3 of the roller body 2, the coating 4 has a fine microstructure and a low hardness, in the region of 150 to 250 HV, while simultaneously having increased ductility. Therefore, the coating in the concerning thickness region may follow the expansion of the roller body 2 which results because of the heating during casting.

In the course of the coating process, the depositing current has been continuously increased linearly, with the consequence that the coating formation occurs more

and more rapidly and with increasingly coarse grain. In this way, the hardness of the coating increases linearly in the direction of the external surface 5, which comes into contact with the molten metal, so that the coating has a maximum hardness in the range from 400 to 500 HV, which causes high wear resistance, at the external surface 5.

Reference numbers

- 1 casting roller
- 2 roller body
- 3 external lateral surface of the roller body
- 4 coating
- 5 external surface
- D thickness of the coating 4

CLAIMS

1. A casting roller for casting molten metal, particularly molten steel, having a roller body (2) made of a metallic material, onto which a coating (4) is applied, which is made of a metal material having a greater hardness than the material of the roller body (2),

characterized in that

the coating (4), viewed over its thickness (D), has a lower hardness in its region bordering the roller body (2) than in the region of its free surface (5).
2. The casting roller according to Claim 1,

characterized in that

the coating (4) has a different composition in its region bordering the roller body (2) than in the region of its free surface (5).
3. The casting roller according to one of Claims 1 or 2,

characterized in that

the coating (4) has a softer microstructure in its region adjoining the roller body (2) than in the region of its free surface (5).
4. The casting roller according to one of the preceding claims,

characterized in that

the hardness of the coating (4) increases continuously beginning with the region bordering the roller body (2) up to its free surface (5).

5. The casting roller according to Claim 4,

characterized in that

the hardness increases linearly.

6. The casting roller according to Claim 4,

characterized in that

the increase of the hardness has a progressively increasing trend.

7. The casting roller according to one of the preceding claims,

characterized in that

the hardness of the coating (4) is 150 HV to 250 HV in the region bordering the roller body (2) and is 400 HV to 500 HV in the region of the free surface (5).

8. The casting roller according to one of the preceding claims,

characterized in that

the roller body (2) is manufactured from a copper alloy, at least in its lateral surface (3), which is bonded to the coating (5).

9. The casting roller according to one of the preceding claims,

characterized in that

the coating (4) is formed based on a nickel alloy.

10. A method of manufacturing a casting roller (1) in which a coating (4) made of a metallic coating material is applied to a roller body (2) through electrolytic deposition,

characterized in that

the deposition current is increased starting from a minimum value in the course of the coating process.

11. The method according to Claim 10,

characterized in that

the depositing current is increased continuously.

12. The method according to Claim 11,

characterized in that

the increase is linear.

13. The method according to Claim 11,

characterized in that

the increase is progressive.

14. The method according to one of Claims 10 through 13,

characterized in that

the coating is formed based on a nickel alloy.

15. A method of manufacturing a casting roller (1), in which a coating (4) made of a metallic coating material is applied to a roller body (2) through electrolytic deposition,

characterized in that

in the course of the coating process, the proportions of the elements in the electrolytes which lead to an increase of the hardness of the particular material deposited are increased.

16. The method according to Claim 15,

characterized in that

the increase of the proportions of elements which increase hardness takes place continuously.

17. The method according to Claim 16,

characterized in that

the increase takes place linearly.

18. The method according to Claim 16,

characterized in that

the increase takes place progressively.

19. The method according to one of Claims 15 through 18,

characterized in that

the coating is formed based on a nickel alloy.
20. The method according to one of Claims 15 through 19,

characterized in that

sodium citrate is added to the electrolyte as
hardness-increasing element.
21. The method according to one of Claims 15 through 19,

characterized in that

sulfur is added to the electrolyte as hardness-
increasing element.

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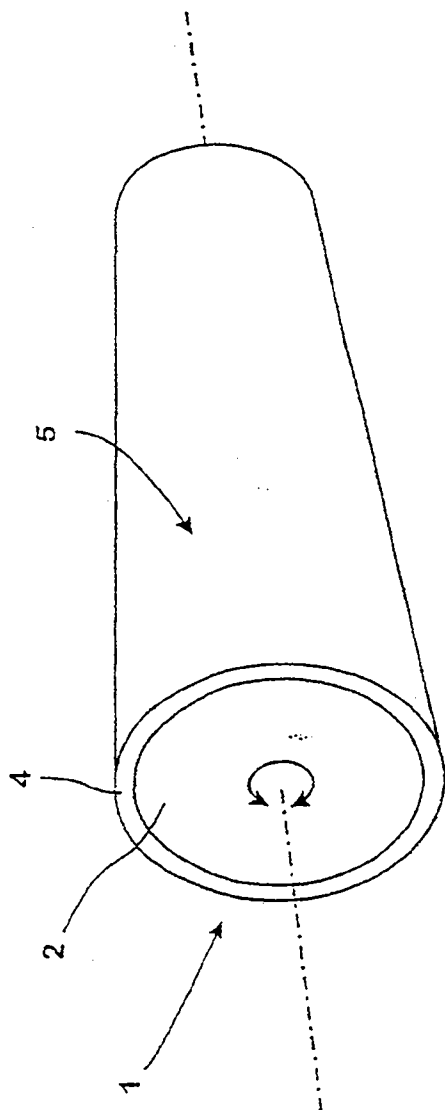


Fig. 1

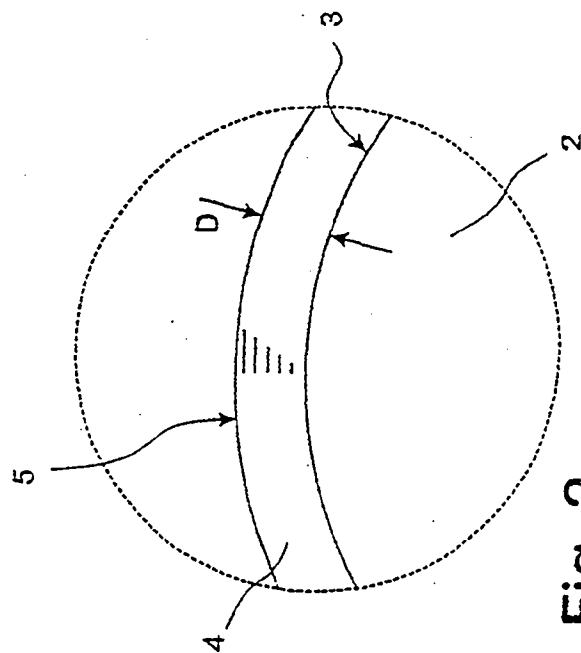


Fig. 2