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(54) Continuous casting roll

(57) A continuous casting roll (1), particularly for producing aluminum or aluminum alloy strips. The roll (1) comprises a roll body (2) which has a substantially cylindrical central portion (3) and a jacket (6) for cladding the central portion (3) of the roll body (2) designed to be contacted by the molten material. The roll (1) has means for cooling the jacket which comprise cooling ducts which are formed at least partially in the jacket (6) and can be supplied with a cooling fluid.

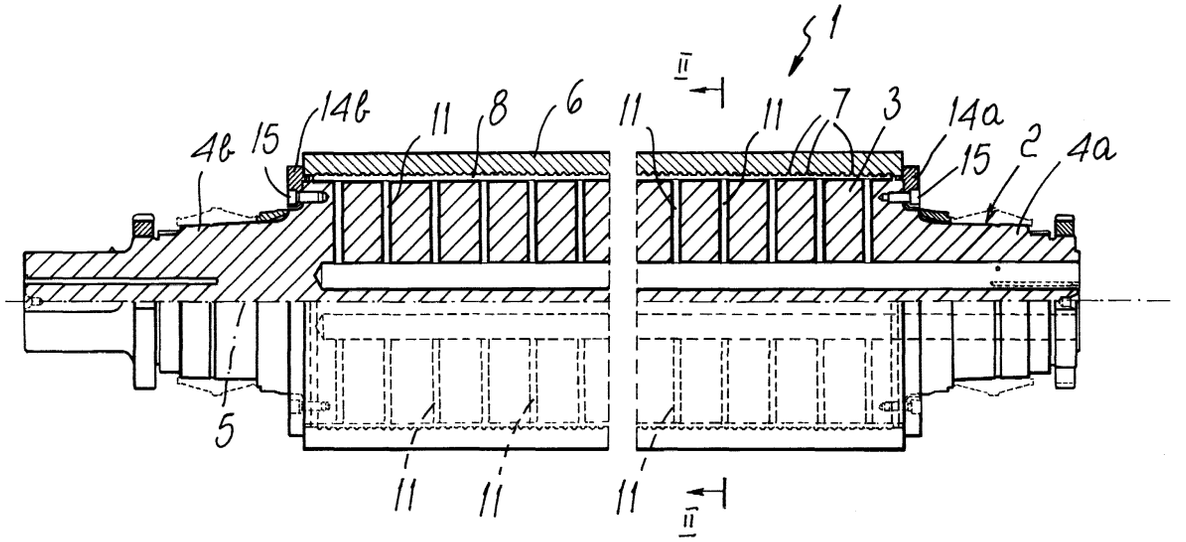

Fig.1

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Description

[0001] The present invention relates to a continuous casting roll particularly for producing aluminum or aluminum alloy strips.

[0002] It is known that in the production of aluminum or aluminum alloy strips, the liquid metal is poured between two hot-rolling rolls which are appropriately cooled and which are turned about their respective mutually parallel axes in opposite directions, causing the solidification of the poured metal and providing in output a strip of metal whose thickness is a function of the distance between the rolls.

[0003] The resulting metal strip is then subjected to cold rolling in order to gradually bring the strip to the required thickness.

[0004] Hot-rolling rolls are generally constituted by a body which has a substantially cylindrical central portion and two end portions which are also substantially cylindrical but have a smaller diameter than the central portion, protrude coaxially from the two ends of said central portion and are used to support the roll so that it can rotate about its own axis and to connect it to actuation means which turn the roll about its own axis.

[0005] The central portion is covered with a jacket which is constituted by a hollow cylinder which is open at its ends and is the part of the roll that makes direct contact with the molten metal.

[0006] The roll is cooled by circulating a cooling fluid, generally constituted by water, in cooling ducts formed in the body of the roll.

[0007] More particularly, the cooling ducts are constituted by circumferential grooves which are formed in the cylindrical surface of the central portion of the body of the roll. The circumferential grooves generally have, in a cross-section taken along a radial plane, a semicircular shape and are closed, on their side directed away from the axis of the roll, by the internal surface of the jacket, which mates with the cylindrical surface of the central portion of the body of the roll.

[0008] The jacket is cooled mostly by direct contact of the jacket with the cooling fluid and to a much smaller extent by virtue of the contact of the jacket with the cylindrical surface of the central portion of the body of the roll.

[0009] Continuous research aimed at increasing the rolling speed in order to improve production has revealed limitations and problems in rolls of the above described type.

[0010] The cooling of the roll is in fact often insufficient to adequately dissipate the heat transmitted from the molten metal to the roll.

[0011] As a consequence, the jacket can wear rapidly, forcing to stop the rolling plant in order to replace it.

[0012] Furthermore, the gradual heating of the roll can produce deformations of the roll which cause irregularities in the thickness of the rolled metal strip. Accordingly, the thickness of the rolled strip cannot be reduced below a certain limit, as instead would be desirable in order to reduce the cold-rolling cycles and thus speed up production.

[0013] Another problem is constituted by the times and costs required to restore, during the replacement of the jacket, the profile of the central portion of the body of the roll. Particularly the edge regions of the circumferential grooves adjacent to the cylindrical surface of said portion, as a consequence of the temperatures that are reached and of the mating contact with the jacket, are often broken or seized and require machining in order to restore the correct profile of the portion of the body of the roll.

[0014] The aim of the present invention is to solve the above problems, by providing a continuous casting roll, particularly for producing aluminum or aluminum alloy strips, which can be cooled more effectively than conventional continuous casting rolls.

[0015] Within the scope of this aim, an object of the invention is to provide a continuous casting roll which allows to achieve higher rolling speeds and thus allows to increase the productivity of rolling lines.

[0016] Another object of the invention is to provide a roll which achieves a longer life for the jacket and thus reduces maintenance for replacing it.

[0017] Another object of the invention is to provide a roll which, by virtue of better cooling, is less deformable and thus allows to obtain a rolled strip which has a more uniform thickness.

[0018] Another object of the invention is to provide a roll which allows simpler and faster jacket replacement operations.

[0019] This aim and these and other objects which will become better apparent hereinafter are achieved by a continuous casting roll, particularly for producing aluminum or aluminum alloy strips, which comprises a roll body which has a substantially cylindrical central portion and a jacket for cladding said central portion of the roll body which is designed to be contacted by the molten material, means for cooling said jacket being provided, characterized in that said cooling means comprise cooling ducts which are formed at least partially in said jacket and can be supplied with a cooling fluid.

[0020] Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of the continuous casting roll according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a partially sectional view, taken along an axial plane, of the roll according to the invention;

Figure 2 is an enlarged-scale sectional view of Figure 1, taken along the line II-II;

Figure 3 is an enlarged-scale view of a detail of Figure 1, illustrating the cooling ducts;

Figure 4 is an enlarged-scale view of another detail of Figure 1, related to the sealing region between

the jacket and the roll body.

[0021] With reference to the figures, the continuous casting roll according to the invention, generally designated by the reference numeral 1, comprises a body 2 of the roll which has a central portion 3 which covers most of the axial extension of the roll 1 and is substantially cylindrical.

[0022] Two end portions 4a and 4b protrude from the two ends of the central portion 3 and are coaxial to the central portion 3; by virtue of said end portions, the roll 1 is supported, in a per se known manner, so that it can rotate about its own axis 5, which constitutes the common axis of the portions 3, 4a and 4b; by virtue of said end portions, furthermore, the roll 1 is connected to actuation means which turn it about the axis 5.

[0023] The roll 1 also comprises a jacket 6 which clads the central portion 3 and is provided with means for cooling the jacket 6.

[0024] According to the invention, the cooling means comprise cooling ducts which are formed at least partially in the jacket 6 and can be supplied with a cooling fluid which can be simply constituted by water, optionally corrected with known types of additive.

[0025] The jacket 6 is constituted by a hollow cylinder which is open at its ends and is fitted coaxially around the central portion 3 of the body 2 of the roll. The cooling ducts comprise a plurality of circumferential grooves 7 which are formed on the internal surface of the jacket and run around the axis 5 of said jacket. The circumferential grooves 7 are closed, on their side directed toward the axis 5, by the cylindrical surface of the central portion 3 of the body 2 of the roll 1 which mates with the internal surface of the jacket 6.

[0026] The circumferential grooves 7 preferably have, in a radial cross-section, a substantially rectangular shape, in which one side is closed by the cylindrical surface of the central portion 3 of the body 2 of the roll and the edges that are not adjacent to said side are radiused.

[0027] As an alternative, the circumferential grooves 7 can have, in radial cross-section, a substantially semicircular shape.

[0028] The central portion 3 of the body 2 of the roll has, on its cylindrical surface mated with the internal surface of the jacket 6, axial grooves 8 for connecting the cooling ducts constituted by the circumferential grooves 7.

[0029] In the central portion 3 of the body 2 of the roll, proximate to the axis 5, there are at least one supply duct 9 and at least one discharge duct 10 for the cooling fluid. The supply duct 9 and the discharge duct 10 run parallel to the axis 5 and are connected to the grooves 7 through connecting ducts 11 which are formed radially in the central portion 3 of the body 2 of the roll and have an inlet or an outlet in the axial grooves 8.

[0030] In the illustrated embodiment there are two supply ducts 9 which are alternated with two discharge ducts 10, but the number of these ducts can vary according to the requirements.

[0031] The supply ducts 9 and the discharge ducts 10 are provided with an inlet or an outlet at one of the axial ends of the body 2 of the roll 1 and are connected, by virtue of said inlets or outlets, to a line for circulating the cooling fluid, in a per se known manner.

[0032] Sealing means are conveniently interposed between the jacket 6 and the central portion 3 of the body 2 of the roll.

[0033] More particularly, said sealing means comprise, for each axial end of the central portion 3 of the body 2 of the roll 1, as shown in particular in Figure 4, an annular gasket 12 which is partially accommodated in a circumferential seat 13 formed coaxially in the cylindrical surface of the central portion 3 of the body 2 of the roll proximate to its axial ends.

[0034] The jacket 6 is locked axially on the central portion 3 of the body of the roll 2 by two disk-like bodies 14a and 14b which are fixed, by virtue of screws 15, to the two opposite ends of the central portion 3 of the body 2 of the roll 1. The circumferential seat 13 is delimited axially, toward the outside of the central portion 3, by an annular protrusion 16 of the corresponding disk-like body 14a or 14b. An additional annular gasket 17 can be interposed between the gasket 12 and the annular protrusion 16.

[0035] In the continuous casting roll according to the invention, since the cooling ducts constituted by the circumferential grooves 7 are formed in the jacket 6 instead of in the central portion of the body of the roll as in conventional rolls, the surface of the jacket that is in direct contact with the cooling fluid is greater for an equal passage section for the cooling fluid. By virtue of this fact, again for an equal passage section for the cooling fluid, the heat exchange between the jacket and the cooling fluid is more efficient. For this reason, the cooling of the continuous casting roll according to the invention is better than the cooling that can be obtained in conventional types of continuous casting roll. For this reason, the jacket 6 of the continuous casting roll according to the invention can be cooled to a greater extent and more uniformly than conventional types of continuous casting roll. This allows to achieve higher rolling speeds and reduce the wear of the jacket.

[0036] Furthermore, since the cooling ducts are formed in the jacket 6, the central portion 3 of the body 2 of the roll 1 clad by the jacket 6 has a substantially continuous cylindrical profile which, during the replacement of the jacket 6, does not have to be subjected to mechanical operations in order to repair breakages or seizures, thus allowing to replace the jacket 6 in a shorter time.

[0037] The better cooling achieved in the continuous casting roll according to the invention considerably limits the deformation of the roll during its operation and therefore provides a rolled product which has a more uniform thickness. This allows to also reduce the thickness of the rolled product and therefore to consequently reduce

the subsequent cold-rolling cycles required to bring the rolled product to the intended thickness. All these advantages lead to an increase in the productivity of the entire rolling line and therefore ultimately lead to a reduction in the production costs of the rolled product.

[0038] In practice it has been observed that the roll according to the invention fully achieves the intended aim, since it can be cooled more effectively than continuous casting rolls of the conventional type, achieving all of the above noted advantages.

[0039] The continuous casting roll thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept; all the details may further be replaced with other technically equivalent elements.

[0040] In practice, the materials employed, so long as they are compatible with the specific use, as well as the dimensions, may be any according to requirements and to the state of the art.

[0041] The disclosures in Italian Patent Application No. MI2000A000148 from which this application claims priority are incorporated herein by reference.

[0042] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A continuous casting roll, particularly for producing aluminum or aluminum alloy strips, comprising a roll body which has a substantially cylindrical central portion and a jacket for cladding said central portion of the roll body which is designed to be contacted by the molten material, means for cooling said jacket being provided, characterized in that said cooling means comprise cooling ducts which are formed at least partially in said jacket and can be supplied with a cooling fluid.

2. The continuous casting roll according to claim 1, characterized in that said jacket is constituted by a hollow cylinder which is open at its ends and is fitted coaxially around said central portion of the body of the roll, said cooling ducts comprising a plurality of circumferential grooves which are formed on the internal surface of said jacket and run around the axis of said jacket; said circumferential grooves being closed, on their side directed toward the axis of the jacket, by the cylindrical surface of said central portion of the body of the roll which mates with the internal surface of said jacket.

3. The continuous casting roll according to claims 1 and 2, characterized in that said central portion of the body of the roll has, on its cylindrical surface which is mated with the internal surface of said jacket, axial grooves for the connection of said cooling ducts.

4. The continuous casting roll according to one or more of the preceding claims, characterized in that at least one supply duct and at least one discharge duct for the cooling fluid are formed in said central portion of the body of the roll, proximate to the axis of the body of the roll, said supply duct and said discharge duct running parallel to the axis of the body of the roll and being connected to said cooling ducts by means of connecting ducts formed radially in said central portion of the body of the roll and with an inlet or outlet in said axial grooves.

5. The continuous casting roll according to one or more of the preceding claims, characterized in that said circumferential grooves have, in a radial cross-section, a substantially rectangular shape in which one side is closed by the cylindrical surface of said central portion of the body of the roll and the comers that are not adjacent to said side are radiused.

6. The continuous casting roll according to one or more of the preceding claims, characterized in that said circumferential grooves have a substantially semicircular radial cross-section.

7. The continuous casting roll according to one or more of the preceding claims, characterized in that sealing means are interposed between said jacket and said central portion of the body of the roll.

8. The continuous casting roll according to one or more of the preceding claims, characterized in that said sealing means comprise, for each axial end of said central portion of the body of the roll, an annular gasket which is partially accommodated in a circumferential seat formed coaxially in the cylindrical surface of said central portion of the body of the roll.

9. The continuous casting roll according to one or more of the preceding claims, characterized in that said jacket is locked axially on said central portion of the body of the roll by two disk-like bodies which are fitted coaxially on said body of the roll on the two opposite ends of said central portion of the body of the roll, said disk-like bodies closing one side of said circumferential seats that accommodate said annular gaskets.

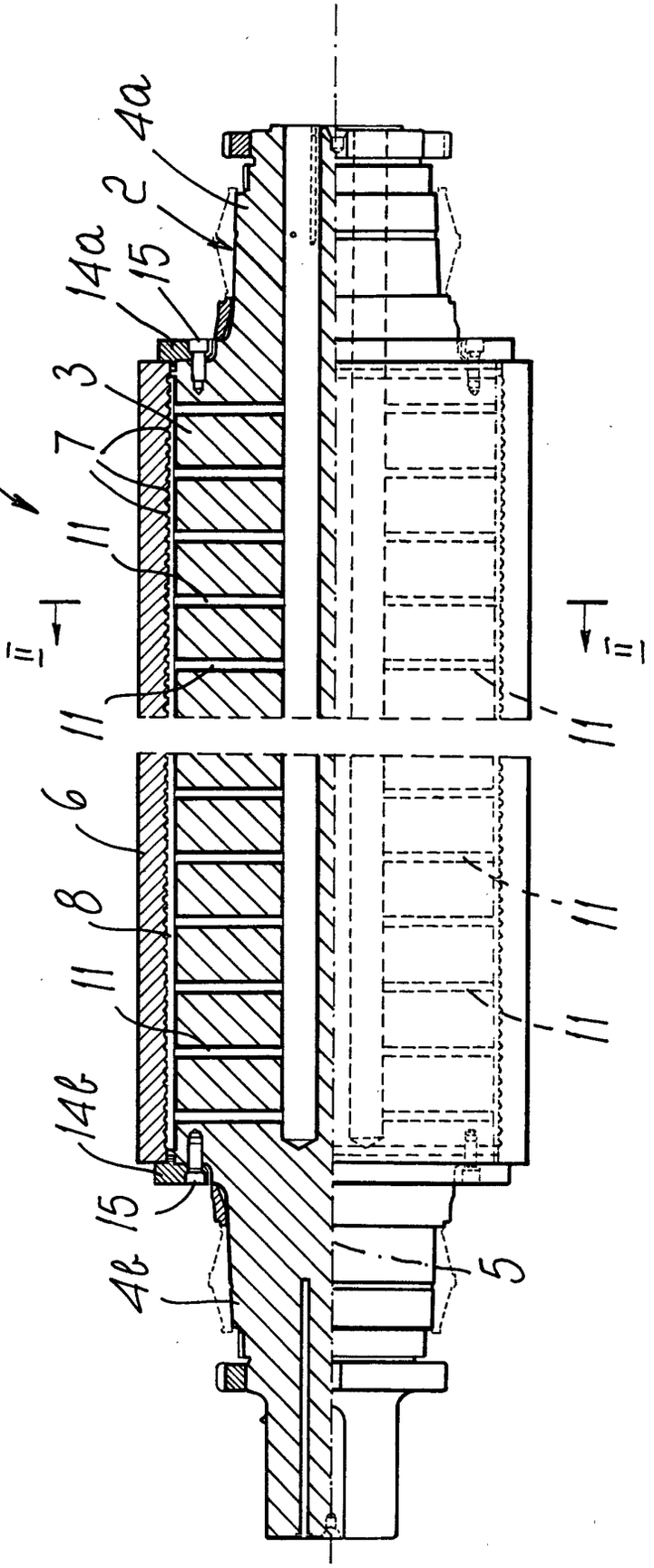

Fig. 1

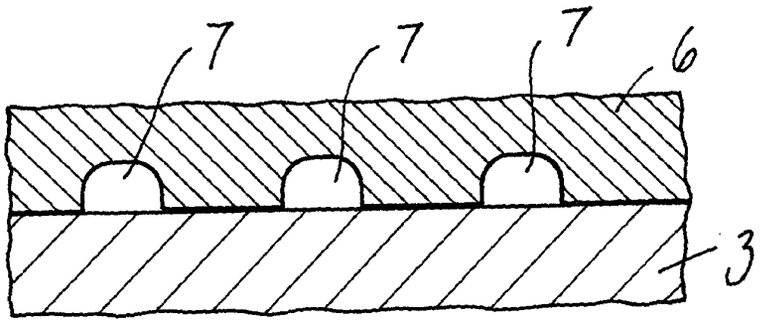

FIG. 3

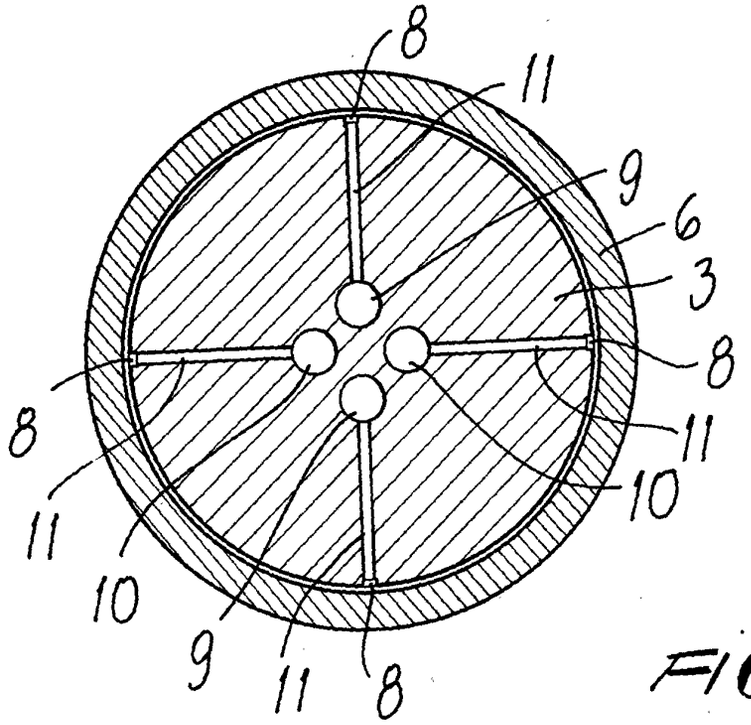

FIG. 2

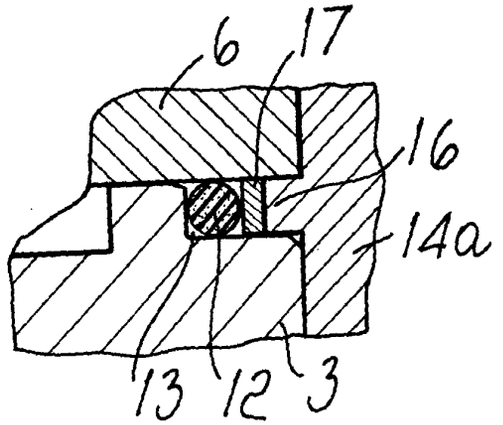

FIG. 4

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30 May 2001	Mailliard, A

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

Application Number
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

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