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(54) **SEALING DEVICE OF THE DUMMY BAR OF A CONTINUOUS CASTING MACHINE AND ASSOCIATED ASSEMBLY PROCESS**

(57) The present invention relates to a sealing device of the dummy bar of a continuous casting machine that does not depend on the dimensions of the dummy bar of the continuous casting machine due to the fact that it comprises a guiding system that makes it possible to couple the sealing device to the dimensions of the dummy bar of the continuous casting machine to which it is coupled. The assembly process associated with the sealing device of the dummy bar of a continuous casting machine is also an object of the present invention.

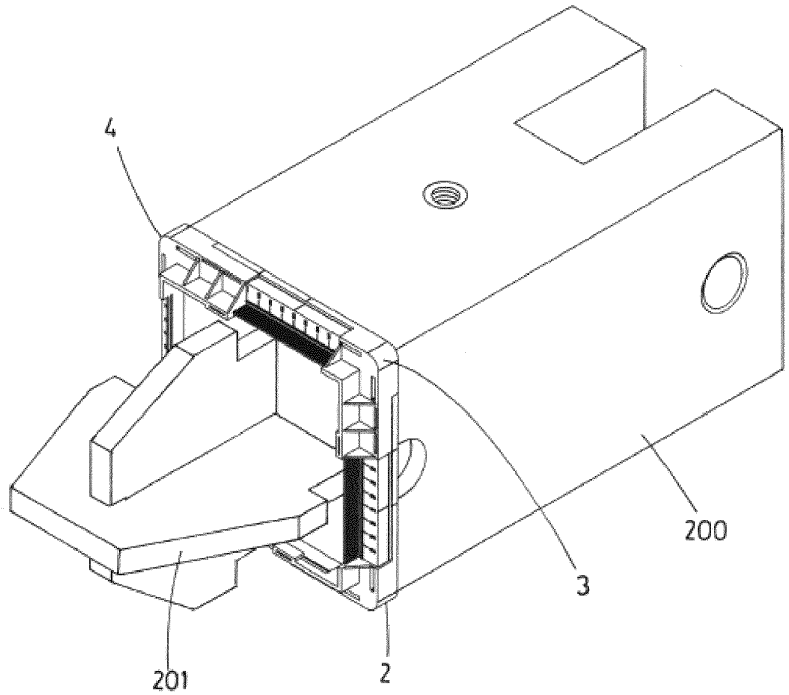

FIG.3

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Description

OBJECT OF THE INVENTION

[0001] The present invention relates to a sealing device of the dummy bar of a continuous casting machine that does not depend on the dimensions of the dummy bar of the continuous casting machine.

[0002] The sealing device of the dummy bar of a continuous casting machine of the present invention comprises a guiding system that makes it possible to couple the sealing device to the dimensions of the dummy bar of the continuous casting machine to which it is coupled.

[0003] The assembly process associated with the sealing device of the dummy bar of a continuous casting machine is also an object of the present invention.

BACKGROUND OF THE INVENTION

[0004] Document JPH08174160A is known in the state of the art, which describes a sealing device of a dummy bar head consisting of a recessed groove of dovetail groove section which is annularly provided on the periphery of a dummy bar head and an annular seal packing which is fittable to the recessed groove and made of an elastic body such as silicone or rubber.

[0005] The seal packing is provided with a fixed base part having a trapezoidal section, and a tongue part which is projected from the fixed base part in the cantilever manner, and a semi-circular slit is provided on the bottom part of the fixed base part. The dummy bar head where the seal packing is fitted to the recessed groove is inserted in the mould, and the whisker is arranged on the seal packing to complete the sealing work. The tongue-shaped part seals the clearance between the dummy bar head and the mould.

[0006] Document US2016065121A1 is also known, which describes a continuous casting apparatus comprising: a cast steel receiving unit for receiving a molten steel in a liquid phase; a mould connected to the cast steel receiving unit for cooling the molten steel; and a dummy bar head inserted into the mould. It also comprises a flat sealing unit that is hermetically sealed between the mould and the dummy bar head and is located in a flat unit of the dummy bar head and includes the first sealing unit and a second sealing unit connected to the first sealing unit, and has a mould sealing unit. The first sealing unit includes a first heat sink having a shape corresponding to the flat unit of the fill bar head, and a first frame arranged on the first heat sink.

[0007] However, the sealing devices of the dummy bar of continuous casting machines described above depend on the dimensions of the continuous casting machine and do not allow its coupling to any dummy bar.

[0008] The applicant is not aware of any sealing device of the dummy bar of a continuous casting machine that resolves the issues mentioned above.

DESCRIPTION OF THE INVENTION

[0009] The present invention relates to a sealing device of the dummy bar of a continuous casting machine that does not depend on the dimensions of the dummy bar of the continuous casting machine.

[0010] The sealing device of the dummy bar of a continuous casting machine, wherein the casting machine comprises a mould and a dummy bar head, which in turn comprises a starting element, comprises:

- at least two parts that can be coupled together, configured to be coupled to the starting element, which in turn is coupled to the dummy bar head and carries out the sealing between the dummy bar and the mould, wherein the at least two parts that can be coupled together comprise guiding means configured to vary the relative position between them of the at least two parts that can be coupled together in a first direction and in a first guide direction.

[0011] This way, the sealing device of the dummy bar of a continuous casting machine of the present invention does not depend on the dimensions of the dummy bar head of the continuous casting machine, and consequently of the head thereof, and can be coupled to different dummy bar heads of casting machines of different dimensions.

[0012] Preferably, the guiding means comprise first splines which are essentially perpendicular to the first guide direction and arranged on a first part that can be coupled of the at least two parts that can be coupled together, which are arranged opposite to second splines which are essentially perpendicular to the first guide direction and arranged on a second part that can be coupled of the at least two parts that can be coupled together,

[0013] Optionally, the guiding means comprise anchoring means configured to set the final position of the at least two parts that can be coupled together, which final position is associated with the dimensions of the dummy bar head of the continuous casting machine where the sealing device is coupled.

[0014] Preferably, the anchoring means are the first splines which are essentially perpendicular to the first guide direction and arranged on the first part that can be coupled of the at least two parts that can be coupled together, which are arranged opposite the second splines which are essentially perpendicular to the first guide direction and arranged on the second part that can be coupled of the at least two parts that can be coupled together, because they prevent the movement of the first part that can be coupled with respect to the second part that can be coupled or vice versa, in the first guide direction and in a first anchoring direction opposite the first guide direction.

[0015] Optionally, the at least two parts that can be coupled together comprise a graduated scale that makes it possible to determine the final position of the guiding

means depending on the dimensions of the dummy bar head of the continuous casting machine.

[0016] Optionally, at least one of the at least two parts that can be coupled together is flexible.

[0017] The invention also relates to an assembly process of the sealing device of the dummy bar of a continuous casting machine described above, comprising:

- a guiding step of the guiding means of the at least two parts that can be coupled together, wherein there is a variation of the relative position between them and a coupling of the at least two parts that can be coupled together.

[0018] Optionally, the assembly process also comprises an anchoring step, wherein the final position of the at least two parts that can be coupled together is set, which final position is associated with the dimensions of the dummy bar head of the continuous casting machine.

[0019] Optionally, the assembly process comprises a fitting step of the at least two parts that can be coupled together to the dimensions of the dummy bar head of the continuous casting machine prior to the guiding step, wherein the fitting step comprises a cutting sub-step of at least one of the at least two parts that can be coupled together.

[0020] Optionally, the assembly process also comprises an installation step of the at least two parts that can be coupled together to the starting element, which in turn is coupled to the dummy bar head of the continuous casting machine after the guiding step.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

FIG. 1 shows a perspective view of the coupling of the four parts that can be coupled together, two by two, of the sealing device of the dummy bar head of a continuous casting machine of the present invention according to a first preferred embodiment.

FIG. 2 shows a perspective view of the first and the second part that can be coupled of the at least two parts that can be coupled together of the sealing device of the dummy bar head of a continuous casting machine of the present invention.

FIG. 3 shows a perspective view of the sealing device of the present invention, according to the first preferred embodiment, already installed in the starting element, which has already been coupled to the dummy bar head of the continuous casting machine.

PREFERRED EMBODIMENT OF THE INVENTION

[0022] In a preferred embodiment of the invention, the sealing device of the dummy bar of a continuous casting machine, wherein the casting machine comprises a mould and a dummy bar head (200), which in turn comprises a starting element (201) of the casting, comprises:

- at least two parts (1, 2, 3, 4) that can be coupled together, configured to be coupled to the starting element (201) of the casting that is connected to the dummy bar head (200) and carries out the sealing between the starting element (201) and the mould, wherein the at least two parts (1, 2, 3, 4) that can be coupled together comprise guiding means (5, 6) configured to vary the relative position between them of the at least two parts (1, 2, 3, 4) that can be coupled together in a first direction (10) and in a first guide direction.

[0023] The guiding means (5, 6) comprise first splines (5) which are essentially perpendicular to the first guide direction (10) and arranged on a first part (1) that can be coupled of the at least two parts (1, 2, 3, 4) that can be coupled together, which are arranged opposite second splines (6) which are essentially perpendicular to the first guide direction (10) and arranged on a second part (2) that can be coupled of the at least two parts (1, 2, 3, 4) that can be coupled together.

[0024] In a first preferred embodiment, the sealing device comprises four parts (1, 2, 3, 4) that can be coupled together, two by two, as shown in FIG. 1, namely a first part (1) that can be coupled, a second part (2) that can be coupled, a third part (3) that can be coupled, and a fourth part (4) that can be coupled, wherein each of the four parts (1, 2, 3, 4) that can be coupled together comprises the guiding means (5, 6), which in turn comprise first splines (5) which are essentially perpendicular to a guide direction (10, 11, 12, 13), which can be the first guide direction (10) or a second (11), third (12) or fourth (13) guide direction, and second splines (6) which are essentially perpendicular to the guide direction (10, 11, 12, 13) which can be the first guide direction (10) or the second (11), third (12) or fourth (13) guide direction, for coupling each of the four parts (1, 2, 3, 4) that can be coupled together with the other two adjacent parts (1, 2, 3, 4) that can be coupled together, wherein at least one of the at least two parts (1, 2, 3, 4) that can be coupled together is flexible.

[0025] In this first embodiment, each of the four parts (1, 2, 3, 4) that can be coupled together comprises a first straight section (7) followed by a second straight section (8) forming a 90° angle with the first straight section, wherein preferably the first straight section (7) is shorter than the second straight section (8), or vice versa, or also preferably, the first straight section (7) has the same length as the second straight section (8).

[0026] This way, it is possible to configure rectangular or square-shaped sealing means of the starting element (201) connected to the dummy bar head (200).

[0027] The guiding means (5, 6) also act as anchoring means configured to set the final position of the at least two parts (1, 2, 3, 4) that can be coupled together, which final position is associated with the dimensions of the

starting element (201) of the continuous casting machine coupled to the dummy bar head (200), i.e. the anchoring means are the first splines (5) which are essentially perpendicular to the first guide direction (10) and arranged on the first part (1) that can be coupled of the at least two parts (1, 2, 3 4) that can be coupled together, which are opposite the second splines (6) which are essentially perpendicular to the first guide direction (10) and arranged on the second part (2) that can be coupled of the at least two parts (1, 2, 3, 4) that can be coupled together because they prevent the movement of the first part (1) that can be coupled with respect to the second part (2) that can be coupled or vice versa, in the first guide direction (10) and in the first anchoring direction opposite the first guide direction.

[0028] The at least two parts (1, 2, 3, 4) that can be coupled together comprise a graduated scale (15) that makes it possible to determine the final position of the guiding means (5, 6) depending on the dimensions of the starting element (201) coupled to the dummy bar head (200) of the continuous casting machine.

[0029] In a second embodiment, the at least two parts that can be coupled together have the shape of an arc, wherein the guide direction or directions are essentially perpendicular to an initial spline located on an edge of the guiding means. In this case, the two parts are intended to be coupled to the starting element (201) that is coupled to the dummy bar head (200), when the same has a circular section, regardless of the diameter of the dummy bar head (200).

[0030] The invention also relates to an assembly process of the sealing device of the starting element (201) connected to the dummy bar head (200) of a continuous casting machine described above, comprising:

- a guiding step of the guiding means (5, 6) of the at least two parts (1, 2, 3, 4) that can be coupled together, wherein there is a variation of the relative position between them and a coupling of the at least two parts (1, 2, 3, 4) that can be coupled together.

[0031] In the case of the first embodiment, the guiding step is repeated for each two pairs of parts (1, 2, 3, 4) that can be coupled together, two by two, between the first part (1) that can be coupled, the second part (2) that can be coupled, the third part (3) that can be coupled, and the fourth part (4) that can be coupled. This step coincides with the anchoring step.

[0032] Optionally, the assembly process comprises a fitting step of the at least two parts (1, 2, 3, 4) that can be coupled together to the dimensions of the starting element (201), which in turn is coupled to the dummy bar head (200) of the continuous casting machine prior to the guiding step, wherein the fitting step comprises a cutting sub-step of at least one (1, 2, 3, 4) of the at least two parts (1, 2, 3, 4) that can be coupled together.

[0033] Optionally, the assembly process also comprises an installation step of the at least two parts (1, 2, 3, 4) that can be coupled together to the starting element (201) of the casting which is connected to the dummy bar head (200) of the continuous casting machine after the guiding step.

Claims

1. A sealing device of the dummy bar of a continuous casting machine, wherein the casting machine comprises a mould and a dummy bar head (200), which in turn comprises a starting element (201) of the casting, and wherein the sealing device comprises:

   • at least two parts (1, 2, 3, 4) that can be coupled together, configured to be coupled to the starting element (201), that is connected to the dummy bar head (200), and to carry out the sealing between the starting element (201) and the mould,

   characterised in that the at least two parts (1, 2, 3, 4) that can be coupled together comprise guiding means (5, 6) configured to vary the relative position between them of the at least two parts (1, 2, 3, 4) that can be coupled together in a first direction (10) and in a first guide direction.

2. The sealing device of the dummy bar of a continuous casting machine according to claim 1, **characterised in that** the guiding means (5, 6) comprise first splines (5), which are essentially perpendicular to the first guide direction (10) and arranged on a first part (1) that can be coupled of the at least two parts (1, 2, 3, 4) that can be coupled together, which are arranged opposite to second splines (6), which are essentially perpendicular to the first guide direction (10) and arranged on a second part (2) that can be coupled of the at least two parts (1, 2, 3, 4) that can be coupled together.

3. The sealing device of the dummy bar of a continuous casting machine according to any of the preceding claims, **characterised in that** the guiding means comprise anchoring means (5, 6) configured to set a final position of the at least two parts (1, 2, 3, 4) that can be coupled together.

4. The sealing device of the dummy bar of a continuous casting machine according to claims 2 and 3, **characterised in that** the anchoring means are the first splines (5), which are essentially perpendicular to the first guide direction (10) and arranged on the first part (1) that can be coupled of the at least two parts (1, 2, 3, 4) that can be coupled together, which are arranged opposite the second splines (6) which are essentially perpendicular to the first guide direction (10) and arranged on a second part (2) that can be coupled of the at least two parts (1, 2, 3, 4) that can

be coupled together, because they prevent the movement of the first part (1) that can be coupled with respect to the second part (2) that can be coupled or vice versa, in the first guide direction (10) and in a first anchoring direction opposite the first guide direction.

5. The sealing device of the dummy bar of a continuous casting machine according to any of the preceding claims, **characterised in that** the at least two parts (1, 2, 3, 4) that can be coupled together comprise a graduated scale (15) that allows to determine the final position of the guiding means (5, 6) depending on the dimensions of the starting element (201) that is connected to the dummy bar head (200) of the continuous casting machine.

6. The sealing device of the dummy bar of a continuous casting machine according to any of the preceding claims, **characterised in that** at least one of the at least two parts (1, 2, 3, 4) that can be coupled together is flexible.

7. The sealing device of the dummy bar of a continuous casting machine according to claim 6, **characterised in that** it comprises four parts (1, 2, 3, 4) that can be coupled together, two by two, namely a first part (1) that can be coupled, a second part (2) that can be coupled, a third part (3) that can be coupled, and a fourth part (4) that can be coupled, wherein each of the four parts (1, 2, 3, 4) that can be coupled together comprises the guiding means (5, 6), which in turn comprise first splines (5) which are essentially perpendicular to a guide direction (10, 11, 12, 13), which can be the first guide direction (10) or a second (11), third (12) or fourth (13) guide direction, and second splines (6) which are essentially perpendicular to the guide direction (10, 11, 12, 13) which can be the first guide direction (10) or the second (11), third (12) or fourth (13) guide direction, for coupling each of the four parts (1, 2, 3, 4) that can be coupled together with the other two adjacent parts (1, 2, 3, 4) that can be coupled together.

8. The sealing device of the dummy bar of a continuous casting machine according to claim 7, **characterised in that** each of the four parts (1, 2, 3, 4) that can be coupled together comprises a first straight section (7) followed by a second straight section (8) forming a 90° angle with the first straight section.

9. The sealing device of the dummy bar of a continuous casting machine according to claim 8, **characterised in that** the first straight section (7) is shorter than the second straight section (8), or vice versa, or the first straight section (7) has the same length as the second straight section (8).

10. The sealing device of the dummy bar of a continuous casting machine according to claim 7, **characterised in that** the at least two parts that can be coupled together have the shape of an arc, wherein the guide direction or directions are essentially perpendicular to an initial spline of the guiding means.

11. An assembly process of the sealing device of any of the preceding claims of the dummy bar head (200) of a casting machine, **characterised in that** it comprises:

- a guiding step of the guiding means (5, 6) of the at least two parts (1, 2, 3, 4) that can be coupled together, wherein a variation of the relative position between them and a coupling of the at least two parts (1, 2, 3, 4) that can be coupled together is carried out.

12. The assembly process of the sealing device according to claim 11, **characterised in that** it comprises an anchoring step wherein the final position of the at least two parts (1, 2, 3, 4) that can be coupled together is set.

13. The assembly process of the sealing device according to any of claims 11 or 12, **characterised in that** it comprises a fitting step of the at least two parts (1, 2, 3, 4) that can be coupled together to the dimensions of the starting element (201) of the continuous casting machine, prior to the guiding step, wherein the fitting step comprises a cutting sub-step of at least one of the at least two parts (1, 2, 3, 4) that can be coupled together.

14. The assembly process of the sealing device according to any of claims 11 to 13, **characterised in that** it also comprises an installation step of the at least two parts (1, 2, 3, 4) that can be coupled together, to the starting element (201) which is connected to the dummy bar head (200) of the continuous casting machine after the guiding step.

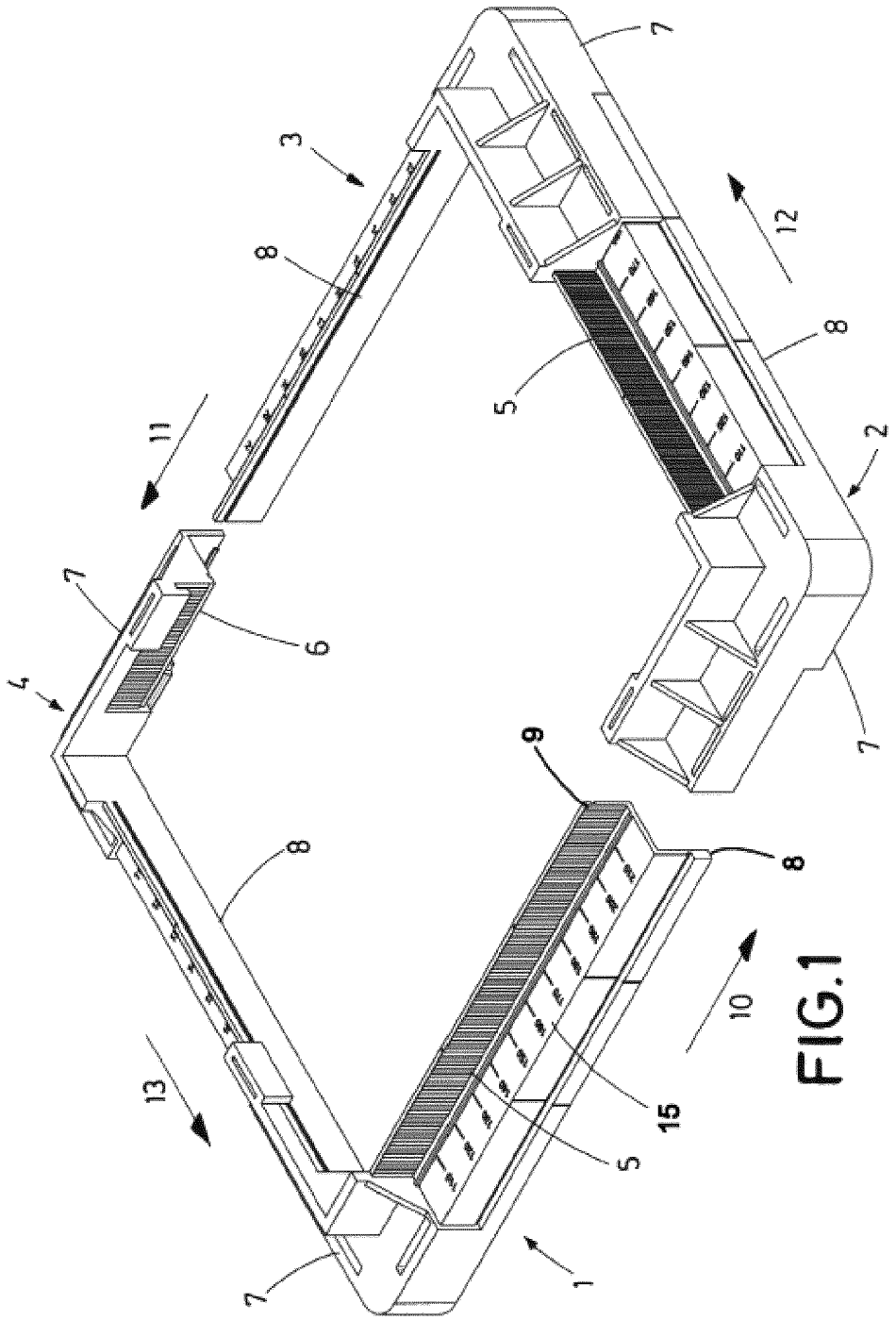

FIG.1

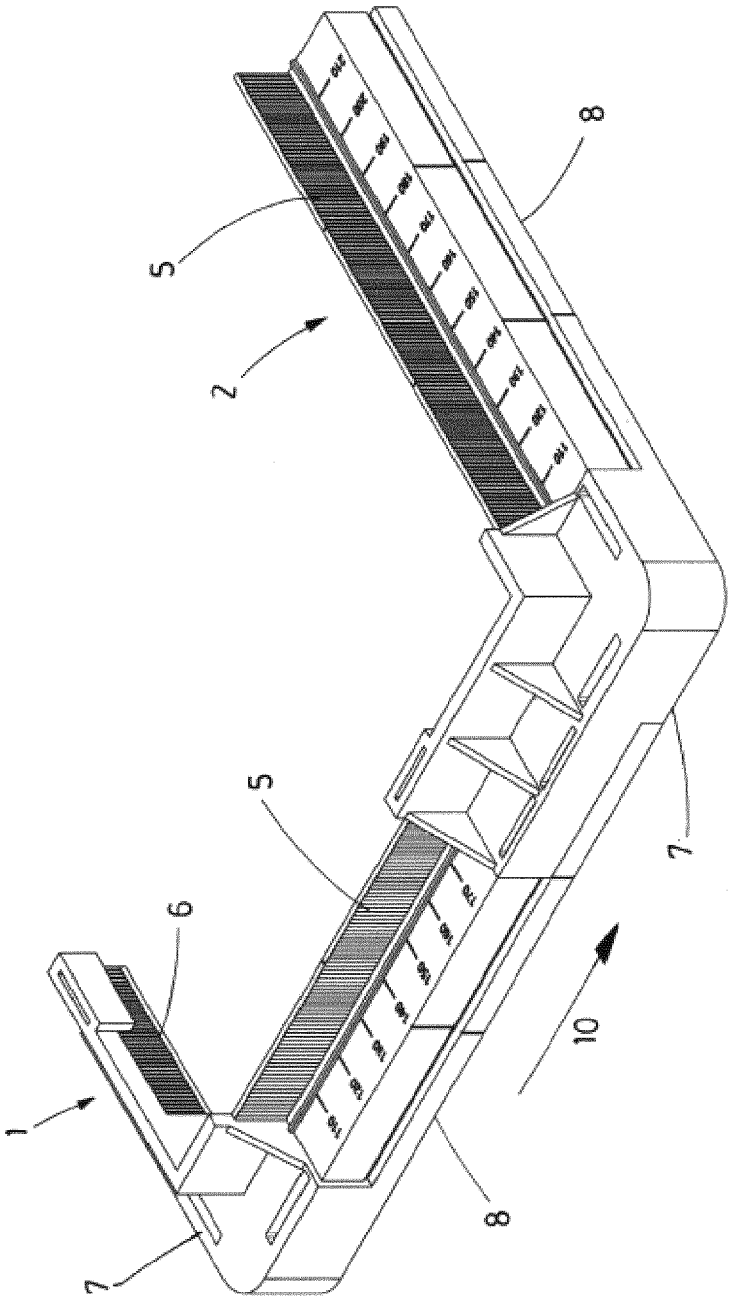

FIG.2

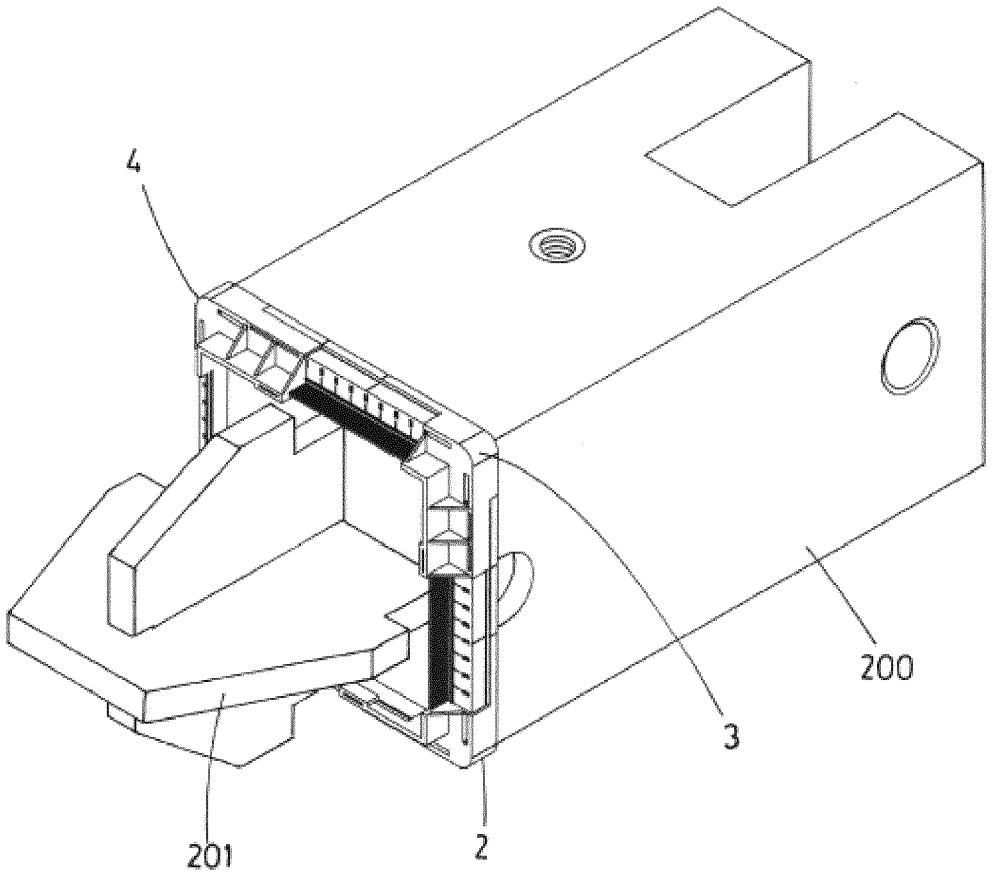

FIG.3

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EUROPEAN SEARCH REPORT

Application Number
EP 19 38 2829

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	KR 101 852 619 B1 (POSCO [KR]) 26 April 2018 (2018-04-26) * paragraph [0040] - paragraph [0074]; figures 1-8 *	1-3,5,6, 11-14	INV. B22D11/08
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TECHNICAL FIELDS SEARCHED (IPC)

B22D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 December 2019	Pipoli, Tiziana

CATEGORY OF CITED DOCUMENTS

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REFERENCES CITED IN THE DESCRIPTION

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