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(54) Temperature maintainance and/or heating apparatus for long metal products and the corresponding method

(57) Temperature maintenance and/or possible heating apparatus for long products continuously cast and sheared to size by means of shearing means (15) so as to define segments of bloom, said apparatus being disposed between a casting machine (11) having a first casting line (12) and a second casting line (13), and a rolling line (30) disposed downstream of the casting machine (11) in order to make long rolled metal products. The apparatus comprises: a mobile movement section (20) of said bloom segments, disposed downstream of said shearing means (15) and comprising a first mobile line (20) and a second mobile line (21), said first (20) and second (21) mobile line being suitable to move transversely to the direction of advance of the bloom segments in order to move to a first position in which said mobile line (20) and/or said second mobile line (21) are aligned respectively with the first casting line (12) and with the second casting line (13) and to a second position in which one of either of said first mobile line (20) or said second mobile line (21) is aligned with a conveying axis (23); and a furnace (24), disposed downstream of said mobile movement section (20), comprising an entrance rollerway (25) for the bloom segments aligned with said conveying axis (23), and an exit rollerway (27) aligned with said rolling line (30) and transverse transfer devices (46, 47) suitable to transfer the bloom segments from the entrance rollerway (25) toward the exit rollerway (26).

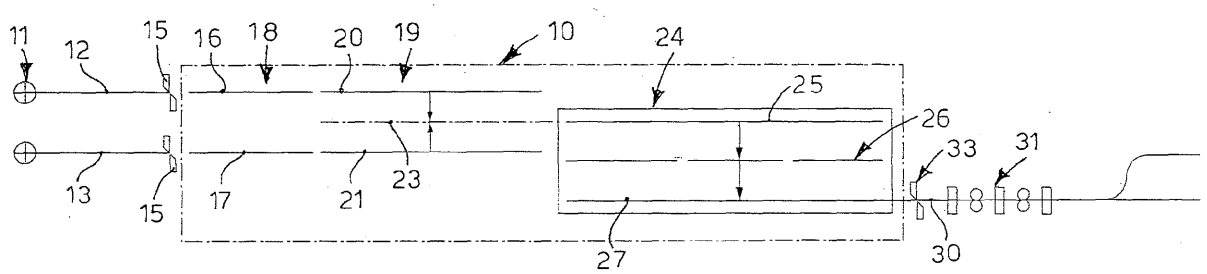

fig. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a temperature maintenance and/or possible heating apparatus for continuously cast long products and the relative method, for a casting and continuous rolling plant in semi-endless mode, to make long metal rolled products such as bars, wire rod, beams, rails or sections in general.

BACKGROUND OF THE INVENTION

[0002] Continuous casting plants known in the state of the art for the production of long rolled products have considerable limitations in that, for reasons intrinsically connected to operating constraints and performance of the components, their productivity does not generally exceed 25-40 ton/h.

[0003] Consequently, in order to obtain higher productivity it is necessary to increase the number of casting lines connected to the same rolling line, which can be up to 8 lines or more.

[0004] This entails, among other things, the need to translate the billets or blooms exiting from the various casting lines on a single entrance point of the heating furnace, with the consequent losses of temperature during the transfers.

[0005] As a consequence of this consideration, a considerable quantity of energy is needed to feed the heating furnace, to restore the temperature lost and bring it from the entrance value, comprised between 650°C and 750°C, to the value suitable for rolling, that is, in a range comprised between 1050°C and 1200°C.

[0006] Moreover, the need to transfer the segments of billets or blooms from the various casting lines to the point where they are introduced into the furnace, imposes limitations on the length and therefore the weight: the length of the billets or blooms is comprised between 12 and 14 meters, up to a maximum of 16 meters, and the weight is on average equal to 2-3 tons.

[0007] These process necessities and limitations are the main cause of an increase in energy required for heating the billets or blooms, and of a worsening in achieving the maximum productivity, due both to the large-sized tundishes that are needed to serve several casting lines and also to the large number of billets or blooms to be processed given the same number of tons/hour to be produced, with consequent high number of crops, heads entrances into the stands of the mill and sub-lengths with non-commercial sizes.

[0008] To overcome this disadvantage, the number of casting lines has been reduced to two only, providing a suitable temperature maintenance and/or possible heating apparatus which receives the blooms from the two lines and renders them available to the rolling line located downstream.

[0009] One purpose of the present invention is therefore to devise a temperature maintenance and/or possible heating apparatus for continuously cast long metal products and a relative method associated with two casting lines which allows to manage in a simple and reliable manner the segments of cast product, sheared to size.

[0010] Another purpose of the present invention is to exploit to the utmost the enthalpy possessed by the original liquid steel along all the production line, and in particular inside the maintenance and possible heating apparatus, reducing temperature losses in the time between shearing the cast product to size and sending it to the rolling step, so as to obtain a considerable saving of energy and a reduction in the running costs compared to conventional processes.

[0011] Further purposes of the invention are:

- to allow stoppages of the rolling mill, and in particular of the rolling trains, without having to interrupt the casting process upstream, thus obtaining a high plant utilization factor;
- to reduce to a minimum or eliminate the scrap material in emergency situations or during programmed stoppages and so completely recover the product which in these situations is temporarily accumulated inside the maintenance and/or possible heating apparatus, thus allowing to obtain a higher yield, equal to the ratio between weight of the finished product and weight of the liquid steel.
- to bring the performance of a semi-endless process closer to that of an endless process, that is, without solution of continuity between the continuous casting machine and the rolling line;
- to guarantee the possibility of changes in production in dimension and type without stopping the continuous casting, obtaining a higher plant utilization factor.

[0012] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0013] The present invention is set forth and characterized in the independent claims, while the dependent claims describe or variants to the main inventive idea.

[0014] A temperature maintenance and/or possible heating apparatus for long metal products according to the present invention is provided in a casting and continuous rolling plant of the semi-endless type for the production of long rolled products and is disposed between a continuous casting machine with two casting lines and a rolling line downstream.

[0015] The continuously cast metal products are sheared to size by shearing means disposed immediately downstream of the casting machine so as to define segments of bloom with a predefined length advantageously comprised between 16 and 60 m, preferably between 30

and 40 m.

[0016] The rolling line is disposed offset and parallel with respect to the casting lines.

[0017] Each casting line has a respective crystallizer which can cast products, in relation to thickness, at a variable speed from 3 to 9 m/min.

[0018] In the description and in the claims, by the term bloom we mean a product with a rectangular or square section in which the ratio between the long side and the short side is comprised between 1 and 4, that is, between the square section and the rectangular section in which the long side can be up to 4 times longer than the short side.

[0019] In the present invention the section of the cast product is not limited, as we said, to a quadrangular or rectangular section with straight and two by two parallel sides, but also comprises sections with at least a curved, concave or convex side, advantageously but not necessarily two by two opposite and specular, or combinations of the aforesaid geometries.

[0020] Simply to give an example, the square sections which are produced by each continuous casting line have dimensions which vary from about 100 mm x 100 mm, 130 mm x 130 mm, 150 mm x 150 mm, 160 mm x 160 mm or intermediate dimensions; in order to increase productivity, rectangular sections having dimensions which vary from 100 mm x 140 mm, 130 mm x 180 mm, 130 mm x 210 mm, 140 mm x 190 mm, 160 mm x 210 mm, 160 mm x 280 mm, 180 mm x 300 mm, 200 mm x 320 mm or intermediate dimensions can also be produced. In the case of the production of average profiles, even bigger dimensional sections can be used, for example of about 300 mm x 400 mm and similar.

[0021] The maintenance and/or possible heating apparatus according to the present invention is located downstream from the casting machine; said segments of bloom, sheared to size, enter directly and without intermediate movements and/or transfers into said apparatus at an average temperature of at least 1000°C, preferably comprised between about 1100°C and about 1150°C. The average temperature at which the bloom exits from the apparatus is comprised between about 1050°C and 1200°C.

[0022] According to a feature of the present invention, the temperature maintenance and/or possible heating apparatus comprises a mobile movement section and a furnace with lateral transfer, wherein the mobile movement section is disposed between the shearing to size means and the lateral furnace, and provides to move the bloom segments which are cast by the two casting lines. The movement section comprises:

- a first mobile line which, in a first position, is disposed aligned with the first casting line so as to receive from it the bloom segments and which, in a second position, is disposed aligned with a conveying axis which in turn is aligned with an entrance rollerway into the lateral furnace;
- a second mobile line which, in a first position, is disposed aligned with the second casting line so as to receive from it the sheared bloom segments and which, in a second position, is disposed aligned with said conveying axis in order to unload the bloom segments inside the lateral furnace.

[0023] The respective first and second position of the mobile movement lines are independent of each other, thus allowing to render independent of each other the casting processes of the two lines, and preventing any interruptions thereof.

[0024] The furnace with lateral transfer is disposed downstream of the mobile movement section of the blooms, and comprises said entrance rollerway, an exit or removal rollerway which is parallel and offset with respect to the entrance rollerway and aligned with the rolling line downstream, and transfer devices that provide to transfer the bloom segments from the entrance rollerway to the exit rollerway.

[0025] According to a variant of the invention, between the shearing to size means of the bloom segments and the mobile movement section, there is also a fixed movement section having a first fixed movement line and a second fixed movement line, each of which provides to transport respectively the bloom segments from the first casting line toward the first mobile movement line and respectively from the second casting line toward the second mobile movement line.

[0026] In some operating conditions of the plant the fixed movement section advantageously allows to receive the bloom segments arriving from the casting lines during the step when the mobile lines of the mobile movement section are still unloading the bloom segments inside the furnace. This allows to give greater continuity and uniformity in the transfer of the bloom segments for example with very high casting speeds.

[0027] According to another variant, the furnace with lateral transfer comprises a buffer, or support plane or store zone, to temporarily contain the bloom segments that are temporarily disposed inside it.

[0028] The buffer is disposed between the entrance rollerway and the exit rollerway from the furnace.

[0029] According to another feature of the invention, the transverse transfer devices comprise displacement means, which transfer the bloom segments from the entrance rollerway toward the buffer that contains the blooms, and extraction means that extract the bloom segments from the buffer in order to render them available to the exit rollerway and thus render them available to the rolling line.

[0030] The furnace of the apparatus of the present invention is of a length that can vary at least from about 16 to about 60 meters, preferably between 30 and 40 m.

[0031] The buffer acts as an accumulation store for the blooms, for example when it is necessary to overcome an interruption in the rolling process, due to accidents or for a programmed roll-change or for change of produc-

tion, in this way avoiding any losses of material and energy and, above all, avoiding any interruption of the casting. The apparatus allows to accumulate blooms for a time that can even reach up to 60/80 minutes (at maximum casting speed) and more, and is in any case variable during the design of the plant.

[0032] This allows to considerably improve the plant utilization factor.

[0033] Thanks to the accumulation capacity of the furnace, the overall yield is also improved for the following reasons:

- the number of casting re-starts is reduced or eliminated, with consequent saving of waste material at start and end of casting;
- steel which at the moment of an accidental blockage in the rolling mill, for example due to a cobble, is to be found from the tundish (which unloads the liquid steel into the crystallizer) to the beginning of the rolling mill does not have to be scrapped, nor the steel remaining in the ladle, which often cannot be recovered;
- in the event of an accidental blockage of the rolling mill, the bloom already gripped in one or more stands can be returned inside the furnace and kept there, also at temperature, preventing any segmentation and therefore any loss of material.

[0034] According to another feature of the present invention, the optimum length of the bloom segments, and hence of the furnace that has to contain them, is chosen as a function of the reduction to a minimum of the linear combination of the heat losses in the furnace and the losses of material due to crops, short bars and cobbles.

[0035] The present invention also concerns a method in which the continuous casting step is made in two casting lines; the cast products are sheared to size and conveyed to a furnace following respectively the following steps.

[0036] The bloom segments are introduced into a mobile movement section having two mobile movement lines, each of which is suitable to receive the bloom segments from the corresponding casting line.

[0037] In a subsequent step, once the bloom segments are loaded on the mobile movement line, one of them is displaced transversely to the direction of feed of the bloom so as to align itself with a conveying axis which in turn is aligned with an entrance rollerway into the lateral furnace. There then follows a step of loading the furnace through said entrance rollerway.

[0038] A similar step, subsequent or prior to the one described above, is provided for the other mobile movement line.

[0039] In the furnace the bloom segments are translated transversely to be disposed on an exit rollerway from the furnace which allows to feed a feed mill disposed downstream from the apparatus.

[0040] According to a characteristic feature, the furnace is provided with a buffer, between the entrance and exit rollerway, in which the bloom segments are kept for a time correlated to their size.

BRIEF DESCRIPTION OF THE DRAWINGS

[0041] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 shows a possible lay-out of a rolling plant into which a temperature maintenance and/or possible heating apparatus according to the present invention is inserted;
- fig. 2 shows a plane view of the maintenance apparatus according to the present invention;
- fig. 3 shows a section view of fig. 2 from III to III;
- fig. 4 shows a section view of fig. 2 from IV to IV;
- figs. 5 and 6 show working configurations different from fig. 4;
- fig. 7 shows a section view of fig. 2 from VII to VII;
- figs. 8-11 show examples of some different sections that can be cast with the plant in fig. 1;

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT

[0042] With reference to the attached drawings, fig. 1 shows a first example of a lay-out 14 of a plant for the production of long products according to the present invention, in which a temperature maintenance and/or possible heating apparatus 10 according to the present invention is installed.

[0043] The lay-out 14 in fig. 1 comprises, in the essential elements shown, a continuous casting machine 11 comprising two casting lines, respectively a first casting line 12 and a second casting line 13, which develop parallel to each other, each of which uses a crystallizer or other device suitable to cast blooms with a square or rectangular section and of various shapes and sizes, with straight, curved, concave or convex sides, or other. Some examples of sections that can be cast with the present invention are shown in figs. 8-11, which show respectively a rectangular section with straight and parallel sides (fig. 8), a section with short sides with a convex curvature and straight and parallel long sides (fig. 9), a section with short sides having a convex curvature at the center and with straight and parallel long sides (fig. 10) and a section with short sides with a concave curvature and straight and parallel long sides (fig. 11).

[0044] It is quite evident that the same considerations can also be made for blooms with a square section.

[0045] Advantageously, in the case of rectangular sections, the lay-out 10 of this casting and rolling plant allows to obtain blooms with a high metric weight given the same section height, or thickness.

[0046] In this way, a discontinuous or semi-endless process is achieved, but with a yield which, thanks to the sizing of the parameters of the apparatus 10, is very close to the yield of a process with no break in continuity, or endless mode.

[0047] The first 12 and the second 13 casting lines (fig. 1) are disposed on lines offset but parallel to each other and with respect to a single rolling line 30 disposed downstream, they cast two blooms in parallel, preferably with the same section, square or rectangular, and both feed a rolling mill 31 located downstream.

[0048] Downstream of the first 12 and the second 13 casting line there are means for shearing to size 15, for example a shears or an oxy cutting torch, which shear the cast blooms into segments of a desired length, hereafter referred to as bloom segments. Advantageously, the blooms are cut into segments of a length from 1 to 5 times more than that in the state of the art and, according to the present invention, the length is comprised between 16 and 80 meters or more, preferably between 30 and 60 meters. In this way blooms of a great weight are obtained, from 5 to 15 times higher than in the state of the art which, according to the present invention, is comprised between 10 and 50 ton.

[0049] In this way, although the different lay-outs are configured as operating in semi-endless mode, in that they start from segments sheared to size, the blooms of great length and great linear weight allow, during normal working conditions, to operate in a condition of substantial continuity, obtaining a performance very close to that of the endless mode.

[0050] The apparatus 10 (figs. 1 and 2) is installed downstream of the continuous casting machine 11 and immediately after the shearing to size means 15, and comprises a possible fixed movement section 18, a mobile movement section 19 and a lateral maintenance and/or possible heating furnace 24.

[0051] The fixed movement section 18 comprises a first fixed movement line 16 (hereafter referred to as first fixed line) to receive the bloom segments cast by the first casting line 12, and a second fixed movement line 17 (hereafter referred to as second fixed line) to receive the bloom segments cast by the second casting line 13.

[0052] In particular (fig. 3), the first fixed line 16 and the second fixed line 17 are aligned respectively with the first 12 and second casting line 13 and each comprises a rollerway that comprises drawing rollers 36, suitably motorized, which feed the bloom segments which are mounted inside a transit tunnel 35 closed on the perimeter and suitably insulated to reduce the temperature losses of the bloom segments. Simply to give an example, the bloom segments entering the fixed movement section have a temperature comprised between about 1100°C and 1150°C.

[0053] The main function of the fixed movement section 18 is to temporarily contain the bloom segments sheared by the shearing means 15 when the mobile movement section, in determinate operating conditions, is not yet completely aligned with the fixed one 18.

[0054] The mobile movement section 19 (fig. 1) in turn comprises a first mobile movement line 20 (hereafter referred to as first mobile line) to receive the bloom segments from the first fixed line 16, and a second mobile movement line 21 (hereafter referred to as second mobile line) to receive the bloom segments from the second fixed line 17.

[0055] In particular (fig. 2 and figs. 4-6), both the first 20 and the second mobile line 21 each comprise a plurality of movement sliders 37, motorized and sliding along rails 39 disposed transversely to the direction of feed of the bloom segments.

[0056] The movement sliders 37, in their essential components, comprise drawing rollers 40 each of which is made to rotate by drive members 41, and a conveyor tunnel 43 suitably closed and insulated to limit the temperature losses of the bloom segments. The temperature losses must in any case be contained, so that the bloom segments in the mobile movement section 19 are kept at an average temperature comprised between 1090°C and 1140°C.

[0057] Both the first and the second mobile line 21 are suitable to convey into the lateral furnace 24 the bloom segments loaded into them. In particular, in the condition where they receive the blooms (fig. 4,) the two mobile lines 20, 21 are perfectly aligned respectively with the first 16 and with the second fixed line 17, whereas, when the bloom segments are conveyed into the furnace 24, they move transversely and independently of each other, until the bloom segments loaded on them are aligned with a conveying axis 23 which in turn is aligned with an entrance rollerway 25 for the bloom segments into the furnace 24.

[0058] The conveying axis 23 is in an intermediate position with respect to the first 20 and the second mobile line 21 so that the latter can align with it at the suitable moment for loading the furnace 24.

[0059] More specifically, fig. 5 shows a condition in which the first mobile line 20 is in the position for receiving the bloom segments from the first casting line 12 whereas the movement sliders 37 of the second mobile line 21 are displaced transversely in the condition for unloading the bloom segments.

[0060] In the same way, fig. 6 shows a condition in which the movement sliders 37 of the first mobile line 20 are displaced transversely in the position for unloading the bloom segments whereas the second mobile line 21 is in the condition for receiving the bloom segments from the second casting line 13.

[0061] The independent movement of the movement sliders 37 advantageously renders the two casting lines 12, 13 independent of each other, and hence also the methods for conveying the bloom segments inside the furnace 24.

[0062] As we said, the main function of the fixed movement section 18 is therefore to allow the advance of a bloom segment arriving from a casting line 12 or 13 even

when one of the mobile lines 20 or 21 is in an unloading condition and hence in a position that is not suitable for receiving the bloom segments arriving from casting.

[0063] It is clear however that, according to other embodiments, by combining the speeds of advance of the bloom segments along the mobile lines, and the speeds at which the bloom segments are conveyed into the furnace 24, it is possible to avoid the insertion of the fixed movement section 18 by loading the bloom segments arriving from the casting lines directly onto the mobile lines 20, 21.

[0064] The entrance rollerway 25 conveys the bloom segments inside the furnace 24 (fig. 7), and transverse displacement devices 46 provide to displace the bloom segments from the entrance rollerway 25 to a buffer 26 or temporary containing store, in order to render them available, at the appropriate moment, to the rolling line 30 disposed downstream of the furnace 24.

[0065] The buffer has a containing capacity indicatively of about eighteen bloom segments, which varies according to the cross section sizes, and has six positions for heating the segments. Simply as an example, the furnace 24 is able to process a quantity of products of about 145 tons/hour.

[0066] The positioning of the bloom segments inside the buffer 26 depends on the particular operating condition of the plant. If the buffer 26 is free, the blooms are positioned in the terminal zone thereof, adjacent to the respective exit rollerway 27, while if there are other blooms already present on the buffer 26, or if the rolling mill has a productivity lower than that of the casting, or if the rolling line 22 is stopped for some reason, then the new blooms arriving are put in a queue after those already accumulated and subsequently all of the buffered blooms are trusted together by said transverse displacement devices toward the out position. In another embodiment, the movement of the blooms placed on the buffer could be realized, instead of the above mentioned transverse displacement devices, with a plurality of longitudinal walking beams, which are provided of movement mechanisms.

[0067] Extraction devices 47 provide to selectively extract the bloom segments from the buffer 26 in order to load them onto an exit rollerway 27 from the furnace 24 which is aligned with the rolling line 30 downstream.

[0068] The entrance rollerway 25 and the exit rollerway 27 are each provided with a plurality of motorized drawing rollers 49, respectively 50, disposed equidistant with respect to each other along the whole extension of the furnace 24 and driven by drive members disposed outside the furnace 24.

[0069] The temperature of the bloom segments leaving the furnace 24 is comprised between 1100°C and 1150°C, advantageously 1130°C.

[0070] The rolling line 30 is provided with other shearing means 33, of a known type, disposed upstream of the rolling mill 31.

[0071] The furnace 24 not only creates the lateral connection between the two casting lines 12 and 13 and the rolling line 22, but also has the following functions and works with the following modes:

- it functions as a chamber only to maintain the bloom segments at temperature. In this configuration the chamber guarantees that the temperature is maintained between entrance and exit;
- it functions as a heating furnace for the bloom segments, raising the temperature of the load between entrance and exit;
- it also functions as a store to compensate the different productivities of the continuous casting machine 11 and the rolling mill 31 located downstream.

[0072] Furthermore, if there is an interruption in the functioning of the rolling mill 31, due to accidents or for a programmed roll-change or for change of production, the transfer displacement devices 46 continue to accumulate inside the buffer 26 the bloom segments arriving from the two casting lines 12 and 13, whereas the extraction devices 47 remain still.

[0073] The buffer 26 allows to carry out production changes, offering the possibility of a buffer time that varies up to 60/80 minutes, without needing to stop or slow down the continuous casting machine 11.

[0074] In the same way it is possible to provide, due to the need to reduce productivity, to make only one casting line function, and therefore only one mobile line 20 or 21, without needing to stop the whole plant.

[0075] The optimum length of the bloom segments cast by each casting line 12 and 13, and hence the optimum length of the furnace 14 that will have to contain the bloom segments, is chosen according to the reduction to the minimum of the linear combination of the heat losses inside it and the losses of material due to crops, short bars and cobbles that occur along the rolling line 30.

[0076] Since the optimum length of the bloom segment is calculated as a function of the consumption parameters of the furnace 24 which are directly connected to its length, it is also valid to determine the optimum length of the furnace 24 itself. In fact, the furnace 24 will have an optimum length at least equal to that of the bloom segments, except that advantageously a safety margin is provided which takes into account possible bloom segments sheared out of tolerance, and also the necessary dimensional and constructional adaptations.

[0077] In this way, the optimum operating conditions for the coordination of the continuous casting machine 11 and the rolling mill 31 are identified.

[0078] Another parameter of particular relevance is the sharp reduction in the consumption of natural gas or other fuel to feed the furnace 24, which is up to 50% lower compared with traditional solutions.

[0079] The lay-out 14 (fig. 1) can in any case provide for other devices such as for example units to reduce the section of the rolled product immediately upstream or downstream of the maintenance apparatus 10, or heating

inductors to take the temperature of the blooms to values suitable for the subsequent rolling.

Claims

1. Temperature maintenance and/or possible heating apparatus for long products continuously cast and sheared to size by means of shearing means (15) so as to define segments of bloom, said apparatus being disposed between a casting machine (11) having a first casting line (12) and a second casting line (13), and a rolling line (30) disposed downstream of the casting machine (11) in order to make long rolled metal products, **characterized in that** it comprises:

   - a mobile movement section (20) of said bloom segments, disposed downstream of said shearing means (15) and comprising a first mobile line (20) and a second mobile line (21), said first (20) and second (21) mobile line being suitable to move transversely to the direction of advance of the bloom segments in order to move to a first position in which said mobile line (20) and/or said second mobile line (21) are aligned respectively with the first casting line (12) and with the second casting line (13) and to a second position in which one of either of said first mobile line (20) or said second mobile line (21) is aligned with a conveying axis (23);
   - a furnace (24), disposed downstream of said mobile movement section (20), comprising an entrance rollerway (25) for the bloom segments aligned with said conveying axis (23), and an exit rollerway (27) aligned with said rolling line (30) and transverse transfer devices (46, 47) suitable to transfer the bloom segments from the entrance rollerway (25) toward the exit rollerway (26).

2. Apparatus as in claim 1, **characterized in that** it also comprises a fixed movement section (18), disposed between said shearing means (15) and said mobile movement section (19), comprising a first fixed line (16) aligned with said first casting line (12) suitable to move the bloom segments cast by the first casting line (12) toward said first mobile line (20) and a second fixed line (17) aligned with said second casting line (13) and suitable to move the bloom segments cast by the second casting line (13) toward said second mobile line (21).

3. Apparatus as in claim 1 or 2, **characterized in that** said first mobile line (20) and said second mobile line (21) each comprise movement means (37) sliding on guide elements (39) disposed transversely to the direction of advance of the bloom segments.

4. Apparatus as in any claim hereinbefore, **characterized in that** said furnace (24) comprises a buffer (26), disposed between the entrance rollerway (25) and the exit rollerway (27), to temporarily contain the bloom segments coming from said first casting line (12) and said second casting line (13).

5. Apparatus as in claim 4, **characterized in that** said transverse transfer devices of the furnace (24) comprise displacement devices (46) suitable to transfer the bloom segments from said entrance rollerway (25) toward said buffer (26) and extraction devices (47) suitable to selectively extract from said buffer (26) one of said bloom segments in order to dispose it on said exit rollerway (27).

6. Method for the temperature maintenance and/or possible heating of long metal products continuously cast by a continuous casting machine (11), having a first casting line (12) and a second casting line (13), sheared to size by means of shearing means (15) so as to define segments of bloom, and subsequently rolled by a rolling line (30) disposed downstream of a temperature maintenance and/or possible heating apparatus of the bloom segments, **characterized in that** it comprises:

   - a first step of introducing the bloom segments into a mobile movement section (19), provided with a first mobile line (20) and a second mobile line (21), which comprises a first sub-step of introducing the bloom segments cast by said first casting line (12) into said first mobile line (20) which is disposed aligned with said first casting line (12); and a second sub-step of introducing the bloom segments cast by said second casting line (13) into said second mobile line (21) which is disposed aligned with said second casting line (13);
   - a second step of loading the bloom segments into a furnace (24) which provides a transverse displacement of the first mobile line (20) or the second mobile line (21) in order to selectively align them to a conveying axis (23) and subsequently to unload the bloom segments into an entrance rollerway (25) of the furnace (24) which is aligned with said conveying axis (23);
   - a third lateral transfer step of the bloom segments, inside the furnace (24), from said entrance rollerway (25) to an exit rollerway (27) of the furnace (24) which is aligned with said rolling line (31) by means of transverse transfer devices (46, 47).

7. Method as in claim 6, **characterized in that** before said first step it provides to introduce said bloom segments into a fixed movement section (18) having a first fixed line (16) aligned with said first casting line

(12) and a second fixed line (17) aligned with said second casting line (13), said bloom segments being transferred from said first fixed line (16) to said first mobile line (20) and respectively, from said second fixed line (17) to said second mobile line (21).

8. Method as in claim 6 or 7, **characterized in that** said third lateral transfer step comprises a first sub-step of displacing said bloom segments transversely from said entrance rollerway (25) into a buffer (26), and a second sub-step of selectively extracting said bloom segments from said buffer (26) to dispose them on said exit rollerway (27) and to render them available to said rolling line (30).

9. Method as in any claim from 6 to 8, **characterized in that** the bloom segments are introduced into said furnace (24) with an average temperature comprised between 1060°C and 1110°C.

10. Method as in any claim from 6 to 9, **characterized in that** the temperature at exit from said furnace (24) is comprised between 1050°C and 1200°C.

11. Method as in any claim from 6 to 10, **characterized in that** the bloom segments have an overall length comprised between 16 and 60m.

12. Method as in claim 11, **characterized in that** the bloom segments have an overall length comprised between 30 and 40m.

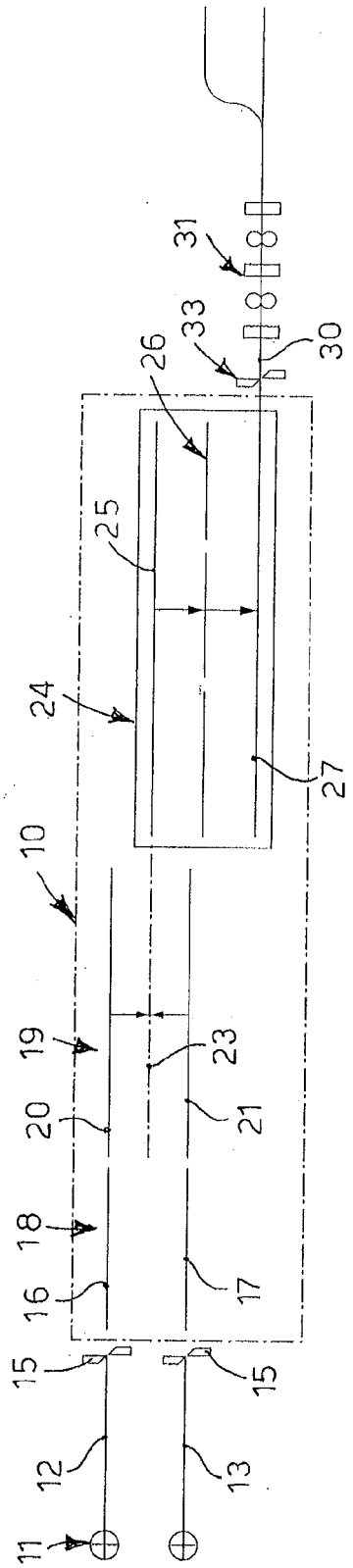
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fig. 1

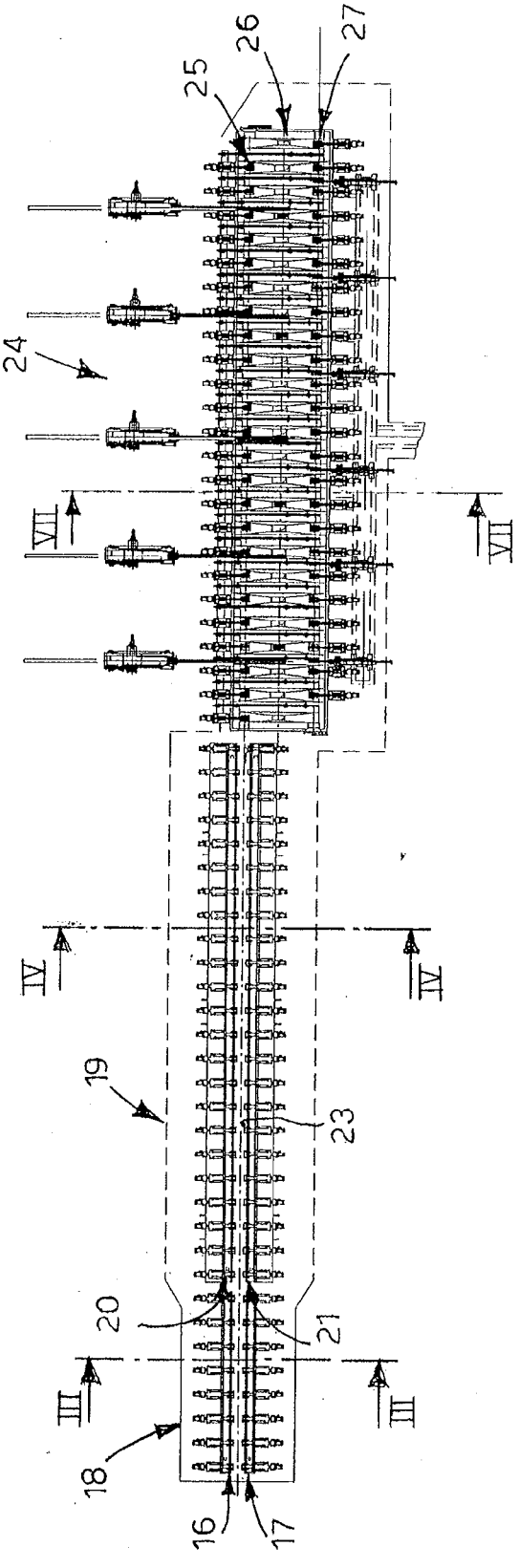
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fig. 2

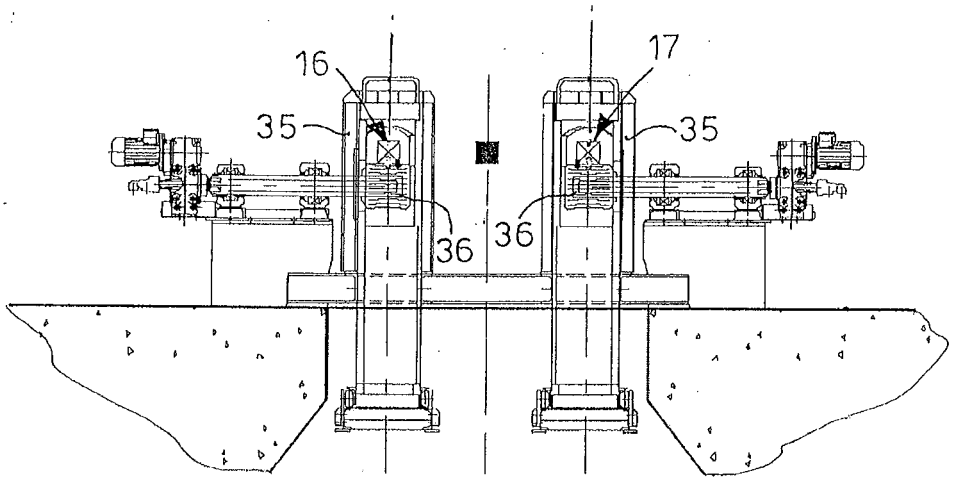

fig. 3

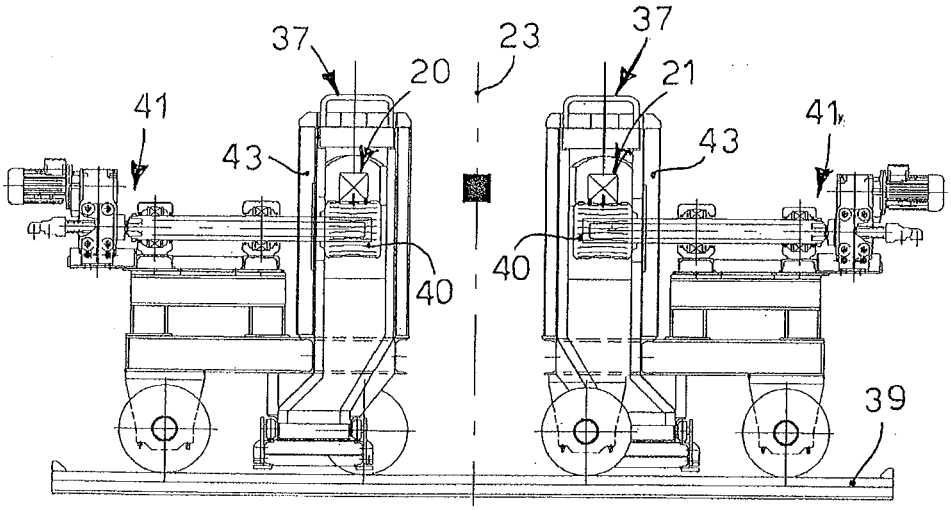

fig. 4

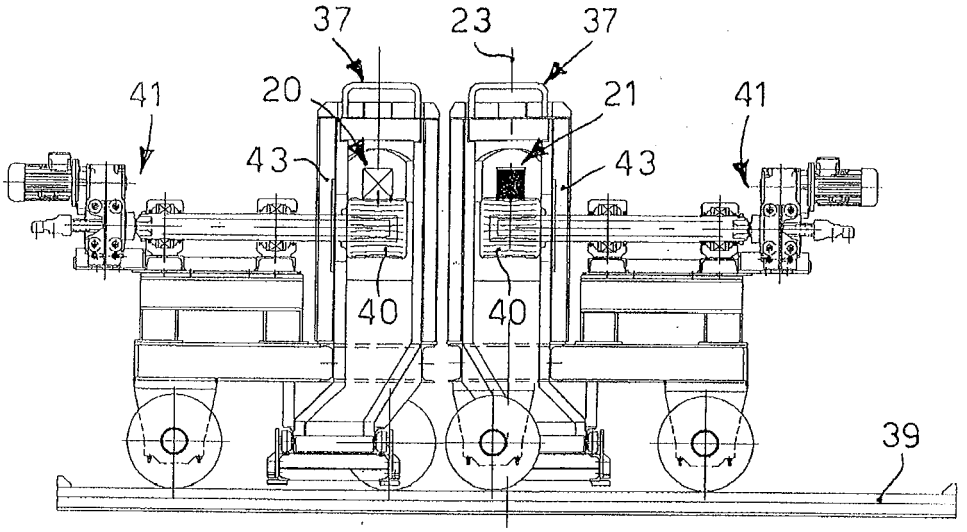

fig. 5

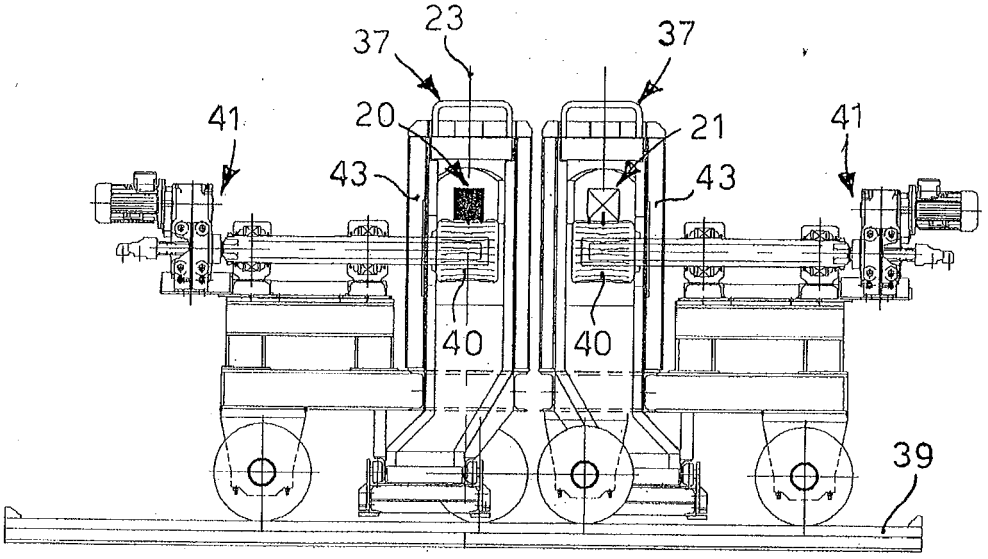

fig. 6

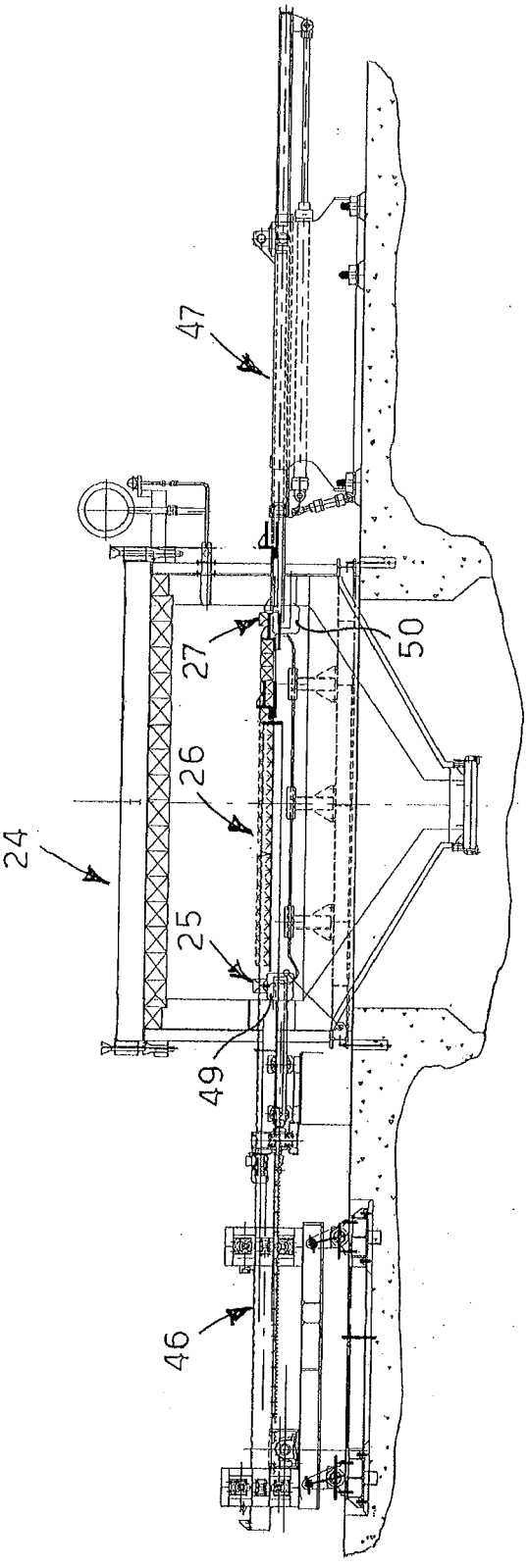

fig. 7

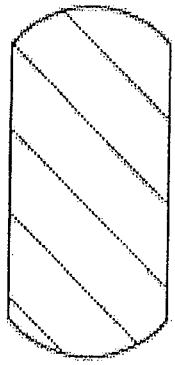

fig. 9

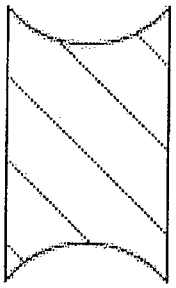

fig. 11

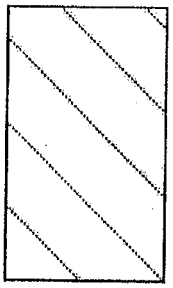

fig. 8

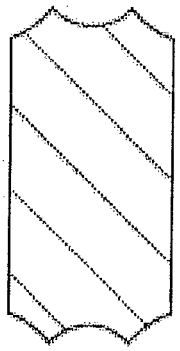

fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 10 17 3164

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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
Munich	15 March 2011	Gavriliu, Alexandru

CATEGORY OF CITED DOCUMENTS

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