

(19)



(11)

EP 3 208 005 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
29.01.2020 Bulletin 2020/05

(51) Int Cl.:
B21B 1/28 (2006.01) B21B 15/00 (2006.01)

(21) Application number: **17156641.7**

(22) Date of filing: **17.02.2017**

(54) COMBINED WELDING AND ROLLING PLANT FOR METALLIC STRIPS

KOMBINIERTE SCHWEISS- UND WALZANLAGE FÜR METALLBÄNDER

INSTALLATION COMBINÉE DE SOUDAGE ET DE LAMINAGE DE BANDES MÉTALLIQUES

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(30) Priority: **18.02.2016 IT UB20160862**

(43) Date of publication of application:
23.08.2017 Bulletin 2017/34

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(56) References cited:
DE-A1- 1 452 440 DE-A1- 2 606 301
US-A- 3 898 436 US-A- 6 009 736

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DescriptionField of the invention

[0001] The present invention relates to a combined welding and rolling plant for welding and rolling metallic strips.

Background art

[0002] The benefit of continuously rolling strips by rolling welding joints has significant benefits in terms of plant productivity, with 20% to 100% increases in hourly productivity or in kilometers rolled, of surface quality, by reducing the risk of generating defects during the step of feeding the heads and of exiting the tails being rolled, and in terms of yield, by reducing the losses of head and tail material due to out of thickness.

[0003] In the case of continuous rolling mills, the plant comprises an inlet section, where the strips of successive coils are joined through a welder; a storing section which allows the rolling process to be fed when the last strip entering the inlet section stops to be joined with the strip preceding it; control systems for monitoring the tension and the centering of the strip, which are conveniently arranged along the plant; a four-or five-stand rolling mill, one after the other; an outlet section provided with a coil winding system; suitable systems for feeding incoming coils and evacuating exiting coils.

[0004] A drawback of such a solution is that from time to time, based on the length of the product to be rolled, production is limited by the "bottleneck" of the plant which, according to the size and weight of the coil, may be the plant inlet section, the storing section or the rolling mill, according to the maximum speed expressible by the tandem rolling mill with respect to the speed obtainable from each stand and to the installed power.

[0005] Moreover, the cost of the investment is high due to the high number of pieces of equipment required to obtain the continuous rolling and the significant space required to install the plant.

[0006] An alternative solution used by certain manufacturers has been rolling so-called "jumbo coils", which in certain cases weigh 60 metric tons and are close to 3 meters in diameter. This system, used on discontinuous tandem rolling mills, asymptotically brings productivity towards the value obtainable with a continuous rolling train, improves the yield thereof and partly the surface quality of the rolled product. The advantage of this solution is a reduced investment cost for the rolling plant, but such a solution involves a significant cost for the coil handling structures, such as roadways and related overhead cranes, which must be sized upstream and downstream of the plants to continuously support these high loads.

[0007] Thus the need is felt of a method for obtaining the continuous rolling in a multi-stand tandem rolling mill, which allows the aforesaid drawbacks to be overcome.

[0008] The preamble of claim 1 is based on DE 26 06

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Summary of the invention

[0009] It is an object of the present invention to make a combined welding and cold rolling plant in tandem with several stands which allows the maximum production capacity obtainable to be increased and which simultaneously allows quality and yield comparable to a traditional continuous tandem rolling mill to be obtained, but with a lower investment cost.

[0010] It is another object of the invention to make a plant which allows coils of rolled strip of specific weight from 10 to 21 kg/mm to be obtained, which are therefore compatible with usual coil handling structures.

[0011] Therefore, the present invention achieves the above objects by making a combined welding and cold rolling plant for metallic strips which, comprises

- at least two first reels sized to receive coils having a predetermined coil weight limit or a predetermined coil diameter limit;
 - a welding line arranged downstream of said at least two first reels, provided with at least one first welder for making a rollable weld seam between each coil and the next coil coming from said at least two first reels;
 - a cold rolling mill, arranged downstream of said welding line and having at least two rolling stands arranged in tandem;
 - at least one second reel, arranged downstream of said at least two rolling stands, sized to wind rolled strip portions up to said predetermined coil weight limit or said predetermined coil diameter limit;
 - cutting means, arranged between said cold rolling mill and said at least one second reel and adapted to cut the rolled strip each time a portion of rolled strip wound on the at least one second reel reaches said predetermined coil weight limit or said predetermined coil diameter limit;
 - sensors apt to send a control signal to said cutting means each time a portion of rolled strip wound on the at least one second reel reaches said predetermined coil weight limit or said predetermined coil diameter limit;
- wherein there is provided a rotating platform, arranged between the welding line and the cold rolling mill, which is adapted to rotate about a vertical axis and provided with a third reel and a fourth reel, which are positioned on said rotating platform so that alternatively the third reel is used as winding reel of the strip coming from the welding line and the fourth reel is used as strip unwinding reel for feeding the cold rolling mill,
- and wherein the third reel and the fourth reel are sized to wind a coil weighing from 80 to 200 metric tons and/or with a diameter of up to 6 meters, defined mega coil, made by said welding line by joining a

plurality of said coils coming from the at least two first reels.

[0012] A second aspect of the present invention provides a welding and cold rolling process for welding and cold rolling a metallic strip, performed by means of the aforesaid plant, which comprises the following steps:

- a) unwinding coils having a predetermined coil weight limit or a predetermined coil diameter limit, from the at least two first reels and feeding them to said welding line;
- b) welding a tail of one coil to a head of a next coil by means of the at least one first welder;
- c) winding a first mega coil onto the third reel;
- d) rotating the rotating platform whereby the fourth reel is used as winding reel of the strip for winding a second mega coil, while the third reel is used as unwinding reel of the first mega coil for feeding the cold rolling mill;
- e) rolling the first mega coil in the at least two rolling stands and winding a first portion of rolled strip of the first mega coil onto the at least one second reel up to said predetermined coil weight limit or predetermined coil diameter limit, thus defining a first rolled coil;
- f) cutting, by means of the cutting means, the rolled strip after the formation of said first rolled coil;
- g) winding further remaining rolled strip portions of the first mega coil onto said at least one second reel up to said predetermined coil weight limit or predetermined coil diameter limit, thus defining further rolled coils, by cutting the rolled strip, by means of said cutting means, after the formation of each of said further rolled coils;
- h) in which, simultaneously to steps e), f) and at least partially to step g), the second mega coil is wound onto the fourth reel and then the rotating platform is rotated, whereby the third reel is used as winding reel of the strip for making the next mega coil, while the fourth reel is used as unwinding reel of the second mega coil for feeding the cold rolling mill, thus performing the steps from e) to g) for the second mega coil.

[0013] In particular, the invention provides to continuously roll a mega coil, thus obtaining at least two or three thickness reductions, preferably at least four or five thickness reductions.

[0014] In this description, a "mega coil" means a coil of strip obtained, for example, from at least 2 to 5 weldings of smaller strips. Typically, a mega coil has a weight from 80 to 200 metric tons and a diameter of up to 6 meters, preferably from 4 to 6 m. The size and/or weight of the final rolled coils are set at automation level, in particular by means of automation means, by setting a weight limit and/or a diameter limit. Preferably, the weight limit of

each final rolled coil wound on a second reel is a specific weight of the final rolled coil ranging from 10 and 21 Kg per millimeter (Kg/mm). Preferably, the size limit is a diameter limit of each final rolled coil wound on a second reel, said diameter limit ranging from about 2000 to about 2100 mm.

[0015] The first limit of the size limit and the weight limit which is reached by the rolled coil on the respective second reel triggers the cutting by means of the cutting means at the outlet of the rolling mill. In particular, when the sensors detect that the size limit or the weight limit has been reached, sensors send a control signal to said cutting means, to actuate the cutting means.

[0016] Advantageously, the plant and process of the invention allow to obtain final rolled coils having a predetermined diameter and/or a predetermined weight. In particular, starting from each mega coil, a plurality of final rolled coils are obtained. Each final rolled coil has a diameter and/or weight lower than the mega coil.

[0017] Optionally, the rotating platform is arranged directly downstream of the at least one welder. Alternatively, there is provided a pickling apparatus, between the at least one first welder and the rotating platform; preferably only the pickling apparatus is arranged between the least one first welder and the rotating platform.

[0018] Optionally, the plant of the invention comprises only one rotating platform. Optionally, between the cold rolling mill and the at least one second reel, there are only provided the cutting means.

[0019] According to the invention, the rotating platform is provided with blocking means to block the tail of the mega coil just wound on each of the third reel and fourth reel. For example, the rotating platform comprises a respective deflector roller for each of the third and fourth reels, on which deflector roller the tail of the mega coil just wound is blocked, due to a corresponding pressure roller arranged above the deflector roller, to then rotate the platform and therefore the mega coil just wound in the unwinding position for feeding the rolling mill.

[0020] There are several further advantages of the plant and the process of the invention, including the following:

- the plant receives coils, possibly already pickled, having conventional size with specific weight from 10 to 21 kg/mm, thus allowing to avoid modifications to the handling systems and to the roadways of the overhead cranes;
- the cycle time for forming the mega coil is defined by the sum of the unwinding times of the coils which will form the mega coil, with the welding times for joining them;
- the plant is sized so that under the most burdensome conditions, the time for making a mega coil is always less than the time for unwinding/rolling the same, thus avoiding the mega coil formation line from being a "bottleneck" for the plant productivity;
- the rotating platform rotates together with the deflec-

tor rollers so that the wound tail is already ready for the successive unwinding;

- the mega coil winding and unwinding assemblies are mounted on slides controlled by hydraulic actuators so as to ensure the centering of the strip during the winding and unwinding;
- the rolling mill feeding system includes two roller centering devices so as to obtain the centering of the strip during the rolling; such centering devices are also equipped with motorized pressure rollers so as to promote the feeding of the head of the mega coil along the rolling mill and to promote the exiting of the tail of the mega coil at the end of rolling.

[0021] In an advantageous variant, another welder, or second welder, is provided, between rotating platform and rolling mill, for obtaining the rolling continuity between one mega coil and the next one.

[0022] Optionally, when there is provided the second welder, the rotating platform is arranged directly between the at least one first welder and the second welder. In particular, there is only the rotating platform between the at least one first welder and the second welder.

[0023] Moreover, by providing to install a double winding reel or a reel carousel acting in cooperation with a flying shear downstream of the rolling mill, a perfect continuous rolling is achieved up to obtaining the final rolled coils.

[0024] The dependent claims describe preferred embodiments of the invention.

Brief description of the drawings

[0025] Further features and advantages of the invention will be more apparent in light of the detailed description of preferred, but not exclusive, embodiments of a combined welding and rolling plant, disclosed by way of a non-limiting example, with the aid of the enclosed drawings in which:

Fig. 1 depicts a diagrammatic view of a first embodiment of a plant according to the invention;
 Fig. 2 depicts a diagrammatic view of a second embodiment of a plant according to the invention;
 Fig. 3 depicts a diagrammatic view of a third embodiment of a plant according to the invention;
 Fig. 4 depicts a diagrammatic view of a fourth embodiment of a plant according to the invention;
 Fig. 5 depicts a diagrammatic view of a dual strip winding and unwinding system;
 Fig. 6 depicts a working sequence of the aforesaid dual winding and unwinding system;
 Figure 7 depicts a diagrammatic view of a first part of the plant of the invention, when it comprises a pickling apparatus.

[0026] The same reference numerals in the drawings identify the same elements or components.

Detailed description of preferred embodiments of the invention

[0027] With reference to the figures, there are depicted preferred embodiments of a combined welding and cold rolling plant.

[0028] The plant of the present invention, in all its embodiments comprises:

- at least two reels 1 sized to wind or receive coils having a predetermined coil weight limit or a predetermined coil diameter limit, preferably a specific weight from 15 to 21 kg/mm (kg per mm of strip width) or a predetermined coil diameter of about 2000 to 2100 mm;
- a welding line arranged downstream of said at least two reels 1, provided with at least one welder 2, preferably of the laser type, for making a rollable weld seam between each coil and the next coil coming from said at least two reels 1, thus defining a continuous strip;
- a cold rolling mill 9, arranged downstream of the welding line and having at least two rolling stands 19 arranged in tandem;
- at least one reel 11, 11', arranged downstream of said at least two rolling stands 19 arranged in tandem, sized to wind rolled strip portions up to said predetermined coil weight limit or predetermined coil diameter limit;
- cutting means, for example a shear 10, 12, arranged between said cold rolling mill 9 and said at least one reel 11, 11', configured to cut the rolled strip each time a portion of rolled strip wound on the at least one reel 11, 11' reaches said predetermined coil weight limit or predetermined coil diameter limit;
- sensors configured to send a control signal to said cutting means each time a portion of rolled strip wound on the at least one second reel reaches said predetermined coil weight limit or said predetermined coil diameter limit.

[0029] Advantageously, a rotating platform 3 is provided, arranged between the welding line and the cold rolling mill 9, which is configured to rotate about a vertical axis and is provided with two reels 4, 5 positioned on the rotating platform 3 so that alternatively reel 4 is used as winding reel of the strip coming from the welding line and reel 5 is used as strip unwinding reel for feeding the cold rolling mill 9.

[0030] A further advantage lies in the fact that the two reels 4, 5 are sized to wind a coil weighing from 80 to 200 metric tons and/or with a diameter of up to 6 meters, defined mega coil, made by the welding line by joining a plurality of coils coming from the reels 1. The number of coils required to make the aforesaid mega coil may vary according to the length of the starting strips. Generally, there is a need of from three to six coils to obtain a mega coil.

[0031] By way of non-limitative example, the at least two first reels 1 have an external diameter comprised between 500 and 700 mm. Typically, but not exclusively, the at least two first reels 1 are actuated by a 50-100 kW motor, for example by a 75 kW motor.

[0032] By way of non-limitative example, the at least one second reel 11 or 11' has an external diameter comprised between 500 and 700 mm. Typically, but not exclusively, the at least one second reel is actuated by a 50-100 kW motor, for example by a 75 kW motor.

[0033] Reels 4, 5 are high capacity reels made, for example, with a high thickness tube or with a metal round bar capable of carrying the weight of large sized coils weighing up to 200 t or with a diameter of up to 6 meters. The capacity of the reels 4, 5 is of 500 to 8000 meters of length of strip.

[0034] Preferably, reels 4, 5 are configured to rotate always in the same rotation direction. Preferably, the two reels 4, 5 are integral with opposite ends or sides of the rotating platform 3 (Figure 5), which is adapted to rotate by 180° about the vertical axis after a predetermined time in which a mega coil is wound, for example onto reel 4, and another mega coil is unwound from the other reel 5.

[0035] The power of the motors for winding and unwinding the mega coil onto/from the reels 4, 5 is selected so as to obtain a predetermined pulling action during the winding, preferably from 15 to 20 N/mm², and to obtain a predetermined pulling action during the unwinding, preferably from 20 to 50 N/mm², such to optimize the rolling process downstream.

[0036] Therefore, the rotating platform 3 defines a dual system for winding/unwinding the strip. The rotating platform can be actuated by means of e.g. a rack system. Preferably, the rotation of the platform 3 is controlled (Figure 5) by an electric or hydraulic motor 32 which allows a rotation of 180° to be achieved.

[0037] The rotation commands 31, 30 and 31', 30' of the respective reels 4, 5 are independent from each other so as to independently control the winding rotation of the strip coming from the welding line and the unwinding rotation of the strip towards the rolling stands 19 of the cold rolling mill 9.

[0038] During the 180° rotation of the rotating platform 3, the rotation commands 31, 30 and 31', 30' are uncoupled from the respective reels 4, 5 through a respective movable joint 29, 29' which is retracted.

[0039] The strip wound onto and unwound from the reels 4, 5 is kept aligned and centered by an axial movement of a respective mandrel or slide 34, 34' controlled by a corresponding hydraulic cylinder 33, 33'.

[0040] A respective deflector roller 6, 6' is provided on platform 3 itself for each of the reels 4, 5 (Figures 1 to 4), on which deflector roller the tail of the mega coil just wound is blocked, due to a corresponding pressure roller 16, 16' arranged above the deflector roller 6, 6', to then rotate platform 3 and therefore the mega coil just wound in the unwinding position for feeding the rolling mill.

[0041] A pickling apparatus may be optionally provided

between welder 2 of the welding line and the rotating platform 3. In this case, it is preferable that between the welder 2 and the rotating platform 3 there is only provided the pickling apparatus. An example of pickling apparatus is shown in Figure 7, and comprises in sequence:

- inlet storing means 20 for storing the continuous strip and ensuring the continuous operation of the pickling process;
- a scale or oxide breaker 21 in which, through the combined action of pulling and alternating bending about rollers of a suitable diameter, it is obtained the crushing of the oxide layer covering the continuous strip, thus promoting the successive etching;
- pickling tanks 22, for example from one to four pickling tanks according to the productivity required, where the aforesaid etching occurs on the continuous strip; said tanks 22 being provided with auxiliary systems for recirculating and heating the acidic pickling solution.

[0042] Strip guide systems, systems for controlling the pulling action, and various auxiliary systems are preferably provided along the pickling apparatus.

[0043] Optionally, downstream of the pickling tanks 22, there may be provided:

- intermediate storing means 23 where the pickled continuous strip exiting the pickling tanks 22 is stored after being rinsed and dried;
- a trimming machine 24 for trimming the edges of the pickled continuous strip, said intermediate storing means 23 serving the function of avoiding stops in the pickling process in case the trimming machine 24 is stopped to change the strip width or the blades.

[0044] Alternatively, no pickling apparatus is provided between welder 2 and platform 3 if the coils received from the reels 1 were pickled previously.

[0045] There are provided further cutting means, for example a further shear (not shown), arranged upstream of the rotating platform 3 and configured to cut the strip once the mega coil has been wound onto one of the two reels 4, 5. Here, suitable sensors send a control signal to said further cutting means once the predetermined weight limit, in the range for example between 80 and 200 metric tons, or the predetermined coil diameter limit, in the range for example of 4 and 6 meters, is reached. After this cut, the rotating platform 3 is rotated by 180°. Examples of sensors are weight sensors and/or coil diameter sensors.

[0046] If the pickling apparatus is provided, a serpentine path 25 (Figure 7) may be provided upstream of said further cutting means, with idler rollers 26 of the pickled continuous strip, whose purpose is to store the strip processed by the pickling apparatus each time the winding reel 4 or 5 stops.

[0047] Said serpentine path 25 is possibly provided di-

rectly:

- between the trimming machine 24 and said further cutting means; or
- between the pickling tanks 22 and said further cutting means.

[0048] Immediately downstream of the rotating platform 3, there are preferably provided in sequence (Figures 1 to 4):

- equipment for guiding and centering the strip at the inlet of the rolling mill;
- the non-reversible cold rolling mill 9, with at least two or three rolling stands 19, preferably four or five;
- the cutting shear 10, 12;
- at least one reel 11, 11' advantageously configured to wind strip portions with specific weight from 15 to 21 kg/mm or coils with a diameter of up to 2000 - 2100 mm.

[0049] The equipment for guiding and centering the strip at the inlet of the rolling mill preferably is provided with a first three-roller centering device 7 and with a second two-roller centering device 8 which, with their conveniently motorized respective pressure rollers 7', 8', help the feeding of the strip into the first of the rolling stands 19.

[0050] Auxiliary systems for cooling and lubricating the strip and further auxiliary systems for monitoring the rolling process can be provided along the rolling mill.

[0051] In the first embodiment of the plant of the invention (shown in Figure 1), the cutting shear 10 is a static cutting shear which cuts the strip being wound onto reel 11.

[0052] In the second embodiment of the plant of the invention (shown in Figure 2), a further welder 2', preferably of the laser type, is provided in addition to all the components provided in the first embodiment. This further welder 2' is arranged between the rotating platform 3 and the cold rolling mill 9 and is configured to weld the tail of a first mega coil entering the rolling mill to a head of a second mega coil coming from reel 4 or reel 5. In particular, welder 2' is arranged between the rotating platform 3 and the equipment for guiding and centering the strip at the inlet of the rolling mill, preferably between the deflector roller-pressure roller pair of the reel 4 or 5 in the unwinding step and the first roller centering device 7.

[0053] The third embodiment of the plant of the invention (shown in Figure 3) is equal to the first embodiment, except that it provides:

- a flying cutting shear 12 in place of the static cutting shear 10;
- and a double reel or a carousel 13 of reels 11', in place of the individual reel 11. The flying cutting shear 12 is preferably configured to cut the rolled strip at a speed of 50 to 500 mpm. Carousel 13 pref-

erably has two reels 11' which are diametrically opposite to each other and are hinged on a rotating drum, which alternatively wind the rolled strip. In both variants - double reel with or without carousel - when one of the reels is winding a rolled coil, the other reel is freed of the previously wound rolled coil.

[0054] In the fourth embodiment of the plant of the invention (shown in Figure 4), the further welder 2', preferably of the laser type, is provided in addition to all the components provided in the third embodiment. As in the second embodiment in Figure 2, this further welder 2' is arranged between the rotating platform 3 and the cold rolling mill 9 and is configured to weld the tail of a first mega coil entering the rolling mill to a head of a second mega coil coming from reel 4 or reel 5. In particular, welder 2' is arranged between the rotating platform 3 and the equipment for guiding and centering the strip at the inlet of the rolling mill, preferably between the deflector roller-pressure roller pair of the reel 4 or 5 in the unwinding step and the first roller centering device 7.

[0055] The operation of the first embodiment of the invention is described below.

[0056] The unwinding reels 1 unwind respective strips which are welded to each other by means of welder 2, thus defining a continuous strip.

[0057] If the pickling apparatus (Figure 7) is provided, the continuous strip is stored in the inlet storing means 20 to ensure the continuous operation of the pickling process. The continuous strip, still covered by an oxide layer, exiting from the storing means 20, crosses the scale breaker 4 where, through the combined action of pulling and alternating bending about rollers of a suitable diameter, it is obtained the crushing of the oxide layer, thus promoting the successive etching in the pickling tanks 22. Then the continuous strip passes through the pickling tanks 22 and afterwards is rinsed and dried. When provided, the pickled continuous strip enters the intermediate storing means 23 and then crosses the edge trimming machine 24 and the serpentine path 25.

[0058] The continuous strip is wound onto high capacity reel 4 or 5 of the rotating platform 3 immediately downstream of welder 2 or of the pickling apparatus.

[0059] Fig. 6 diagrammatically depicts the working sequence of the rotating platform 3 in working regime. In a first step (Fig. 6a), reel 4 starts winding a mega coil of strip, while reel 5 starts unwinding another mega coil, wound previously, towards the rolling stands 19 so as to start the rolling.

[0060] In a second step (Fig. 6b), while the rolling mill completes rolling the mega coil and reel 5 is empty, reel 4 completes winding the other mega coil of strip; the strip is cut upstream of the rotating platform 3 by means of said further cutting means; and the rotating platform 3 begins rotating to bring reel 4 into the unwinding position of the strip towards the rolling stands 19. In particular, the platform 3 causes the deflector roller 6 and related pressure rollers 16 to rotate with it so that the tail of the

mega coil wound on reel 4 is already ready for the successive unwinding, thus becoming the head of the mega coil to be directed to the rolling mill.

[0061] In a third step (Fig. 6c), with reel 4 in the unwinding position, the strip is unwound from reel 4 and brought to the second position for feeding the rolling mill, while reel 5 begins winding a new mega coil of strip.

[0062] The head of the mega coil of strip which is unwound from the rotating platform 3 is pushed in a coordinated manner by reel 4 and by the deflector roller 6, thus passing through the three-roller centering device 7 and the two-roller centering device 8 which, with their pressure rollers 7', 8', help with feeding the strip to the rolling mill.

[0063] The head of the mega coil then crosses the tandem cold rolling mill 9, the static cutting shear 10 and is wound onto the winding reel 11 (Figure 1).

[0064] At this point, when it is achieved the proper tension between the last rolling stand and winding reel 11, the rolling mill 9 begins rolling.

[0065] When the joining welding between the two coils coming from the reels 1 reaches the outlet of the rolling mill or when the coil wound on reel 11 reaches the size or the weight limit monitored by the automation, for example by automation means, the rolling process is stopped. Sensors send a control signal to said cutting means each time a portion of rolled strip wound on the at least one second reel 11 reaches said predetermined coil weight limit or said predetermined coil diameter limit. In particular, sensors send a control signal to the static cutting shear 10 which performs a separation cut, thus cutting the strip, and a first rolled coil, for example with specific weight from 10 to 21 kg/mm or with a diameter of about 2000 - 2100 mm, is unloaded from the winding reel 11. Examples of sensors are weight sensors and/or coil diameter sensors.

[0066] As is known, specific weight is a method used in the steel industry to define the weight of the coils processed by the plants.

[0067] When, e.g., 18 kg/mm is indicated, it means that it is sufficient to multiply the width (mm) by the specific weight (kg/mm) in order to calculate the weight (kg) of the coil.

[0068] When the winding reel 11 is ready to receive a new rolled coil, the rolled strip head obtained exiting from the rolling stands 19 is fed onto reel 11 and rolling is resumed up to obtaining a second rolled coil on reel 11 having a specific weight from 15 to 21 kg/mm or with a diameter of 2000 - 2100 mm. The rolling mill stops again, the static cutting shear 10 cuts the rolled strip being wound onto reel 11 and the second rolled coil is unloaded from reel 11. These operations are repeated up to the rolling of the strip portion corresponding to the last coil, or strip portion, forming the mega coil. Then rolling stops, the rolling stands 19 are opened, the static cutting shear 10 cuts the rolled strip again and said last rolled coil having a specific weight from 15 to 21 kg/mm or with a diameter of 2000 - 2100 mm is unloaded from reel 11.

[0069] As soon as the tail of the mega coil leaves reel 4, the rotating platform 3 rotates thus bringing the new mega coil onto reel 5 into the unwinding position towards the rolling mill, and reel 4 into the winding position of the strip coming from the welding line, since in the meantime a new mega coil was wound by reel 5 with the tail blocked by the pressure roller 16' on the deflector roller 6, and the strip was cut upstream of the rotating platform 3 by means of the further cutting means. The process thus continues without interruption.

[0070] As regards the operation of the second embodiment of the plant, it is identical to that described above but additionally the welding is provided of a tail of a mega coil entering the rolling mill with a head of a next mega coil coming from the rotating platform 3. This welding is executed by means of welder 2', which is arranged between the rotating platform 3 and the cold rolling mill 9, and results in benefits in reducing the feeding times for the next mega coil since the head of the latter is pulled by the tail of the previous mega coil, thus increasing the continuity of rolling.

[0071] As regards the operation of the third embodiment of the plant, it is identical to that described for the first embodiment but in substitution of the static cutting of shear 10, a flying cutting of the rolled strip is provided by means of the flying cutting shear 12 when the rolled coil wound on one of the reels 11' reaches the size or the specific weight provided by the automation. The two reels 11' allow that, while a rolled coil is unloaded from a first reel 11', the head of a new rolled coil to be wound onto the second reel 11', with obvious benefits in the quality and productivity of the plant. This allows a continuous rolling for the individual mega coil to be achieved.

[0072] In the operation of the fourth embodiment of the plant, a continuous rolling is instead achieved for a continuous series of mega coils, such a plant providing the use of the further welder 2' and of the flying cutting shear 12 and of the double reel 11', or of the carousel 13 of reels 11'.

[0073] In the above-described embodiments, the welding line generates, by means of welder 2, a continuous strip starting from coils coming from the reels 1. Alternatively, the welding line could generate a series of separate strips, in which each of these strips exiting welder 2 is formed by the union of, for example, from three to six coils coming from the reels 1 suitable for forming a single mega coil. Here, the further cutting means immediately upstream of the rotating platform 3 are no longer required. Moreover, should the pickling apparatus be provided between welder 2 and platform 3, the serpentine path 25 is possibly directly provided:

- between the trimming machine 24 and the rotating platform 3; or
- between the pickling tanks 22 and the rotating platform 3.

[0074] If the strip exiting from welder 2 is not continu-

ous, the initial part of the operation of the plant of the invention provides that:

- a first coil is fed from a reel 1 along the welding line up to reel 4 to form the mega coil; 5
- at the complete unwinding of the first coil itself, the tail of the latter leaves reel 1 and stops at welder 2;
- a second coil of the other reel 1 is fed along the welding line and the head thereof is stopped at welder 2; 10
- welder 2 performs the welding between the tail of the first coil and the head of the second coil and a strip, obtained by the union of these coils, starts being wound onto reel 4;
- the welding operation continues with the next coils coming from the reels 1 only up to obtaining a strip which results in a mega coil weighing from 80 to 200 t and having a diameter of up to 6 m; 15
- the tail of the mega coil is blocked by the pressure roller 16 arranged above the deflector roller 6 and platform 3 rotates by 180°, thus bringing the mega coil into the unwinding position. 20

[0075] The remaining part of the operation is unvaried with respect to that described above.

Claims

1. A welding and rolling plant of metallic strips comprising: 30
 - at least two first reels (1) sized to receive coils having a predetermined coil weight limit or a predetermined coil diameter limit;
 - a welding line arranged downstream of said at least two first reels (1), and provided with at least one first welder (2) for making a rollable weld seam between each coil and the next coil coming from said at least two first reels (1); 35
 - a cold rolling mill (9), arranged downstream of said welding line and having at least two rolling stands (19) arranged in tandem; 40
 - at least one second reel (11, 11'), arranged downstream of said at least two rolling stands (19), sized to wind rolled strip portions up to said predetermined coil weight limit or said predetermined coil diameter limit; 45
 - cutting means, arranged between said cold rolling mill (9) and said at least one second reel (11, 11'), the cutting means being adapted to cut the rolled strip each time a portion of rolled strip wound on the at least one second reel (11, 11') reaches said predetermined coil weight limit or said predetermined coil diameter limit; 50
 - sensors apt to send a control signal to said cutting means each time a portion of rolled strip wound on the at least one second reel reaches said predetermined coil weight limit or said pre-

determined coil diameter limit;
wherein the third reel (4) and the fourth reel (5) are sized to wind a coil weighing from 80 to 200 metric tons and/or with a diameter of up to 6 meters, defined mega coil, made by said welding line by joining a plurality of said coils coming from said at least two first reels (1), **characterized in that**

there is provided a rotating platform (3), arranged between the welding line and the cold rolling mill (9), adapted to rotate about a vertical axis, and provided with a third reel (4) and a fourth reel (5), positioned on said rotating platform (3) so that alternatively the third reel (4) is used as winding reel of a strip coming from the welding line and the fourth reel (5) is used as strip unwinding reel for feeding the cold rolling mill (9),

wherein the rotating platform (3) is provided with blocking means (6, 6', 16, 16') to block the tail of the mega coil just wound on each of the third reel (4) and fourth reel (5).

2. A welding and rolling plant according to claim 1, wherein there is provided a second welder (2') between the rotating platform (3) and the cold rolling mill (9), said second welder (2') being configured to weld a tail of a first mega coil entering the cold rolling mill (9) to a head of a second mega coil coming from said either third reel (4) or fourth reel (5). 25
3. A welding and rolling plant according to any one of the preceding claims, wherein the cutting means are either a static cutting shear (10) or a flying cutting shear (12). 35
4. A welding and rolling plant according to claim 3, wherein either a double second reel (11') or a carousel (13) of second reels (11') are provided when there is provided said flying cutting shear (12). 40
5. A welding and rolling plant according to any one of the preceding claims, wherein said predetermined weight limit is a specific weight from 10 to 21 kilograms per millimeter of width of the strip. 45
6. A plant according to any one of the preceding claims, wherein said predetermined coil diameter limit is a coil diameter of 2000 - 2100 millimeters. 50
7. A welding and rolling plant according to any one of the preceding claims, wherein there are provided further cutting means, arranged upstream of said rotating platform (3) and configured to cut the strip once the mega coil has been wound either on the third reel (4) or on the fourth reel (5). 55
8. A welding and rolling plant according to any one of

the preceding claims, wherein between the cold rolling mill (9) and the at least one second reel (11, 11') there are provided only said cutting means.

9. A welding and rolling plant according to any one of the preceding claims, wherein there is provided only one rotating platform (3). 5
10. A welding and rolling plant according to any one of claims from 2 to 9, wherein the rotating platform (3) is arranged directly between the at least one first welder (2) and the second welder (2'). 10
11. A welding and rolling plant according to any one of the preceding claims, wherein there is provided only a pickling apparatus between the least one first welder (2) and the rotating platform (3). 15
12. A welding and rolling plant according to any one of the preceding claims, wherein said blocking means comprise a respective deflector roller (6, 6') for each of the third reel (4) and fourth reel (5), and a corresponding pressure roller (16, 16') arranged above the deflector roller (6, 6'), so that the tail of the mega coil just wound can be blocked on the deflector roller (6, 6') due to the corresponding pressure roller (6, 6', 16, 16'). 20 25
13. A welding and rolling process of metallic strips, by means of a welding and rolling plant according to claim 1, comprising the following steps: 30
 - a) unwinding coils, having a predetermined coil weight limit or predetermined coil diameter limit, from the at least two first reels (1) and feeding them to said welding line; 35
 - b) welding a tail of one coil to a head of a subsequent coil by means of the at least one first welder (2);
 - c) winding a first mega coil on the third reel (4); 40
 - d) blocking the tail of the first mega coil by means of said blocking means (6, 6', 16, 16'); 45
 - e) rotating the rotating platform (3) so that the fourth reel (5) is used as winding reel for winding a second mega coil, while the third reel (4) is used as unwinding reel of the first mega coil for feeding the cold rolling mill (9);
 - f) rolling the first mega coil in the at least two rolling stands (19) and winding a first portion of rolled strip of the first mega coil on the at least one second reel (11, 11') up to said predetermined coil weight limit or said predetermined coil diameter limit, thus defining a first rolled coil; 50
 - g) cutting, by means of the cutting means, the rolled strip after the formation of said first rolled coil; 55
 - h) winding further remaining portions of rolled strip of the first mega coil on said at least one

second reel (11, 11') up to said predetermined coil weight limit or said predetermined coil diameter limit, thus defining further rolled coils, and cutting the rolled strip, by means of said cutting means, after the formation of each of said further rolled coils;

wherein, simultaneously to steps f), g) and at least partially to step h), the second mega roll is wound on the fourth reel (5) and subsequently the rotating platform (3) is rotated so that the third reel (4) is used as winding reel of the strip for making the next mega coil, while the fourth reel (5) is used as unwinding reel of the second mega coil for feeding the cold rolling mill (9), performing the steps from f) to h) for the second mega coil.

14. A welding and rolling process according to claim 13, wherein the formation and winding time of the second mega coil is shorter than the unwinding and rolling time of the first mega coil.
15. A welding and rolling process according to claim 13 or 14, wherein a welding is provided between a tail of a first mega coil entering into the rolling mill and a head of the second mega coil coming from said fourth reel (5), said welding being performed by means of a second welder (2') arranged between the rotating platform (3) and the cold rolling mill (9).
16. A welding and rolling process according to any one of the claims from 13 to 15, wherein, once a mega coil has been wound either on the third reel (4) or on the fourth reel (5), the strip is cut by further cutting means, arranged upstream of the rotating platform (3).

Patentansprüche

1. Schweiss- und Walzanlage für Metallbänder, aufweisend:
 - zumindest zwei erste Trommeln (1), die so dimensioniert sind, dass sie Spulen mit einem vorgegebenen Maximalgewicht oder einem vorgegebenen Höchstdurchmesser aufnehmen können;
 - eine Schweißstraße, die hinter den zumindest zwei ersten Trommeln (1) angeordnet und mit zumindest einem ersten Schweißgerät (2) versehen ist, um eine walzbare Schweißnaht zwischen jede Spule und der nächsten Spule zu setzen, die von den zumindest zwei ersten Trommeln (1) kommt;
 - ein Kaltwalzwerk (9), das hinter der Schweißstraße angeordnet und mit zumindest zwei Walzgerüsten (19) versehen ist, die in Rei-

he angeordnet sind;

- zumindest eine zweite Trommel (11, 11'), die hinter den zumindest zwei Walzgerüsten (19) angeordnet und so dimensioniert ist, dass sie gewalzte Bandteilstücke bis zu dem vorgegebenen Maximalgewicht oder dem vorgegebenen Höchstdurchmesser aufwickeln kann;

- Schneidmittel, die zwischen dem Kaltwalzwerk (9) und der zumindest einen zweiten Trommel (11, 11') angeordnet sind, wobei die Schneidmittel geeignet sind, das gewalzte Band jeweils dann abzuschneiden, wenn das Teilstück des gewalzten Bandes, das auf der zumindest einen zweiten Trommel (11, 11') aufgewickelt wurde, das vorgegebene Maximalgewicht oder den vorgegebenen Höchstdurchmesser erreicht hat;

- Sensoren, die geeignet sind, ein Steuerungssignal an die Schneidmittel zu senden, wenn ein Teilstück des gewalzten Bandes, das auf der zumindest einen zweiten Trommel aufgewickelt wurde, das vorgegebene Maximalgewicht oder den vorgegebenen Höchstdurchmesser erreicht hat;

dadurch gekennzeichnet, dass:

eine Drehplattform (3) vorgesehen ist, die zwischen der Schweißstraße und dem Kaltwalzwerk (9) angeordnet und geeignet ist, um sich um eine vertikale Achse zu drehen, und die mit einer dritten Trommel (4) und einer vierten Trommel (5) versehen ist, die so auf der Drehplattform (3) angeordnet sind, dass abwechselnd die dritte Trommel (4) oder die vierte Trommel (5) als Aufwickeltrommel für ein Band genutzt wird, das von der Schweißstraße kommt, oder als Abwickeltrommel für ein Band genutzt wird, das dem Kaltwalzwerk (9) zugeführt wird, wobei die dritte Trommel (4) und die vierte Trommel (5) so dimensioniert sind, dass sie eine Spule mit einem Gewicht zwischen 80 und 200 Tonnen und/oder mit einem Durchmesser bis zu 6 Metern aufwickeln können, sogenannte Megaspulen, die von der Schweißstraße mittels Verbindung einer Vielzahl von Spulen, die von den zumindest zwei ersten Trommeln (1) kommen, erstellt werden,

wobei die Drehplattform (3) mit Sperrmitteln (6, 6', 16, 16') versehen ist, um das Ende der Megaspule, die soeben auf die dritte Trommel (4) und die vierte Trommel (5) gewickelt wurde, zu blockieren.

2. Schweiss- und Walzanlage gemäß Anspruch 1, wobei ein zweites Schweißgerät (2') zwischen der Drehplattform (3) und dem Kaltwalzwerk (9) vorgesehen ist, wobei das zweite Schweißgerät (2') derart

gestaltet ist, dass es das Ende einer ersten Megaspule, das in das Kaltwalzwerk (9) eintritt, mit dem Anfang einer zweiten Megaspule, der von der dritten Trommel (4) oder der vierten Trommel (5) kommt, verschweißt.

3. Schweiss- und Walzanlage gemäß einem der vorigen Ansprüche, wobei das Schneidmittel entweder eine feststehende Trennschere (10) oder eine fliegende Trennschere (12) ist.

4. Schweiss- und Walzanlage gemäß Anspruch 3, wobei entweder eine doppelte zweite Trommel (11') oder ein Karussell (13) von zweiten Trommeln (11') bereitgestellt werden, wenn die fliegende Trennschere (12) vorgesehen ist.

5. Schweiss- und Walzanlage gemäß einem der vorigen Ansprüche, wobei das vorgegebene Maximalgewicht ein spezifisches Gewicht von 10 bis 21 kg pro mm Bandbreite ist.

6. Anlage gemäß einem der vorigen Ansprüche, wobei der vorgegebene Höchstdurchmesser einen Spulendurchmesser von 2000 bis 2100 mm beträgt.

7. Schweiss- und Walzanlage gemäß einem der vorigen Ansprüche, wobei weitere Schneidmittel vor der Drehplattform (3) vorgesehen sind, die derart gestaltet sind, dass sie das Band schneiden, wenn die Megaspule auf die dritte Trommel (4) oder die vierte Trommel (5) gewickelt wurde.

8. Schweiss- und Walzanlage gemäß einem der vorigen Ansprüche, wobei zwischen dem Kaltwalzwerk (9) und der zumindest einen zweiten Trommel (11, 11') lediglich die Schneidmittel vorgesehen sind.

9. Schweiss- und Walzanlage gemäß einem der vorigen Ansprüche, wobei lediglich eine Drehplattform (3) vorgesehen ist.

10. Schweiss- und Walzanlage gemäß einem der Ansprüche 2 bis 9, wobei die Drehplattform (3) direkt zwischen dem zumindest einen ersten Schweißgerät (2) und dem zweiten Schweißgerät (2') angeordnet ist.

11. Schweiss- und Walzanlage gemäß einem der vorigen Ansprüche, wobei zwischen dem zumindest einen ersten Schweißgerät (2) und der Drehplattform (3) lediglich eine Beizvorrichtung vorgesehen ist.

12. Schweiss- und Walzanlage gemäß einem der vorigen Ansprüche, wobei die Sperrmittel für die dritte Trommel (4) und die vierte Trommel (5) jeweils eine Umlenkrolle (6, 6') und eine zugehörige über der Umlenkrolle (6, 6') angeordnete Druckrolle (16, 16') auf-

weisen, so dass das Ende der soeben aufgewickelten Megaspule auf der Umlenkrolle (6, 6') durch die zugehörige Druckrolle (6, 6', 16, 16') blockiert werden kann.

13. Metallband-Schweiss- und Walzverfahren mit Hilfe einer Schweiss- und Walzanlage gemäß Anspruch 1, aufweisend die folgenden Schritte:

a) Abwicklung von Spulen mit vorgegebenem Maximalgewicht oder vorgegebenem Höchstdurchmesser von den zumindest zwei ersten Trommeln (1) und Zuführung der beiden in die Schweißstraße;

b) Schweißen des Endes der einen Spule an den Anfang einer folgenden Spule mittels des zumindest einen Schweißgeräts (2);

c) Aufwickeln einer ersten Megaspule auf die dritte Trommel (4);

d) Blockieren des Endes der ersten Megaspule mittels der Sperrmittel (6, 6', 16, 16'); 20

e) Drehen der Drehplattform (3), so dass die vierte Trommel (5) als Aufwickeltrommel zum Aufwickeln einer zweiten Megaspule genutzt wird, während die dritte Trommel (4) als Abwickeltrommel der ersten Megaspule zur Zuführung in das Kaltwalzwerk (9) dient; 25

f) Walzen der ersten Megaspule in den zumindest zwei Walzgerüsten (19) und Aufwickeln eines ersten Teilstücks eines gewalzten Bandes der ersten Megaspule auf die zumindest eine zweite Trommel (11, 11') bis zu dem vorgegebenen Maximalgewicht oder dem vorgegebenen Höchstdurchmesser, wodurch eine erste gewalzte Spule gebildet wird; 30

g) Schneiden des gewalzten Bandes nach Bilden der ersten gewalzten Spule mittels der Schneidmittel; 35

h) Aufwickeln weiterer verbliebener Teilstücke des gewalzten Bandes der ersten Megaspule auf die zumindest eine zweite Trommel (11, 11') bis zu dem vorgegebenen Maximalgewicht oder dem vorgegebenen Höchstdurchmesser, wodurch weitere gewalzte Spulen gebildet werden, und Schneiden des gewalzten Bandes nach Bilden jeder der weiteren gewalzten Spulen mittels der Schneidmittel; 40

wobei zeitgleich zu den Schritten f), g) und zumindest teilweise Schritt h) die zweite Megaspule auf die vierte Trommel (5) gewickelt wird und daraufhin die Drehplattform (3) gedreht wird, so dass die dritte Trommel (4) als Aufwickeltrommel für das Band genutzt wird, um die nächste Megaspule herzustellen, während die vierte Trommel (5) als Abwickeltrommel der zweiten Megaspule zur Zuführung in das Kaltwalzwerk (9) dient und die Schritte f) bis h) für die zweite Megaspule durchgeführt werden. 45 50 55

14. Schweiss- und Walzverfahren gemäß Anspruch 13, wobei die Zeit für das Bilden und Aufwickeln der zweiten Megaspule kürzer ist als die Zeit zum Abwickeln und Walzen der ersten Megaspule.

15. Schweiss- und Walzverfahren gemäß einem der Ansprüche 13 oder 14, wobei ein Verschweissen eines Endes einer ersten Megaspule, die in das Walzwerk eintritt, und des Anfangs einer zweiten Megaspule, der von der vierten Trommel (5) kommt, vorgesehen ist, wobei das Verschweissen mittels eines zweiten Schweißgeräts (2') erfolgt, das zwischen der Drehplattform (3) und dem Kaltwalzwerk (9) angeordnet ist.

16. Schweiss- und Walzverfahren gemäß einem der Ansprüche 13 bis 15, wobei das Band durch weitere Schneidmittel, die vor der Drehplattform (3) angeordnet sind, geschnitten wird, wenn eine Megaspule auf die dritte Trommel (4) oder die vierte Trommel (5) gewickelt wurde.

Revendications

1. Machine de soudage et de laminage de bandes métalliques, comprenant :

- au moins deux premiers dévidoirs (1) dimensionnés pour recevoir des bobines présentant une limite prédéterminée de poids de bobine ou une limite prédéterminée de diamètre de bobine ;
- une ligne de soudage disposée en aval desdits au moins deux premiers dévidoirs (1), et munie d'au moins une première soudeuse (2) destinée à exécuter un joint de soudure pouvant être laminé entre chaque bobine et la bobine suivante provenant desdits au moins deux premiers dévidoirs (1) ;
- un laminage à froid (9), disposé en aval de ladite ligne de soudage et comportant au moins deux cages de laminage (19) disposées en tandem ;
- au moins un deuxième dévidoir (11, 11'), disposé en aval desdites au moins deux cages de laminage (19), dimensionné pour enrouler des parties de bande laminée jusqu'à ladite limite prédéterminée de poids de bobine ou ladite limite prédéterminée de diamètre de bobine ;
- des moyens de coupe, disposés entre ledit laminage à froid (9) et ledit au moins un deuxième dévidoir (11, 11'), les moyens de coupe étant conçus pour couper la bande laminée à chaque fois qu'une partie de bande laminée enroulée autour de l'au moins un deuxième dévidoir (11, 11') atteint ladite limite prédéterminée de poids de bobine ou ladite limite prédéterminée de diamètre de bobine ;

- des capteurs pouvant envoyer un signal de commande auxdits moyens de coupe à chaque fois qu'une partie de bande laminée enroulée autour de l'au moins un deuxième dévidoir atteint ladite limite prédéterminée de poids de bobine ou ladite limite prédéterminée de diamètre de bobine ;

caractérisée en ce que

une plate-forme rotative est prévue (3), disposée entre la ligne de soudage et le laminoir à froid (9), conçue pour tourner autour d'un axe vertical, et munie d'un troisième dévidoir (4) et d'un quatrième dévidoir (5), positionnés sur ladite plate-forme rotative (3) de sorte que, en alternance, le troisième dévidoir (4) est utilisé comme enrouleuse d'une bande provenant de la ligne de soudage et le quatrième dévidoir (5) est utilisé comme dérouleuse de bande pour alimenter le laminoir à froid (9), dans laquelle le troisième dévidoir (4) et le quatrième dévidoir (5) sont dimensionnés pour enrouler une bobine qui pèse entre 80 et 200 tonnes métriques et/ou présentant un diamètre allant jusqu'à 6 mètres, appelée méga bobine, réalisée par ladite ligne de soudage au moyen de la jonction d'une pluralité desdites bobines provenant desdits au moins deux premiers dévidoirs (1), dans laquelle la plate-forme rotative (3) est munie de moyens de blocage (6, 6', 16, 16') permettant de bloquer la queue de la méga bobine venant d'être enroulée sur chacun du troisième dévidoir (4) et du quatrième dévidoir (5).

2. Machine de soudage et de laminage selon la revendication 1, dans laquelle est prévue une seconde soudeuse (2') entre la plate-forme rotative (3) et le laminoir à froid (9), ladite seconde soudeuse (2') étant conçue pour souder une queue d'une première méga bobine entrant dans le laminoir à froid (9) à une tête d'une seconde méga bobine provenant soit dudit troisième dévidoir (4) soit dudit quatrième dévidoir (5).
3. Machine de soudage et de laminage selon l'une quelconque des revendications précédentes, dans laquelle les moyens de coupe sont des cisailles à découper statiques (10) ou des cisailles à découper volantes (12).
4. Machine de soudage et de laminage selon la revendication 3, dans laquelle soit un deuxième dévidoir double (11') soit un carrousel (13) de deuxième dévidoirs (11') est prévu lorsque lesdites cisailles à découper volantes (12) sont prévues.
5. Machine de soudage et de laminage selon l'une quelconque des revendications précédentes, dans

laquelle ladite limite de poids prédéterminé est un poids spécifique compris entre 10 et 21 kilogrammes par millimètre de largeur de la bande.

6. Machine de soudage et de laminage selon l'une quelconque des revendications précédentes, dans laquelle ladite limite de diamètre prédéterminé est un diamètre de bobine compris entre 2000 et 2100 millimètres.
7. Machine de soudage et de laminage selon l'une quelconque des revendications précédentes, dans laquelle sont prévus des moyens de coupe supplémentaires, disposés en amont de ladite plate-forme rotative (3) et conçus pour couper la bande une fois que la méga bobine a été enroulée sur le troisième dévidoir (4) ou sur le quatrième dévidoir (5).
8. Machine de soudage et de laminage selon l'une quelconque des revendications précédentes, dans laquelle entre le laminoir à froid (9) et l'au moins un second dévidoir (11, 11') se trouvent uniquement lesdits moyens de coupe.
9. Machine de soudage et de laminage selon l'une quelconque des revendications précédentes, dans laquelle se trouve une seule plate-forme rotative (3).
10. Machine de soudage et de laminage selon l'une quelconque des revendications 2 à 9, dans laquelle la plate-forme rotative (3) est disposée directement entre l'au moins une première soudeuse (2) et la seconde soudeuse (2').
11. Machine de soudage et de laminage selon l'une quelconque des revendications précédentes, dans laquelle se trouve seulement un appareil de décapage entre l'au moins une première soudeuse (2) et la plate-forme rotative (3).
12. Machine de soudage et de laminage selon l'une quelconque des revendications précédentes, dans laquelle lesdits moyens de blocage comprennent un rouleau déflecteur respectif (6, 6') pour chacun du troisième dévidoir (4) et du quatrième dévidoir (5), et un rouleau de pression correspondant (16, 16') disposé au-dessus du rouleau déflecteur (6, 6'), de sorte que la queue de la méga bobine venant d'être enroulée puisse être bloquée sur le rouleau déflecteur (6, 6') grâce au rouleau de pression correspondant (6, 6', 16, 16').
13. Processus de soudage et de laminage de bandes métalliques, au moyen d'une machine de soudage et de laminage selon la revendication 1, comprenant les étapes suivantes :

a) le déroulage de bobines présentant une limite

- prédéterminée de poids de bobine ou une limite prédéterminée de diamètre de bobine, des au moins deux premiers dévidoirs (1) et leur alimentation sur ladite ligne de soudage ;
- b) le soudage de la queue d'une bobine à la tête d'une bobine suivante au moyen de l'au moins une première soudeuse (2) ;
- c) l'enroulement d'une première méga bobine sur le troisième dévidoir (4) ;
- d) le blocage de la queue de la première méga bobine au moyen desdits moyens de blocage (6, 6', 16, 16') ;
- e) la rotation de la plate-forme rotative (3) de sorte que le quatrième dévidoir (5) soit utilisé comme enrouleuse pour enrouler une seconde méga bobine, tandis que le troisième dévidoir (4) est utilisé comme dérouleuse de la première méga bobine pour alimenter le laminoir à froid (9) ;
- f) le laminage de la première méga bobine dans les au moins deux cages de laminage (19) et l'enroulement d'une première partie de bande laminée de la première méga bobine sur l'au moins un deuxième dévidoir (11, 11') jusqu'à ladite limite prédéterminée de poids de bobine ou ladite limite prédéterminée de diamètre de bobine, définissant ainsi une première bobine laminée ;
- g) la coupe, au moyen des moyens de coupe, de la bande laminée après la formation de ladite première bobine laminée ;
- h) l'enroulement de parties restantes supplémentaires de bande laminée de la première méga bobine sur ledit au moins un deuxième dévidoir (11, 11') jusqu'à ladite limite prédéterminée de poids de bobine ou ladite limite prédéterminée de diamètre de bobine, définissant ainsi des bobines laminées supplémentaires, et la coupe de la bande laminée, au moyen desdits moyens de coupe, après la formation de chacune desdites bobines laminées supplémentaires ;
- dans lequel, simultanément aux étapes f), g) et au moins en partie à l'étape h), la seconde méga bobine est enroulée sur le quatrième dévidoir (5) et ensuite, la plate-forme rotative (3) est entraînée en rotation de sorte que le troisième dévidoir (4) soit utilisé comme enrouleuse de la bande pour fabriquer la méga bobine suivante, tandis que le quatrième dévidoir (5) est utilisé comme dérouleuse de la seconde méga bobine pour alimenter le laminoir à froid (9), effectuant les étapes de f) à h) pour la seconde méga bobine.
- 14.** Processus de soudage et de laminage selon la revendication 13, dans lequel la formation et la durée d'enroulement de la seconde méga bobine sont plus courtes que la durée de déroulement et de laminage

de la première méga bobine.

- 15.** Processus de soudage et de laminage selon la revendication 13 ou 14, dans lequel un soudage est prévu entre une queue d'une première méga bobine entrant dans le laminoir et une tête de la seconde méga bobine provenant dudit quatrième dévidoir (5), ledit soudage étant exécuté au moyen d'une seconde soudeuse (2') disposée entre la plate-forme rotative (3) et le laminoir à froid (9).
- 16.** Processus de soudage et de laminage selon l'une quelconque des revendications 13 à 15, dans lequel, une fois qu'une méga bobine a été enroulée sur le troisième dévidoir (4) ou sur le quatrième dévidoir (5), la bande est coupée par des moyens de coupe supplémentaires, disposés en amont de la plate-forme rotative (3).

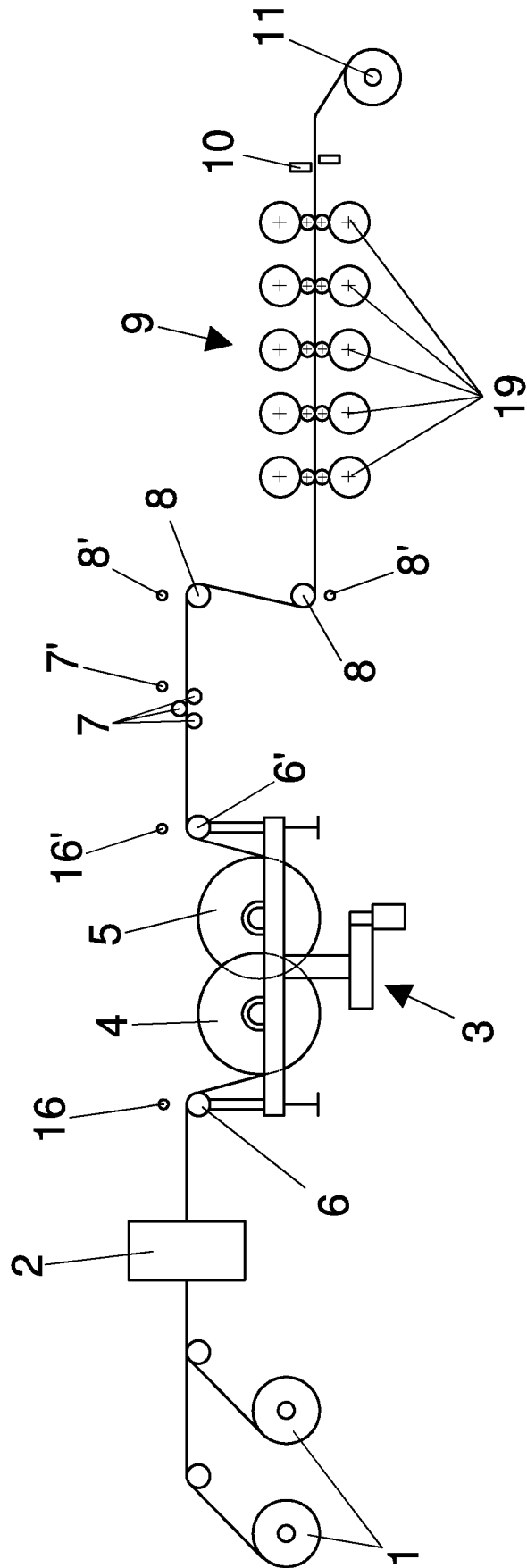


Fig. 1

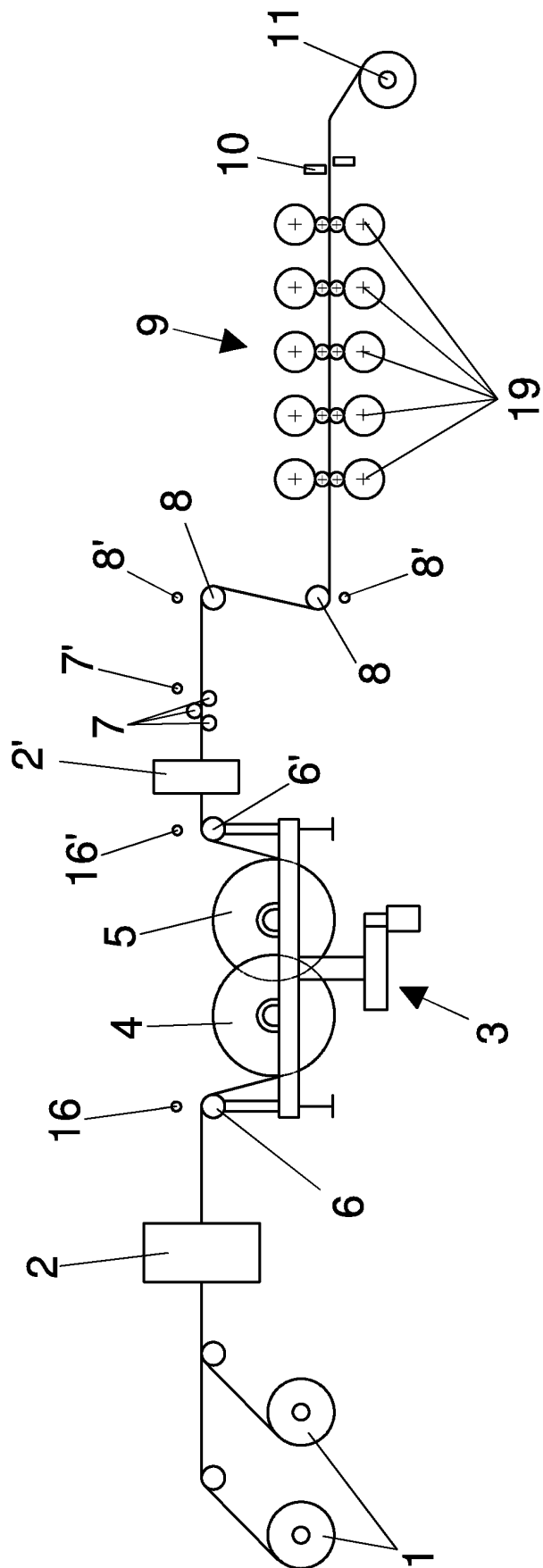


Fig. 2

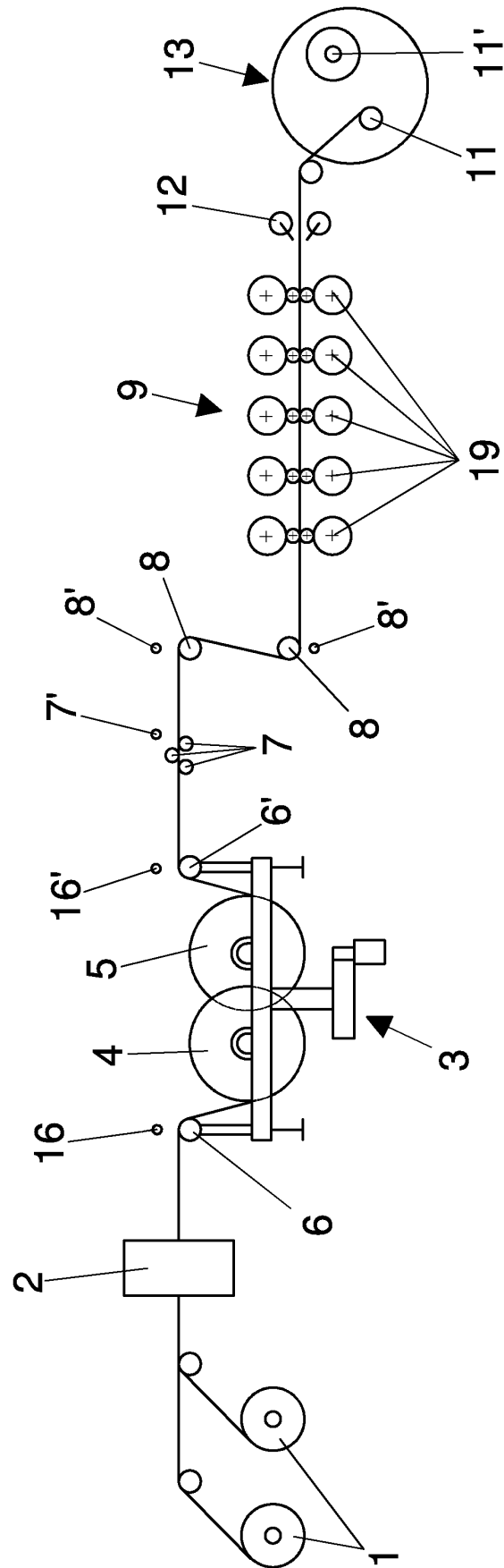


Fig. 3

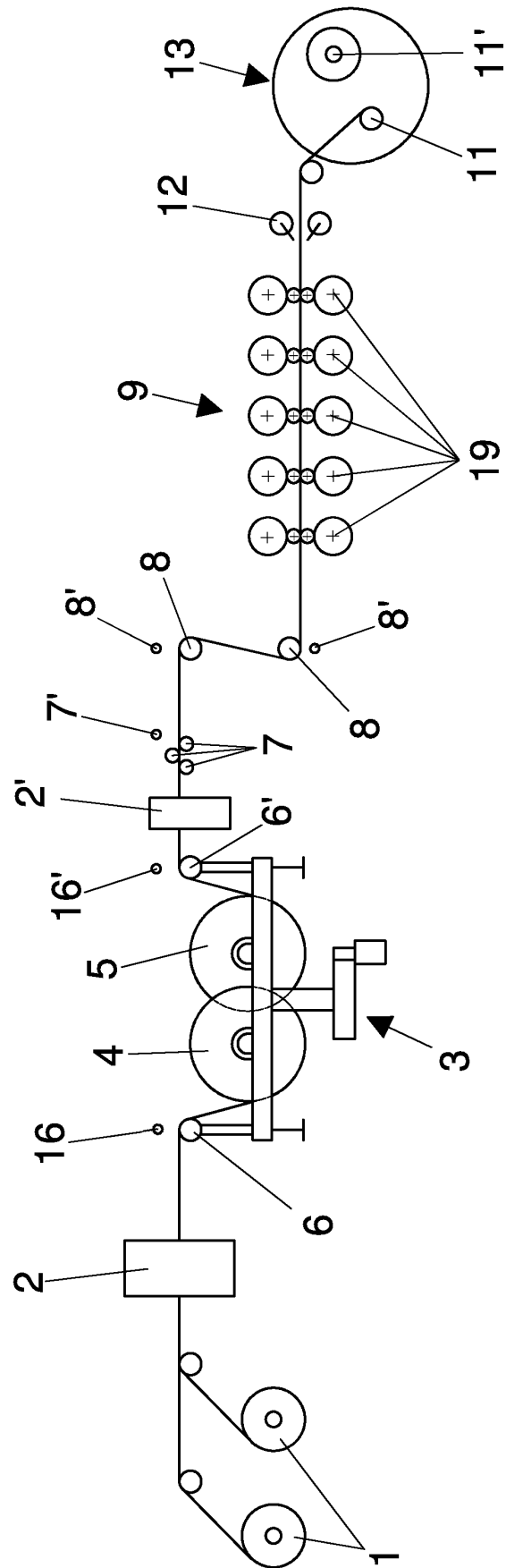


Fig. 4

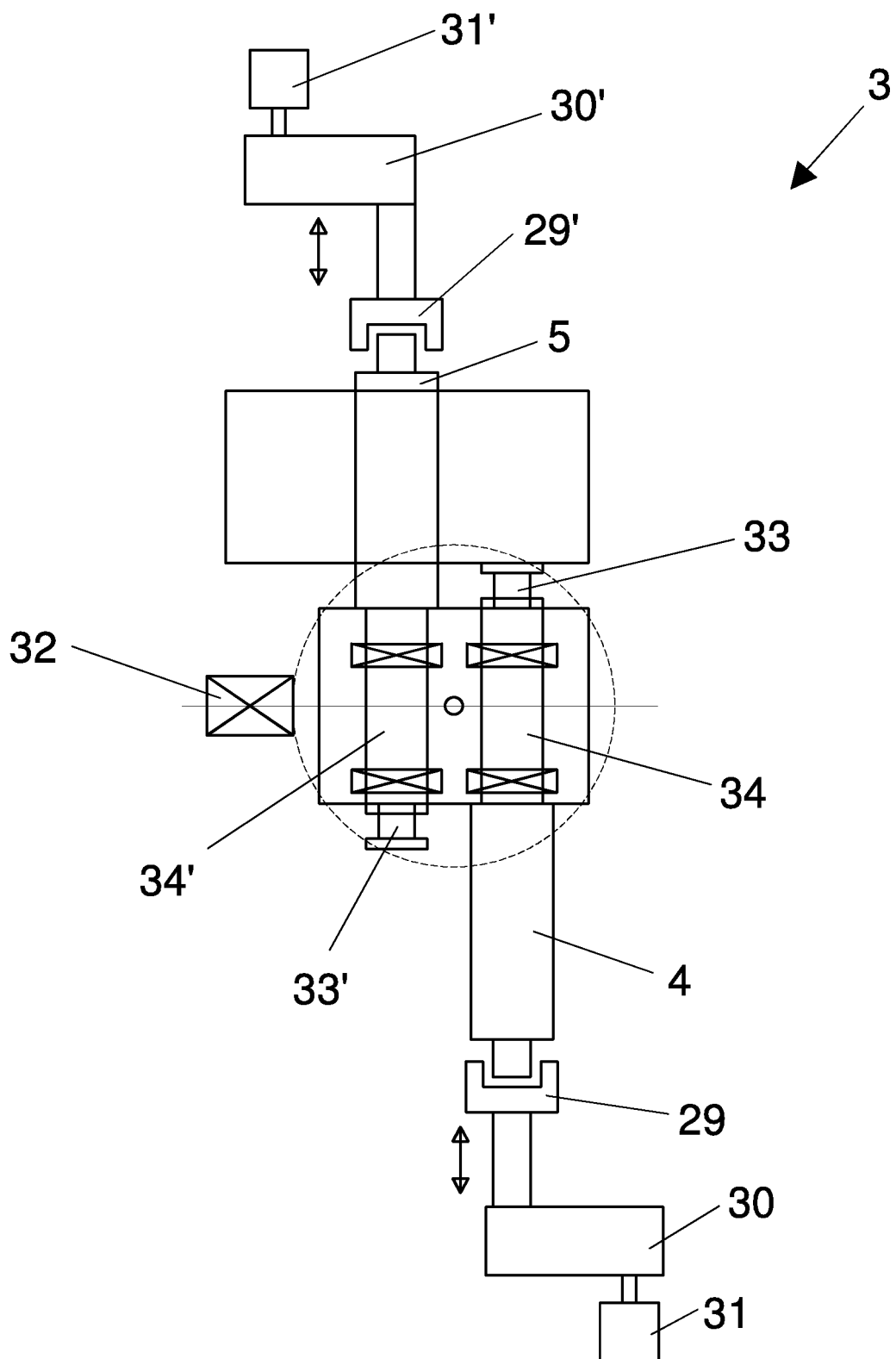


Fig. 5

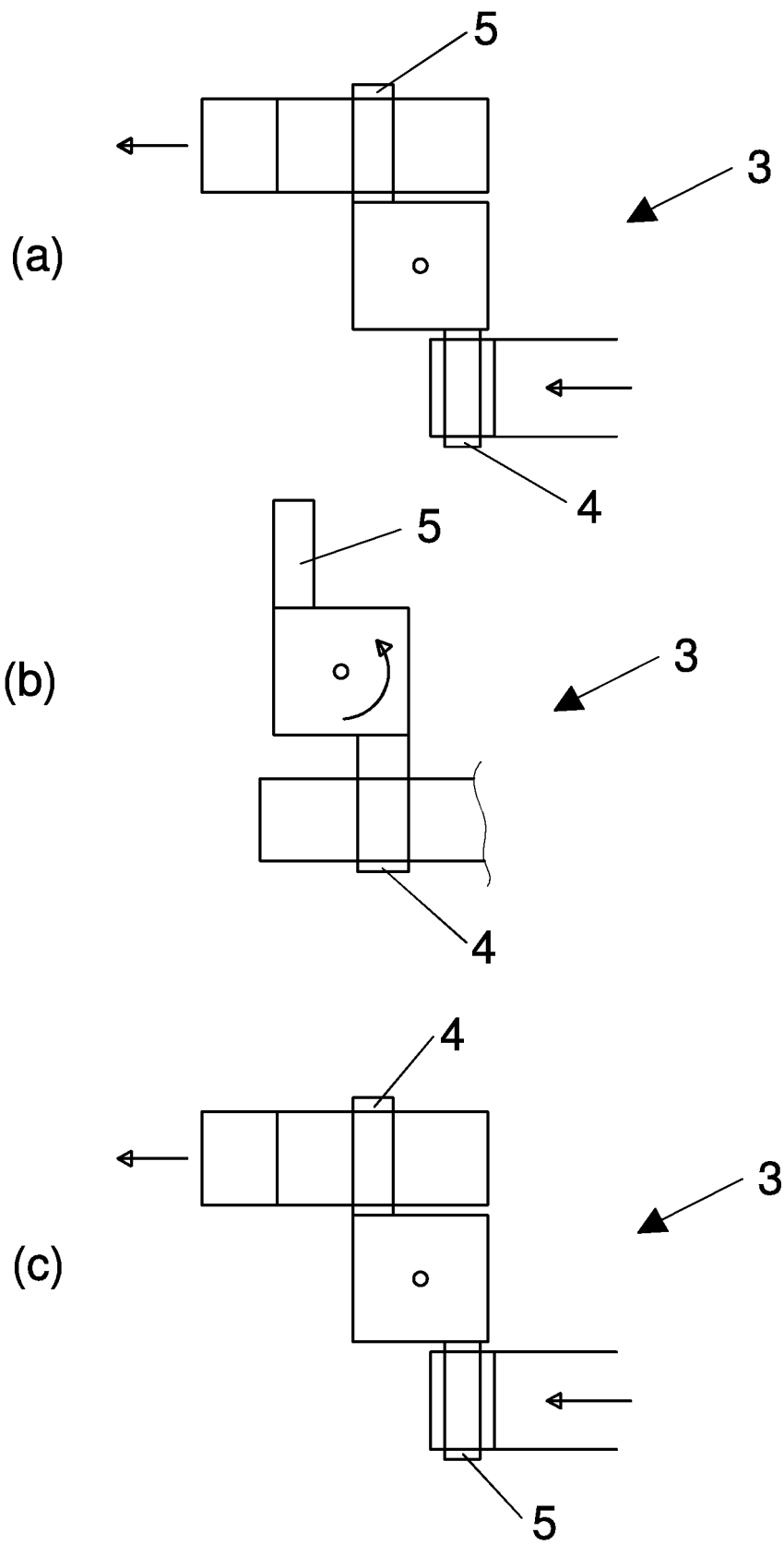


Fig. 6

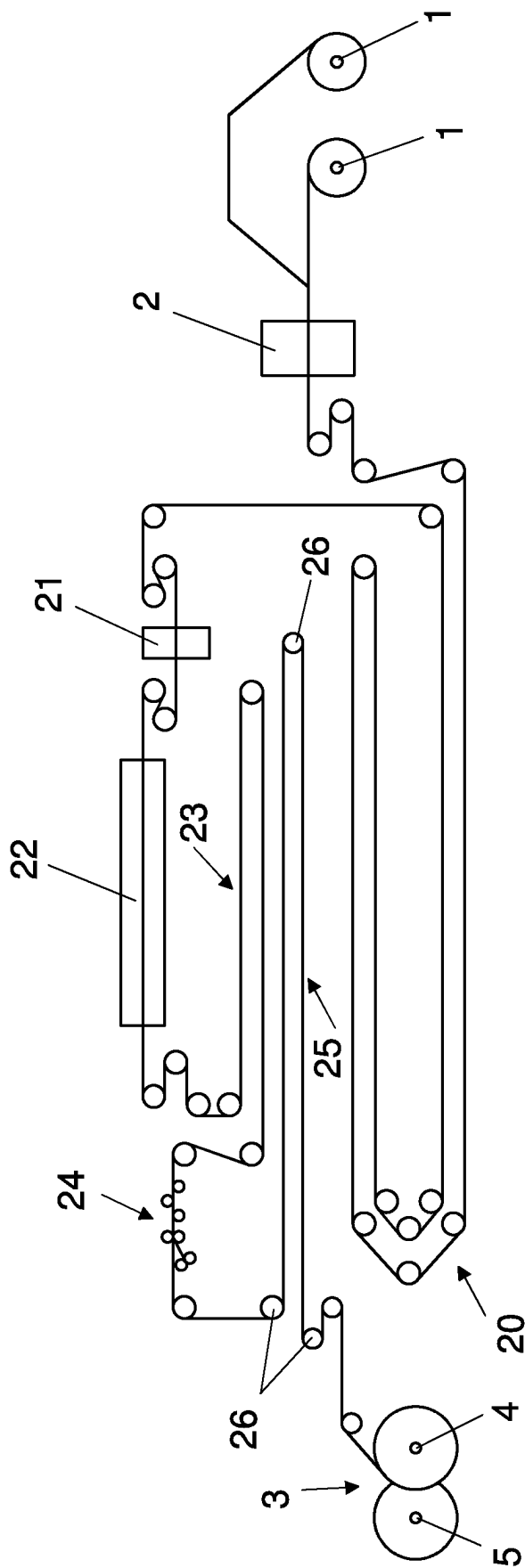


Fig. 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- DE 2606301 A1 [0008]