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(54) TENSIONING UNIT FOR ROLLING APPARATUSES

SPANNEINHEIT FÜR ROLLVORRICHTUNGEN

UNITÉ DE SERRAGE POUR APPAREILS DE ROULEMENT

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a tensioning unit for rolling apparatuses, used to detect and adjust the tension of strips or metal sheets in the interstand segment between two adjacent rolling stands.

BACKGROUND OF THE INVENTION

[0002] Tensioning units are known, used in hot rolling apparatuses for metal sheets, which are disposed in an intermediate position between two adjacent rolling stands, to detect and adjust the tension to which the strip or metal sheet being worked is subjected in the interstand segment.

[0003] The tension of the strip or metal sheet is monitored with the purpose of conferring on the product the desired characteristics, and of reaching high standards of quality.

[0004] For example, it is known that characteristics such as the profile and planarity of the strip or sheet depend on correct and constant tension values being maintained throughout the rolling process, in particular in the interstand segments where the strip or sheet are not directly supported.

[0005] Tensioning units are known comprising a tensioning roll mounted on a support and disposed in contact with the strip or sheet in the interstand segment between two adjacent rolling stands.

[0006] The tensioning roll can be driven to interact with the strip or sheet in relation to the tension value detected, acting on a hydraulic motor positioned in axis with the support.

[0007] The tension value of the strip or metal sheet is detected by load cells installed in proximity to the tensioning roll.

[0008] Alternatively, the tension value of the strip or metal sheet can be obtained by reading the position and/or pressure of hydraulic command devices.

[0009] A typical disadvantage of tensioning units for rolling apparatuses of the known type is that they require big spaces for installation, which significantly influences the distance between one rolling stand and the next.

[0010] One disadvantage deriving from the previous one is that a big distance between the rolling stands leads to a reduction in the temperature of the strip or metal sheet during working, which leads to a considerable disadvantage for the hot rolling steps, and can require operations to restore the temperature before the subsequent rolling pass.

[0011] Another consequent disadvantage is that more energy is required to perform the same workings on the strip or metal sheet compared with what would be required by the same steps performed at higher temperatures.

[0012] Another disadvantage is that sliding friction is

generated between the mobile parts of the devices that support and move the contact element: such friction entails premature wear and inefficiency and inaccuracy in the action of the tensioning unit.

[0013] JP62156013 describes a tensioning unit having a contact roll disposed at the end of the shaft of a hydraulic cylinder with a substantially vertical axis, under which a tension detection element is disposed, in this specific case a load cell.

[0014] In this solution, the combination of the contact roll/hydraulic cylinder acts directly on the load cell, with possible damage caused thereto and imprecisions in the measurements.

[0015] US 5,718,138 describes a tensioning unit having a contact roll associated with a support arm connected to the shaft of a hydraulic cylinder, so as to define a desired height of the roll with respect to a lying plane of the strip or metal sheet. US'138 provides two methods to detect the tension of the strip, a first that uses a load cell generically associated with the tensioning unit, and a second that uses the value of the pressure of the hydraulic cylinder.

[0016] There is therefore a need to perfect a tensioning unit for rolling apparatuses that can overcome at least one of the disadvantages of the state of the art.

[0017] In particular, one purpose of the invention is to obtain a tensioning unit which, installed in the interstand segment, allows to reduce the distance between two adjacent rolling stands compared with known tensioning units, so as to reduce to a minimum the lowering in temperature of the strip or metal sheet being worked.

[0018] Therefore, one purpose of the present invention is to obtain a tensioning unit that is compact and not bulky.

[0019] Another purpose of the present invention is to obtain a tensioning unit that is precise and reliable, and in which the friction deriving from the sliding of moving parts is reduced.

[0020] Another purpose of the present invention is to improve the accessibility of the measuring element of the tensioning unit in order to carry out the maintenance steps.

[0021] Another purpose of the present invention concerns the possibility of replacing the tensioning roll of the tensioning unit when it is worn or ruined, without having to operate in proximity to the measuring element.

[0022] Another purpose of the present invention is to position the measuring element far from the zone where the strip or metal sheet runs, because, since it is a sensitive element, it should preferably be placed somewhere sheltered from vibrations and dirt.

[0023] Furthermore, one purpose of the present invention is to provide a tensioning unit that is simple and economical.

[0024] 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

[0025] The present invention is set forth and characterized in the independent claim, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0026] In accordance with the above purposes, a tensioning unit is provided for a rolling apparatus which includes at least one rolling stand.

[0027] According to the present invention, the tensioning unit comprises a contact unit which is provided with at least one tensioning roll configured to be taken to rest on and put under tension a strip or metal sheet, at least one actuation element to drive the contact unit, taking it into contact with the strip or metal sheet, and at least one detection unit to measure the forces to which the contact unit is subjected, and hence the tension of the strip or metal sheet.

[0028] According to the present invention, the contact unit, the actuation element and the detection unit are disposed one below the other, so as to define a main development of the column type of the tensioning unit, in this way obtaining a compact tensioning unit with a very limited lateral extension, such as to allow to position two adjacent rolling stands of a rolling apparatus close to each other.

[0029] According to another characteristic, the contact unit is disposed on a support element rotatable around an axis lying on a plane substantially parallel to the lying and/or feed plane of the strip or metal sheet.

[0030] According to one formulation of the present invention, the actuation element can be a linear actuator disposed vertical according to its greatest size, hence disposed during use substantially orthogonal to the lying and feed plane of the strip or metal sheet.

[0031] According to a variant, the actuation element defines during use an angle other than zero with respect to the vertical of the strip or metal sheet.

[0032] According to one formulation of the present invention, the tensioning unit includes at least one control unit configured to receive from the detection unit a signal relating to the value of tension of the metal strip or metal sheet advancing in one direction and/or another, between two adjacent rolling stands and acting on the tensioning roll.

[0033] The control unit is therefore suitable to compare the value of the tension signal with a pre-established value and, if different, to drive the contact unit, for example rotating it in a clockwise or anti-clockwise direction, so as to keep the tension value of the strip or metal sheet substantially equal to the optimal value.

[0034] A rolling apparatus is also provided, comprising at least two rolling stands between which at least one tensioning unit according to the present invention is interposed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] These and other characteristics of the present invention will become apparent from the following description of some embodiments, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a lateral view of a tensioning unit for rolling apparatuses in a first operating condition, according to embodiments described here;
- fig. 2 is a lateral view of a tensioning unit for rolling apparatuses in a second operating condition, according to other embodiments described here;
- fig. 3 shows a cross section from III to III of the tensioning unit for rolling apparatuses in fig. 1.

[0036] To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings. It is understood that elements and characteristics of one embodiment can conveniently be incorporated into other embodiments without further clarifications.

DETAILED DESCRIPTION OF SOME EMBODIMENTS

[0037] We shall now refer in detail to the various embodiments of the present invention, of which one or more examples are shown in the attached drawing. Each example is supplied by way of illustration of the invention and shall not be understood as a limitation thereof. For example, the characteristics shown or described insofar as they are part of one embodiment can be adopted on, or in association with, other embodiments to produce another embodiment. It is understood that the present invention shall include all such modifications and variants.

[0038] Before describing these embodiments, we must also clarify that the present description is not limited in its application to details of the construction and disposition of the components as described in the following description using the attached drawings. The present description can provide other embodiments and can be obtained or executed in various other ways. We must also clarify that the phraseology and terminology used here is for the purposes of description only, and cannot be considered as limitative.

[0039] With reference to fig. 1, this is used to describe example embodiments of a tensioning unit 10, used in a rolling apparatus 11, to detect the tension value of a metal strip 15 advancing between two rolling stands 46 in a direction of feed F1 according to the direction of the corresponding arrow.

[0040] According to some variants, in the case of reversing stands, the metal strip 15 can advance between two rolling stands 46 both in the direction of feed F1 and also in a direction of feed F2, opposite to F1, according to the direction of the corresponding arrow.

[0041] According to some variants, a rolling apparatus 11 can comprise a plurality of rolling stands 46.

[0042] According to possible variants, the tensioning unit 10 can be installed between two adjacent rolling stands 46.

[0043] According to other variants, the tensioning unit 10 can be installed between each pair of adjacent rolling stands 46.

[0044] According to some variants, described using fig. 1, two rolling stands 46 can both comprise a lower work roll 50 and an upper work roll 52 disposed respectively below and above the plane identified by the upper surface of at least one guide plate 44 on which, during working, the metal strip 15 runs and is compressed directly by the rolls 50, 52.

[0045] The lower work roll 50 and the upper work roll 52 can be for example cylindrical in shape with an oblong development in a direction perpendicular to the direction of feed F1 and/or F2.

[0046] According to some other variants, the two rolling stands 46 can both also comprise a lower support roll 54 and an upper support roll 56, disposed respectively below the lower work roll 50 and above the upper work roll 52, to limit the flexion of the latter during the rolling of the metal strip 15.

[0047] The lower support roll 54 and the upper support roll 56 can be cylindrical in shape, with an oblong development in a direction perpendicular to the direction of feed F1 and/or F2.

[0048] The disposition of the lower support roll 54 can be provided tangential to the lower work roll 50 and the disposition of the upper support roll 56 can be provided tangential to the upper work roll 52.

[0049] Furthermore, the lower support roll 54 and the upper support roll 56 can have sizes and mass greater than the lower work roll 50 and the upper work roll 52.

[0050] The lower support roll 54 and the upper support roll 56 can be movable nearer to the respective lower work roll 50 and upper work roll 52, in the direction of a vertical axis X perpendicular to the direction of feed F1 and/or F2, and to the lying/feed plane of the metal strip 15, to overcome phenomena of wear deriving from the rolling cycles.

[0051] According to some variants, described using fig. 1, the tensioning unit 10 can be located for example in an intermediate position between two rolling stands 46.

[0052] The tensioning unit 10 can comprise a contact unit 13, an actuation element 26 and a detection unit 17.

[0053] According to some variants, the contact unit 13, in an inactive position, can be disposed below the at least one guide plate 44, which supports the metal strip 15 when it is being worked.

[0054] We must clarify here that by "inactive position" we mean the position taken by the tensioning unit 10 when the actuation element 26 is not driven, i.e. it is not extended, and which corresponds essentially to the condition where the contact unit 13 is not resting from below on the metal strip 15.

[0055] The guide plate 44 also defines the lying and feed plane of the metal strip 15 between the two rolling stands 46.

[0056] The at least one guide plate 44 can have an interruption of appropriate size, in correspondence with the contact unit 13, at least equal to its bulk when in use, i.e. when it is rotated, so as to allow it to bring the metal strip 15 under tension, passing through said interruption.

[0057] The contact unit 13 can be rotatable around an axis of rotation Z that lies on a plane substantially parallel to the lying and feed plane of the metal strip 15 and has a direction substantially perpendicular to the direction of feed F1 and/or F2 of the metal strip 15.

[0058] According to some variants, the contact unit 13 can comprise a tensioning roll 12 and a support element 14.

[0059] The tensioning roll 12 can be cylindrical in shape with an oblong development in a direction substantially parallel to the axis of rotation Z.

[0060] Furthermore, the tensioning roll 12 can have an axis of rotation substantially parallel to the axis of rotation Z.

[0061] According to some variants, the support element 14 is provided to support the tensioning roll 12 and can be mounted directly on a support upright 58 of the rolling stand 46.

[0062] According to some other variants, the support element 14 can be mounted on a dedicated support structure, different from the support upright 58 of the rolling stand 46.

[0063] According to possible embodiments, the support element 14 can be rotatable, by first pivoting means 16, around the axis of rotation Z, to take the tensioning roll 12 into contact with the metal strip 15.

[0064] According to some other variants, the support element 14 can also be connected to an attachment plate 19.

[0065] Moreover, the attachment plate 19 can in turn be connected to the support upright 58 of the rolling stand 46 and clamped by attachment elements 42.

[0066] According to some possible embodiments, the attachment plate 19 can be mounted on a dedicated support structure different from the support upright 58 of the rolling stand 46.

[0067] The contact unit 13 can take on a first "inactive" position at a minimum lower point where it rests on a lower mechanical stop 18 (see fig. 1), and at least a second position at a maximum upper point of maximum aperture in which it rests on an upper mechanical stop 20, as will be explained in more detail hereafter.

[0068] According to some variants, the contact unit 13 can also comprise a first position transducer 22, mounted centered on the axis of rotation Z, which can detect instant by instant the position of the contact unit 13 and consequently can also detect the position of the tensioning roll 12.

[0069] The first position transducer 22 can be for example an angular or rotatable rotary position transducer,

such as an angular or rotary encoder, in particular for example a tachymetric encoder, a relative or incremental encoder, or an absolute encoder.

[0070] According to some variants, the actuation element 26 can include inside it a second position transducer 23 disposed axially to it.

[0071] The positioning of the second position transducer 23 inside the actuation element 26 allows to detect the deviation of the actuation element 26 from the "inactive" position, and consequently to detect the position of the contact unit 13 and hence also the position of the tensioning roll 12.

[0072] According to some possible embodiments, the tensioning unit 10 can comprise both a first position transducer 22 and a second position transducer 23, to detect the position of the contact unit 13.

[0073] According to some variants, the contact unit 13 can be connected to the actuation element 26.

[0074] An actuation element 26 as used in the embodiments described here, both in the case of a single actuation element and also in the case of several dedicated actuation elements, could include a corresponding drive member.

[0075] The drive member can be chosen from a group consisting of: an electric motor, a pneumatic motor, a hydraulic piston, a piezoelectric actuator. Usually, an actuator, as used in association with embodiments described here, can be an actuator with an intrinsically linear movement or be configured to convert a circular movement into a linear movement. The conversion can be commonly done by means of types of mechanism selected from a group consisting of: screw actuators, such as a jack screw, ball screw actuators and roll screw actuators, or wheel and axle, for example drum, gears, pulley or shaft, actuators such as a lifting cable, a winch, a rack and a pinion group, a chain transmission, a belt transmission, actuators with a rigid chain and a rigid belt.

[0076] Advantageously, the actuation element 26 can be a linear actuator.

[0077] The actuation element 26 can comprise a sleeve 28 and a shaft 29, configured to slide inside the sleeve 28.

[0078] Furthermore, the actuation element 26 can be located below the contact unit 13, in a direction substantially parallel to the direction identified by the vertical axis X.

[0079] According to some possible variants, the actuation element 26 can be installed inclined at an angle with respect to the direction identified by the vertical axis X.

[0080] Merely by way of non-restrictive example, the actuation element 26 can be inclined between -35° and $+35^\circ$ with respect to the direction identified by the vertical axis X.

[0081] According to some variants, the actuation element 26 can be provided with a first end 30 and a second end 32, where the first end 30 can correspond to the terminal part of the shaft 29, while the second end 32

can correspond to the terminal part of the sleeve 28.

[0082] According to some variants, the actuation element 26 can be attached by oscillating pins acting on the center line of the actuation element 26.

[0083] The connection between the contact unit 13 and the actuation element 26 can be made by pivoting the first end 30 of the shaft 29 to the support element 14.

[0084] According to some variants, the actuation element 26 can instead be connected to the detection unit 17 by the second end 32.

[0085] Furthermore, the detection unit 17 can be located below the actuation element 26 in a direction substantially parallel to the direction identified by the vertical axis X.

[0086] According to some possible variants, the detection unit 17 can be located below the actuation element 26, so that the two components are not perfectly aligned, i.e. so that an inclination of a certain angle is formed between them, which inclination is kept in consideration by the detection unit 17 when it detects the tension value of the metal strip 15.

[0087] According to some possible embodiments, the detection unit 17 can include a connection element 34, a sensor unit 38 and a support bracket 40.

[0088] According to other possible embodiments, the detection unit 17 can also include a support plate 37.

[0089] The connection between the actuation element 26 and the detection unit 17 can be made by pivoting the second end 32 to the connection element 34.

[0090] According to some variants, the connection element 34 is provided rotatable and can be mounted directly on the support upright 58 of the rolling stand 46.

[0091] According to some possible embodiments, the connection element 34 can be mounted on a dedicated support structure different from the support upright 58 of the rolling stand 46.

[0092] According to some other variants, the connection element 34 can in turn be rotatable with respect to the support plate 37, to which it is connected by second pivoting means 36.

[0093] Furthermore, the support plate 37 can be connected to the support upright 58 of the rolling stand 46 and clamped by attachment elements 42.

[0094] According to some possible embodiments, the support plate 37 can be mounted on a dedicated support structure different from the support upright 58 of the rolling stand 46.

[0095] The connection element 34 can be rotatable around an axis of rotation parallel to the axis of rotation Z and hence perpendicular to the direction of feed F1 and/or F2.

[0096] According to some variants, below the connection element 34, in a direction parallel to the direction identified by the vertical axis X, the sensor unit 38 can be positioned, to measure the tension forces acting on the metal strip 15 due to the action of traction at least of the work rolls 50, 52 and the tensioning roll 12.

[0097] According to some possible variants, the sensor

unit 38 can be located below the connection element 34 so that the two elements are not perfectly aligned, i.e. so that an inclination is formed between them of a certain angle, which is kept in consideration by the sensor unit 38 when it detects the tension value of the metal strip 15.

[0098] The sensor unit 38 can be supported by the support bracket 40 and connected stably to it by the attachment elements 42.

[0099] The support bracket 40 can be located below the sensor unit 38 in a direction parallel to the direction identified by the vertical axis X.

[0100] According to some variants, the bracket 40 can be connected to the support plate 37 by the attachment elements 42.

[0101] Alternatively, the support bracket 40 can be directly connected to the support upright 58 of the rolling stand 46 and clamped by the attachment elements 42.

[0102] According to some possible embodiments, the support bracket 40 can be mounted on a dedicated support structure different from the support upright 58 of the rolling stand 46.

[0103] In some embodiments supplied as a non-restrictive example, the sensor unit 38 can include one or more sensors to detect the force exerted on it by the actuation element 26 as a consequence of the tension caused by the traction of the work rolls 50, 52 and the tensioning roll 12 on the metal strip 15.

[0104] It should be noted here that one or more of the sensors included in the sensor unit 38 as used in the embodiments described here can be at least one sensor element selected from the group comprising:

- a force sensor or transducer, like a load cell, for example a load cell with extensometer, a hydraulic or hydrostatic load cell, a piezoelectric load cell, a vibrating wire load cell or a capacitive load cell;
- a pressure sensor or transducer, for example the electronic type generally used to collect a force to measure deformation or deviance caused by the force applied on an area, like a sensor with a piezo resistive extensometer, a capacitive sensor, an electromagnetic sensor, a piezoelectric sensor, an optical sensor or a potentiometric sensor.

[0105] It should be understood that, depending on the specific disposition of the sensor unit 38, the sensor unit can also include at least a pressure sensor and at least a force sensor, for example a load cell.

[0106] According to different implementations of the embodiments described here, the force exerted on the sensor unit 38 can be detected by one or more load cells, one or more pressure sensors or one or more other sensors, which use an extensometer, a piezoelectric element, a piezo resistive element, a Hall-effect element or suchlike. With this, it must be considered that a pressure is the force exerted per unitary surface, so that depending on whether one or more sensors are provided as pressure sensors or as force sensors or load cells, it could

become necessary to consider a conversion.

[0107] According to some possible embodiments, a control unit 24 can also be provided, which is configured to receive from the detection unit 17 a signal relating to the tension value of the metal strip 15, acting on the tensioning roll 12, and disposed advancing between two adjacent rolling stands 46.

[0108] Furthermore, the control unit 24 is suitable to compare the value of said signal with a pre-established optimal value and to order retroactively a rotation of the contact unit 13, in one direction or another, so as to reduce or increase the pressure exerted by the metal strip 15 in transit on the tensioning roll 12, in order to keep the tension value of the metal strip 15, substantially equal to the optimal value.

[0109] According to some other variants, described with reference to fig. 2, the tensioning unit 10 is provided in a second operating condition in which the contact unit 13 is rotated from the "inactive" position by an angle α such that it is taken to rest on the upper mechanical stop 20. Therefore, all the intermediate positions between the "inactive" position and the latter are respectively identified by an angle α comprised between zero and the value relating to the position of maximum aperture.

[0110] According to some variants, again described with reference to fig. 2, the shaft 29 of the actuation element 26 finds itself in this condition when it is at its maximum possible travel with respect to the other positions that the contact unit 13 can assume.

[0111] Depending on the force with which the actuation element 26 is driven, a force is therefore generated with the same direction and the same intensity but an opposite sense due to the reaction of the metal strip 15 taken under tension.

[0112] This force is measured by the sensor unit 38 and, if it is not the same as the predetermined force, the control unit 24 sends a signal to make the contact unit 13 rotate by a certain angle α or the actuation element 26 by a certain travel.

[0113] Advantageously, the point of contact between the tensioning roll 12 and the metal strip 15 can be provided almost central between two adjacent rolling stands 46 so that the actuation element 26 is subjected to a reaction as perpendicular as possible to the direction of feed F1 and/or F2 and hence as parallel as possible to the vertical axis X. This makes the measuring by the sensor unit 38 repeatable, under constant conditions of incidence.

[0114] According to some variants, described with reference to fig. 3, the tensioning unit 10 can include at least a contact unit 13 which can in turn comprise at least one tensioning roll 12 and at least one support element 14, by way of example two, at least one actuation element 26, by way of example two, and at least one detection unit 17, by way of example two.

[0115] According to some other variants, if the tensioning unit 10 comprises for example one tensioning roll 12, two support elements 14, two actuation elements 26 and

two detection units 17, then the support elements 14, the actuation elements 26 and the detection units 17 can advantageously be disposed in correspondence with the terminal portions of the oblong development of the tensioning roll 12.

[0116] Using two detection units 17 can entail detecting slightly different tension values of the metal strip 15, which can be processed and mediated by the control unit 24, leading to a further refinement in the retroactive adjustment of the tensioning unit 10.

[0117] It is clear that modifications and/or additions of parts may be made to the tensioning unit 10 as described heretofore, without departing from the field and scope of the present invention.

[0118] It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of tensioning unit 10, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

Claims

1. Tensioning unit to detect and adjust a tension value of a metal strip (15) in a rolling apparatus (11), which includes at least one rolling stand (46), comprising:

- at least one contact unit (13) provided with at least one tensioning roll (12);
- at least one actuation element (26) to drive said at least one contact unit (13), the actuation element (26) comprising a sleeve (28) and a shaft (29) configured to slide inside the sleeve (28),
- at least one detection unit (17) to measure the forces to which the at least one contact unit (13) is subjected,

at least one contact unit (13), said at least one actuation element (26) and said at least one detection unit (17) being disposed at least partly aligned with each other, one after the other, so as to define a main development of the column type of the tensioning unit (10), the detection unit (17) being disposed below the actuation element (26) in order to detect a tension value of the metal strip (15), **and** said contact unit (13) comprising at least a support element (14) on which said tensioning roll (12) is mounted, said support element (14) being rotatable around an axis of rotation (Z), said actuation element (26) comprising a first end (30) and a second end (32), the first end (30) being the terminal part of the shaft (29) and the second end (32) being the terminal part of the sleeve (28), the actuation element (26) being pivoted with its first end (30) to said support element (14) in an intermediate position between said axis of rotation (Z) and said tensioning roll (12), and its sec-

ond end (32) being pivoted to a connection element (34) of said detection unit (17).

2. Tensioning unit as in claim 1, **characterized in that** said connection element (34) being rotatable with respect to pivoting means (36).
3. Tensioning unit as in claim 1 or 2, **characterized in that** said actuation element (26) is a linear actuator.
4. Tensioning unit as in any of the claims 1-3, **characterized in that** said support element (14) is configured to be associated to a support upright (58) of said rolling stand (46).
5. Tensioning unit as in any of the claims 1-3, **characterized in that** said support element (14) is configured to be associated to a dedicated support structure which is different from the support upright (58) of the rolling stand (46).
6. Tensioning unit as in any claim hereinbefore, **characterized in that** said contact unit (13) is rotatable between a first position in which it rests on a lower mechanical stop (18) and at least one second position of maximum aperture in which it rests on an upper mechanical stop (20).
7. Tensioning unit as in any claim hereinbefore, **characterized in that** it is provided passing through an interruption of at least one guide plate (44) that prolongs the extension of said at least one rolling stand (46).
8. Tensioning unit as in any claim hereinbefore, **characterized in that** at least one first position transducer (22) and/or at least one second position transducer (23) is associated to said contact unit (13).
9. Tensioning unit as in claim 8, **characterized in that** said first position transducer (22) and/or said second position transducer (23) is an encoder.
10. Tensioning unit as in claim 8 or 9, **characterized in that** said second position transducer (23) is mounted in axis and internally to the actuation element (26).
11. Tensioning unit as in any claim hereinbefore, **characterized in that** said detection unit (17) comprises at least one connection element (34), at least one sensor unit (38) and at least one support bracket (40).
12. Tensioning unit as in claim 11, **characterized in that** said at least one sensor unit (38) comprises at least one load cell disposed below and substantially in contact with said actuation element (26).

13. Tensioning unit as in any claim hereinbefore, **characterized in that** it comprises at least one control unit (24) configured to receive from said detection unit (17) a signal relating to the value of tension of a metal strip (15) advancing in a direction of feed (F1) or in a direction of feed (F2), to compare said value with a pre-established value and, if different, to order a rotation of said contact unit (13), in a clockwise or anti-clockwise direction, so as to reduce or increase the tension value of the metal strip (15), returning it to an optimal value.
14. Tensioning unit as in any claim hereinbefore, **characterized in that** it is installed between two rolling stands (46) that both comprise at least one lower work roll (50) and at least one upper work roll (52).
15. Tensioning unit as in claim 14, **characterized in that** said rolling stands (46) also comprises at least one lower support roll (54) and at least one upper support roll (56).
16. Rolling apparatus comprising at least one rolling stand (46) and a metal strip or sheet (15), **characterized in that** it comprises at least one tensioning unit (10) as in any claim from 1 to 15 and directly mounted on a support upright (58) of said rolling stand (46) or on a dedicated support structure.
17. Rolling apparatus as in claim 16, comprising a guide plate (44) defining a lying and feed plane of said metal strip (15) in a direction of feed (F1, F2), **characterized in that** said axis of rotation (Z) with respect to which said support element (14) rotates lies on a plane substantially parallel to said lying plane of said metal strip (15) and has a direction substantially orthogonal to said direction (F1, F2).
18. Rolling apparatus as in claim 16 or 17, **characterized in that** it comprises rolling stands (46) of the reversing type.

Patentansprüche

1. Spanneinheit zum Erfassen und Einstellen eines Spannungswertes eines Metallstreifens (15) in einer Walzvorrichtung (11) mit wenigstens einem Walzgerüst (46), umfassend:

- wenigstens eine Kontakteinheit (13), die mit wenigstens einer Spannwalze (12) ausgebildet ist;
- wenigstens ein Betätigungselement (26) zum Antreiben der wenigstens einen Kontakteinheit (13), wobei das Betätigungselement (26) eine Hülle (28) und einen Schaft (29), der zum Gleiten in der Hülle (28) eingerichtet ist, umfasst;

- wenigstens eine Erfassungseinheit (17) zum Messen der Kräfte, welche auf die wenigstens eine Kontakteinheit (13) wirken;

wobei die wenigstens eine Kontakteinheit (13), das wenigstens eine Betätigungselement (26) und die wenigstens eine Erfassungseinheit (17) zumindest teilweise miteinander fluchtend hintereinander ausgerichtet sind, um einen Hauptaufbau der Spanneinheit (10) vom Säulentyp zu definieren, wobei die Erfassungseinheit (17) unterhalb des Betätigungselements (26) angeordnet ist, um einen Spannungswert des Metallstreifens (15) zu erfassen; wobei die Kontakteinheit (13) wenigstens ein Trägerelement (14) umfasst, auf welchem die Spannwalze (12) montiert ist, wobei das Trägerelement (14) um eine Rotationsachse (Z) rotierbar ist; wobei das Betätigungselement (26) ein erstes Ende (30) und ein zweites Ende (32) umfasst, wobei das erste Ende (30) den Abschlussteil des Schafts (29) bildet und das zweite Ende (32) den Abschlussteil der Hülle (28) bildet, wobei das Betätigungselement (26) mit seinem ersten Ende (30) an dem Trägerelement (14) an einer Zwischenposition zwischen der Rotationsachse (Z) und der Spannwalze (12) schwenkbar gelagert ist, wobei das zweite Ende (32) an einem Verbindungselement (34) der Erfassungseinheit (17) schwenkbar gelagert ist.

2. Spanneinheit nach Anspruch 1, **dadurch gekennzeichnet, dass** das Verbindungselement (34) bezüglich Schwenkmitteln (36) drehbar ist.
3. Spanneinheit nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Betätigungselement (26) ein linearer Aktuator ist.
4. Spanneinheit nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** das Trägerelement (14) dazu eingerichtet ist, mit einer Trägerstütze (58) des Walzgerüsts (46) verbunden zu sein.
5. Spanneinheit nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** das Trägerelement (14) dazu eingerichtet ist, mit einer zugeordneten Trägerstruktur, die sich von der Trägerstütze (58) des Walzgerüsts (46) unterscheidet, verbunden zu sein.
6. Spanneinheit nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Kontakteinheit (13) zwischen einer ersten Position, in welcher sie an einem unteren mechanischen Anschlag (18) anliegt, und wenigstens einer zweiten Position einer maximalen Öffnung, in welcher sie an einem oberen mechanischen Anschlag (20) anliegt, schwenkbar ist.

7. Spanneinheit nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** sie einen Durchtritt durch eine Unterbrechung wenigstens einer Führungsplatte (44), die die Fortsetzung des wenigstens einen Walzgerüsts (46) verlängert, ermöglicht.
8. Spanneinheit nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** mit der Kontakteinheit (13) wenigstens ein erster Positionswandler (22) und/oder wenigstens ein zweiter Positionswandler (23) verbunden ist.
9. Spanneinheit nach Anspruch 8, **dadurch gekennzeichnet, dass** der erste Positionswandler (22) und/oder der zweite Positionswandler (23) ein Kodierer ist.
10. Spanneinheit nach Anspruch 8 oder 9, **dadurch gekennzeichnet, dass** der zweite Positionswandler (23) in Achse und innerhalb des Betätigungselements (26) gelagert ist.
11. Spanneinheit nach einem der vorangehenden Ansprüche, **durch gekennzeichnet, dass** die Erfassungseinheit (17) wenigstens ein Verbindungselement (34), wenigstens eine Sensoreinheit (38) und wenigstens einen Stützbock (40) umfasst.
12. Spanneinheit nach Anspruch 11, **dadurch gekennzeichnet, dass** die wenigstens eine Sensoreinheit (38) wenigstens eine Lastzelle umfasst, die unterhalb und im wesentlichen in Kontakt mit dem Betätigungselement (26) angeordnet ist.
13. Spanneinheit nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** die Spanneinheit wenigstens eine Steuerungseinheit (24) umfasst, die dazu eingerichtet ist, von der Erfassungseinheit (17) ein Signal zu empfangen, welches sich auf den Wert der Spannung eines Metallstreifens (15), der sich entlang einer Transportrichtung (F1) oder einer Transportrichtung (F2) bewegt, bezieht, den Wert mit einem vorbestimmten Wert zu vergleichen und, im Falle eines Unterschieds, eine Rotation der Kontakteinheit (13) in einem Uhrzeigersinn oder einem Gegenuhrzeigersinn anzuweisen, um den Spannungswert des Metallstreifens (15) zu reduzieren oder zu erhöhen und ihn auf einen optimalen Wert zurückzuführen.
14. Spanneinheit nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** sie zwischen zwei Walzgerüsten (46) installiert ist, die beide wenigstens eine untere Arbeitswalze (50) und wenigstens eine obere Arbeitswalze (52) umfassen.
15. Spanneinheit nach Anspruch 14, **dadurch gekenn-**

zeichnet, dass die Walzgerüste (46) auch wenigstens eine untere Stützwalze (54) und wenigstens eine obere Stützwalze (56) umfassen.

- 5 16. Walzvorrichtung mit wenigstens einem Walzgerüst (46) und einem Metallstreifen oder Metallblech (15), **dadurch gekennzeichnet, dass** die Walzvorrichtung wenigstens eine Spanneinheit (10) nach einem der Ansprüche 1 bis 15 umfasst, die direkt auf einer Trägerstütze (58) des Walzgerüsts (46) oder einer zugeordneten Trägerstruktur gelagert ist.
- 10 17. Walzvorrichtung nach Anspruch 16 mit einer Führungsplatte (44), welche eine Lage- und Transportebene des Metallstreifens (15) in einer Transportrichtung (F1, F2) definiert, **dadurch gekennzeichnet, dass** die Rotationsachse (Z), bezüglich derer das Trägerelement (14) rotiert, in einer Ebene liegt, die im wesentlichen parallel zu der Lageebene des Metallstreifens (15) ist, und eine Richtung aufweist, die im wesentlichen senkrecht zu der Transportrichtung (F1, F2) ist.
- 15 18. Walzvorrichtung nach Anspruch 16 oder 17, **dadurch gekennzeichnet, dass** sie umkehrbare Walzgerüste (46) umfasst.

Revendications

1. Unité de mise sous tension pour détecter et ajuster une valeur de tension d'une bande métallique (15) dans un appareil de laminage (11), qui comprend au moins un socle de laminage (46), comprenant :

- au moins une unité de contact (13) munie d'au moins un rouleau de mise sous tension (12) ;
- au moins un élément d'actionnement (26) pour entraîner ladite au moins une unité de contact (13), l'élément d'actionnement (26) comprenant un manchon (28) et un arbre (29) configuré pour coulisser à l'intérieur du manchon (28),
- au moins une unité de détection (17) pour mesurer les forces auxquelles la au moins une unité de contact (13) est soumise,

la au moins une unité de contact (13), ledit au moins un élément d'actionnement (26) et ladite au moins une unité de détection (17) étant disposés au moins partiellement alignés les uns et l'autres, les uns après les autres, de manière à définir un développement principal du type de colonne de l'unité de mise sous tension (10), l'unité de détection (17) étant disposée en dessous de l'élément d'actionnement (26) afin de détecter une valeur de tension de la bande métallique (15), et ladite unité de contact (13) comprenant au moins un élément de support (14) sur lequel est monté ledit rouleau de mise sous ten-

- sion (12), ledit élément de support (14) pouvant tourner autour d'un axe de rotation (Z), ledit élément d'actionnement (26) comprenant une première extrémité (30) et une seconde extrémité (32), la première extrémité (30) étant la partie terminale de l'arbre (29) et la seconde extrémité (32) étant la partie terminale du manchon (28), l'élément d'actionnement (26) étant pivoté avec sa première extrémité (30) vers ledit élément de support (14) dans une position intermédiaire entre ledit axe de rotation (Z) et ledit rouleau de mise sous tension (12), et sa seconde extrémité (32) étant pivoté vers un élément de connexion (34) de ladite unité de détection (17).
2. Unité de mise sous tension selon la revendication 1, **caractérisée en ce que** ledit élément de connexion (34) peut tourner par rapport à des moyens de pivotement (36).
 3. Unité de mise sous tension selon la revendication 1 ou 2, **caractérisée en ce que** ledit élément d'actionnement (26) est un actionneur linéaire.
 4. Unité de mise sous tension selon l'une quelconque des revendications 1 à 3, **caractérisée en ce que** ledit élément de support (14) est configuré pour être associé à un montant de support (58) dudit socle de laminage (46).
 5. Unité de mise sous tension selon l'une quelconque des revendications 1 à 3, **caractérisée en ce que** ledit élément de support (14) est configuré pour être associé à une structure de support dédiée qui est différente du montant de support (58) du socle de laminage (46).
 6. Unité de mise sous tension selon l'une quelconque des revendications précédentes, **caractérisée en ce que** ladite unité de contact (13) peut tourner entre une première position dans laquelle elle repose sur une butée mécanique inférieure (18) et au moins une seconde position d'ouverture maximale dans laquelle elle repose sur une butée mécanique supérieure (20).
 7. Unité de mise sous tension selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'il** est prévu un passage à travers une interruption d'au moins une plaque de guidage (44) qui prolonge l'extension dudit au moins un socle de laminage (46).
 8. Unité de mise sous tension selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'**au moins un premier transducteur de position (22) et/ou au moins un second transducteur de position (23) est associé à ladite unité de contact (13).
 9. Unité de mise sous tension selon la revendication 8, **caractérisée en ce que** ledit premier transducteur de position (22) et/ou ledit second transducteur de position (23) est un codeur.
 10. Unité de mise sous tension selon la revendication 8 ou 9, **caractérisée en ce que** ledit second transducteur de position (23) est monté dans un axe et à l'intérieur de l'élément d'actionnement (26).
 11. Unité de mise sous tension selon l'une quelconque des revendications précédentes, **caractérisée en ce que** ladite unité de détection (17) comprend au moins un élément de connexion (34), au moins une unité de capteur (38) et au moins une équerre de support (40).
 12. Unité de mise sous tension selon la revendication 11, **caractérisée en ce que** ladite au moins une unité de capteur (38) comprend au moins une cellule de charge disposée en dessous dudit élément d'actionnement (26), et sensiblement en contact avec celui-ci.
 13. Unité de mise sous tension selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'elle** comprend au moins une unité de commande (24) configurée pour recevoir de ladite unité de détection (17) un signal relatif à la valeur de la tension d'une bande métallique (15) qui avance une direction d'alimentation (F1) ou dans une direction d'alimentation (F2), pour comparer ladite valeur à une valeur préétablie et, si elles sont différentes, pour ordonner une rotation de ladite unité de contact (13), dans le sens des aiguilles d'une montre ou dans le sens inverse des aiguilles d'une montre, de manière à réduire ou augmenter la valeur de tension de la bande métallique (15), en la ramenant à une valeur optimale.
 14. Unité de mise sous tension selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'elle** est installée entre deux socles de laminage (46) qui comprennent tous deux au moins un rouleau de travail inférieur (50) et au moins un rouleau de travail supérieur (52).
 15. Unité de mise sous tension selon la revendication 14, **caractérisée en ce que** lesdits socles de laminage (46) comprennent également au moins un rouleau de support inférieur (54) et au moins un rouleau de support supérieur (56).
 16. Appareil de laminage comprenant au moins un socle de laminage (46) et une bande ou feuille métallique (15), **caractérisé en ce qu'il** comprend au moins une unité de mise sous tension (10) selon l'une quelconque des revendications 1 à 15 et monté directement sur un montant de support (58) dudit socle de

laminage (46) ou sur une structure de support dé-
diée.

17. Appareil de laminage selon la revendication 16, com- 5
prenant une plaque de guidage (44) définissant un
plan de couchage et d'alimentation de ladite bande
métallique (15) dans une direction d'alimentation
(F1, F2), **caractérisé en ce que** ledit axe de rotation
(Z) par rapport auquel tourne ledit élément de sup- 10
port (14) repose sur un plan sensiblement parallèle
audit plan de couchage de ladite bande métallique
(15) et a une direction sensiblement orthogonale à
ladite direction (F1, F2).
18. Dispositif de laminage selon la revendication 16 ou 15
17, **caractérisé en ce qu'il** comprend des socles de
laminage (46) du type inverseur.

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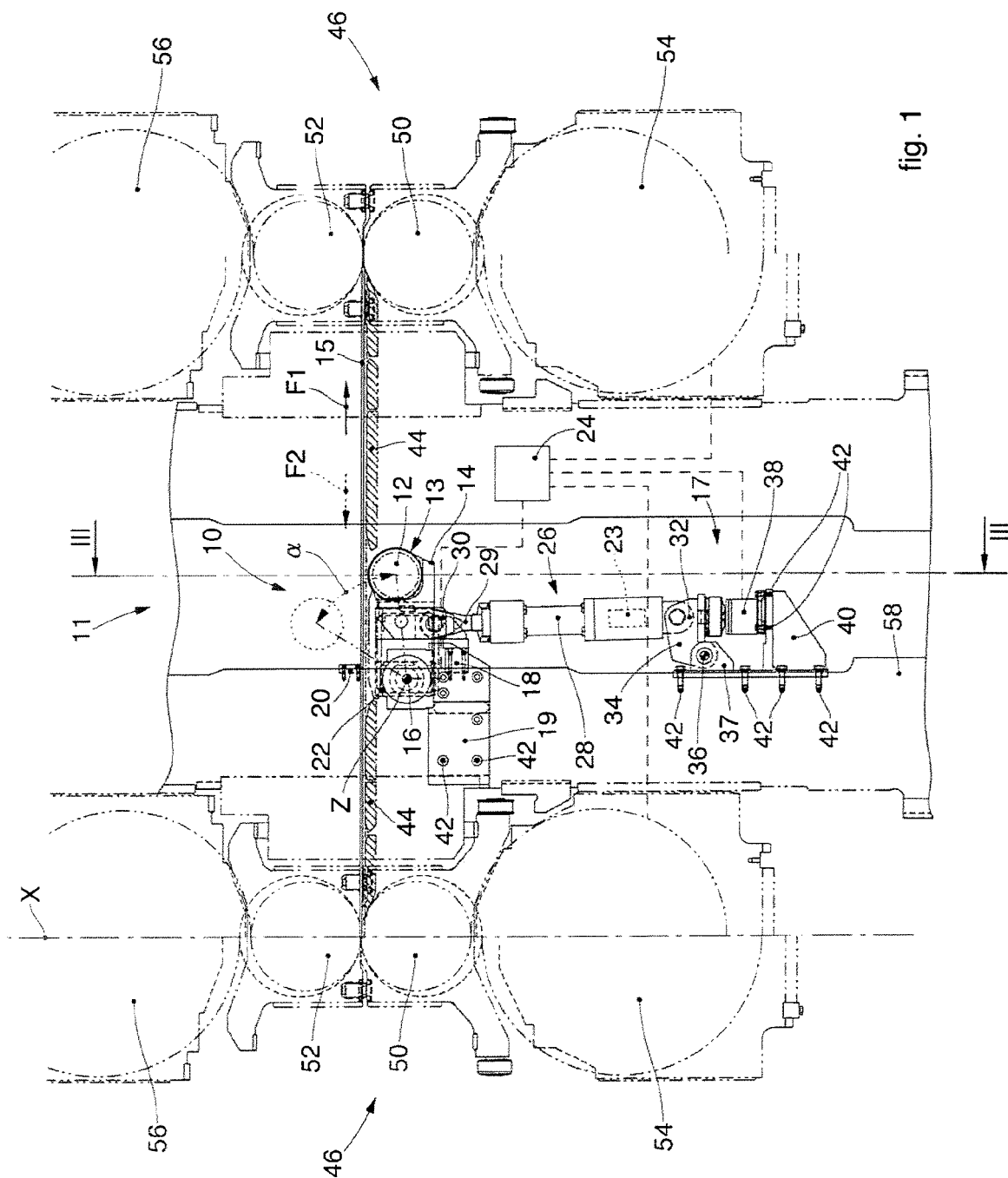
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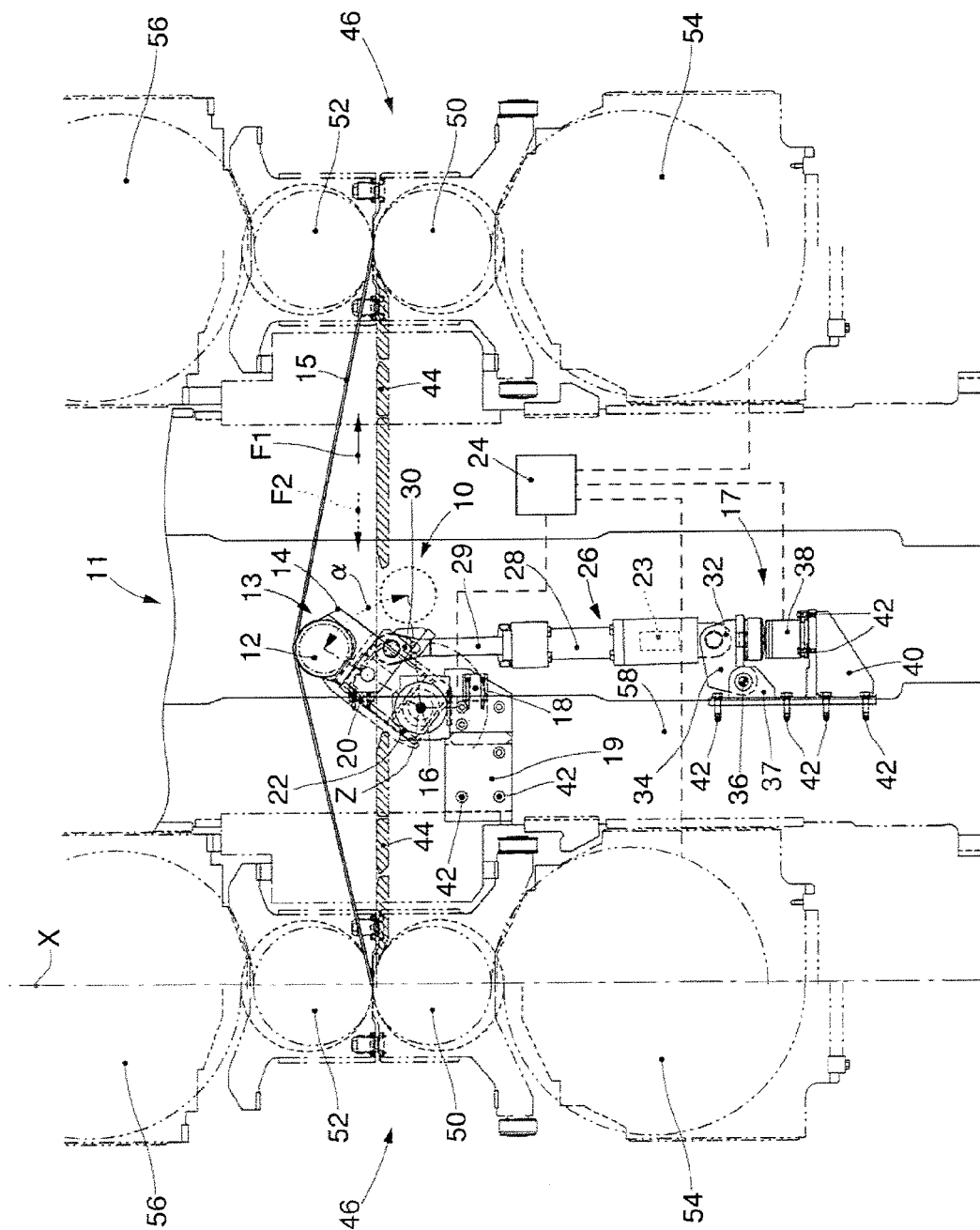


fig. 2

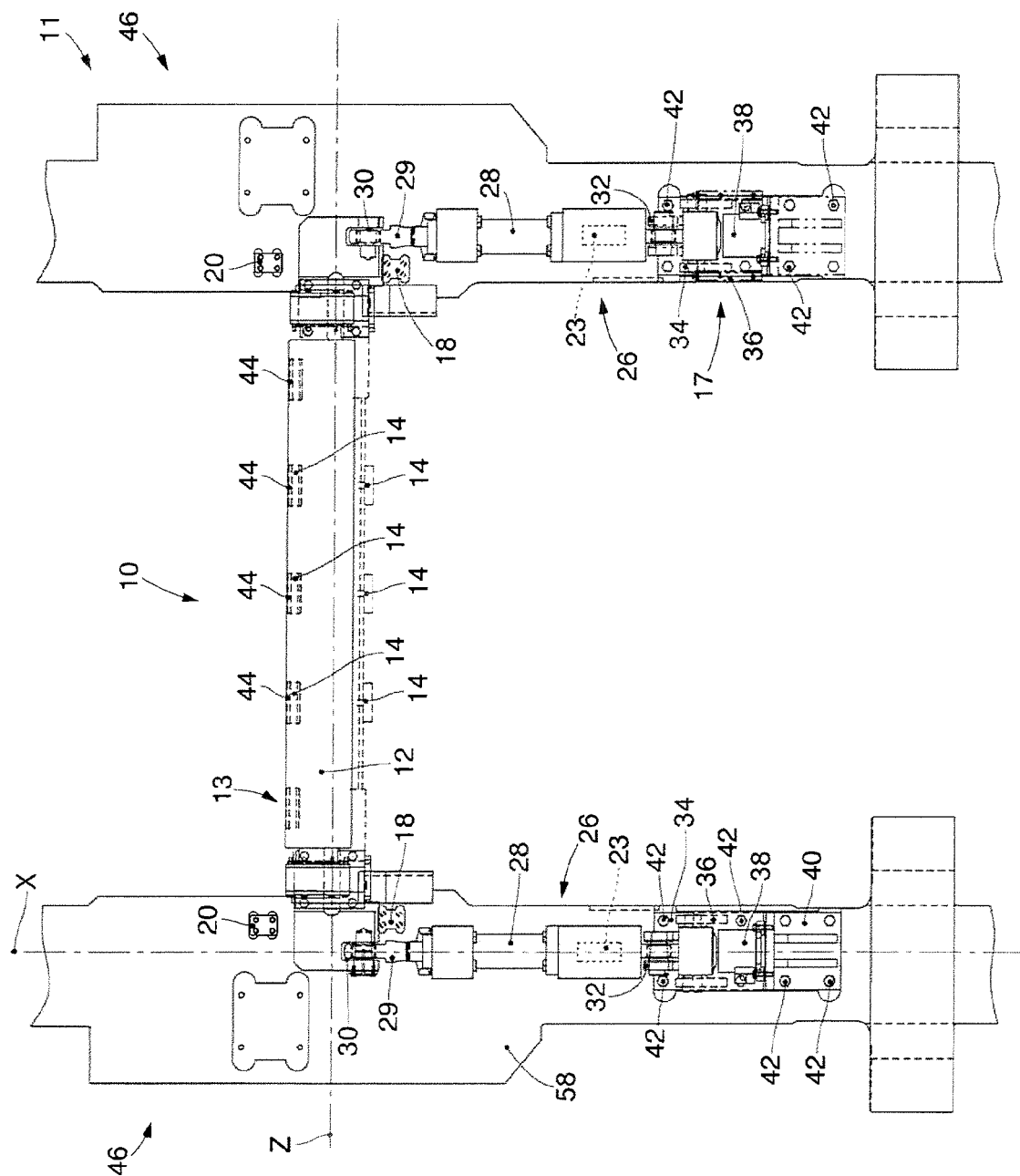


fig. 3

REFERENCES CITED IN THE DESCRIPTION

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