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(54) **Rolling mill with a reel comprising an improved outboard bearing support**

(57) The present invention relates to a rolling mill (1) equipped with at least one reel (10A, 10B) comprising a spindle (11) for winding and/or unwinding a strip (N) during the rolling operations, said reel (10A, 10B) being fitted with at least one outboard bearing support (20) for supporting said spindle (11), said outboard bearing support (20) comprising:

- a fixed part (21);
- a movable part (22), comprising a support element (22A) adapted to support said spindle (11);
- drive means (23), which are associated with said movable part (22) in such a way as to move said movable part (22) relative to said fixed part (21) and cause it to rotate about at least one rotation pin (24), in particular said drive means (23) being adapted to cause the movable part (22) to switch from an open position to a closed position, and vice versa.

The invention is characterized in that the outboard bearing support (20) comprises an actuation system (30) adapted to cause said rotation pin (24) to move along a first axis (Z), so as to prevent the movable part (22) from moving relative to the fixed part (21) and to take up any play of the movable part (22) and of the rotation pin (24), in particular when the movable part (22) of the outboard bearing support (20) is in said closed position.

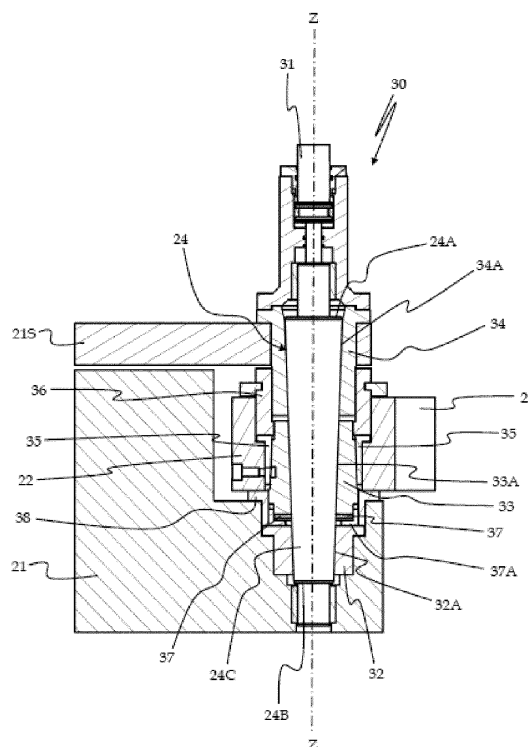


Fig. 3

Description

[0001] The present invention relates to a rolling mill according to the preamble of claim 1.

[0002] The present invention also relates to an outboard bearing support for a rolling mill.

[0003] The invention is particularly applicable to the cold rolling field, the typical object of which is to reduce the thickness of a product to be rolled, generally a metal strip, e.g. made of steel, copper or alloys thereof, aluminium or alloys thereof).

[0004] A rolling mill is known in the art which comprises, in general, a rolling cage comprising at least two superimposed work rolls having substantially parallel axes; the strip or product to be rolled passes between said at least two superimposed rolls and its thickness is thus reduced.

[0005] It is also known in the art that the rolling mill is usually equipped with at least one reel comprising a spindle for winding and/or unwinding the strip or product during the rolling operations.

[0006] In particular, during the process a strip coil is mounted on an unwinding reel and, after passing through the rolling cage, the strip is rewound on a winding reel.

[0007] It must be pointed out that said reels are also typically used for tensioning the strip during the rolling process, thus giving the strip itself a certain pulling force; furthermore, in reversible rolling mills each reel can be used for winding or unwinding the strip.

[0008] It is also known in the art that the rolling mill is usually fitted with at least one outboard bearing support comprising:

- a fixed part;
- a movable part, comprising at least one support element for supporting the spindle;
- drive means associated with said movable part in such a way as to move said movable part relative to said fixed part and cause it to rotate about at least one rotation pin.

[0009] Said at least one outboard bearing support is substantially realised in such a way that the drive means are adapted to cause the movable part to switch from an open position, in which the movable part allows loading and removing a strip coil on/from the spindle, to a closed position, in which said movable part supports the spindle by means of the support element, and vice versa. However, the rolling mill known in the art and described above has a few drawbacks.

[0010] In fact, when the movable part of the outboard bearing support is in said closed position (i.e. when said movable part is supporting the spindle by means of the support element) and the rolling mill is rolling, the outboard bearing support is subjected to considerable forces generated by the pull exerted by the reel and by the rolling itself. In this situation, such forces are mainly discharged onto the rotation pin of the movable part of the outboard bearing support, and the significant stresses undergone

by said rotation pin inevitably create a certain play, which can compromise the accurate and adequate positioning of the support element of the spindle, and hence of the whole reel.

[0011] It is clear that a wrong positioning of the support element implies both an improper operation of the entire rolling mill and heavier wear of the reel and its spindle; this inevitably leads to the need for frequent replacement of such components.

[0012] As a consequence, these problems may impair the quality of the machining of the strip or product to be rolled, and may also increase the maintenance and operating costs of the whole rolling mill.

[0013] In this frame, it is the main object of the present invention to overcome the drawbacks of prior-art rolling mills.

[0014] In particular, it is one object of the present invention to provide a rolling mill which is so realised as to prevent the considerable forces generated by the pulling action of the reel and by the rolling itself from being discharged onto the rotation pin of the movable part of the outboard bearing support, so that no play will be created in said rotation pin.

[0015] It is another object of the present invention to provide a rolling mill which comprises an outboard bearing support suitable for ensuring an accurate and adequate positioning of the support element that supports the spindle of the reel, thereby allowing to obtain an adequate and optimal operation of the whole rolling mill.

[0016] It is a further object of the present invention to provide a rolling mill which comprises an outboard bearing support which is so realised as to avoid any worsening of the quality of the machining of the strip or product to be rolled as well as any increase in the wear of the reel and its spindle.

[0017] Consequently, it is one object of the present invention to realise the outboard bearing support of the rolling mill in a manner such as to attain a constant and optimal quality of the machining of the strip and to limit the maintenance and operating costs of the whole rolling mill.

[0018] Such objects are achieved by the present invention through a rolling mill incorporating the features set out in the appended claims, which are intended to be an integral part of the present description.

[0019] Further objects, features and advantages of the present invention will become apparent from the following detailed description and from the annexed drawings, which are supplied by way of non-limiting example, wherein:

- Fig. 1 is a side view of a rolling mill according to the present invention;
- Figs. 2a and 2b are perspective views of a component of the rolling mill according to the present invention, said component being respectively shown in a first open position (Fig. 2a) and in a second closed position (Fig. 2b);

- Fig. 3 is a sectional view of a part of the component of Figs. 2a and 2b.
- Figs. 4a and 4b are sectional views of the component shown in Figs. 2a and 2b in a first and a second operating conditions, respectively.

[0020] Referring now to the annexed drawings, reference numeral 1 designates as a whole a rolling mill according to the present invention.

[0021] As can be seen in Fig. 1, the rolling mill 1 comprises a rolling cage (generically designated by reference numeral 2) comprising at least two rolls 3, between which a strip N to be rolled passes; as is known, the typical purpose of rolling is to reduce the thickness of said strip N.

[0022] Preferably, said strip N is made of metal, e.g. steel, copper or alloys thereof, aluminium or alloys thereof; furthermore, said at least two rolls 3 are superimposed on each other and have substantially parallel axes.

[0023] It must be pointed out that Fig. 1 shows a rolling mill 1 of the four-high type, in that the rolling cage 2 comprises two work rolls 3 and two support rolls 3; it is however clear that the provisions of the present invention may also be used in a rolling mill 1 having a different configuration.

[0024] The rolling mill 1 is equipped with at least one reel 10A, 10B comprising a spindle 11 for winding and/or unwinding said strip N during the rolling operations.

[0025] It should be noted that in Fig. 1 said at least one reel 10A, 10B comprises a first unwinding reel (designated as a whole by reference numeral 10A in Fig. 1), which allows unwinding the strip N to be rolled, and a second winding reel 10B, which allows rewinding the strip N after it has passed through the rolling cage 2.

[0026] It should also be noted that, in the present description, the term "strip N" refers to a product to be rolled of any typology.

[0027] When the rolling mill 1 according to the present invention is of the reversible type, said first reel 10A and second reel 10B can both, without distinction, be used for winding or unwinding the strip N.

[0028] In Fig. 1 it can be noticed that the rolling mill 1 according to the present invention is fitted with at least one outboard bearing support 20. Preferably, said rolling mill 1 comprises, respectively, an outboard bearing support 20 for the first reel 10A and an outboard bearing support 20 for the second reel 10B; it is however clear that the rolling mill 1 may comprise only one outboard bearing support 20.

[0029] Said at least one outboard bearing support 20 comprises:

- a fixed part 21,
- a movable part 22, comprising at least one support element 22A for supporting said spindle 11.

[0030] As can also be observed in Figs. 2a and 2b, said support element 22A may be provided in the form of a substantially circular seat on the movable part 22 of

the outboard bearing support 20, adapted to receive the terminal portion of the spindle 11. For example, said support element 22A shaped like a substantially circular seat may be associated with the movable part 22 by means of a ball bearing or another equivalent component. It is however clear that said at least one support element 22A may also be realised differently; for example, it may be so realised as to comprise at least one small wheel (not shown in the drawings) adapted to bear or support the terminal portion of the spindle 11 and to allow it to turn as usually needed.

[0031] Consequently, it is apparent that the movable part 22 comprising at least one support element 22A allows to prevent the spindle 11 from working in a cantilever fashion, i.e. bearing the whole weight of the strip N being wound and/or unwound.

[0032] Said at least one outboard bearing support 20 further comprises drive means 23 which are associated with said movable part 22 in such a way as to move said movable part 22 relative to said fixed part 21 and cause it to rotate about at least one rotation pin 24 (visible in Figures 3 to 4b).

[0033] In Figs. 2a and 2b one can also see that said drive means 23 are adapted to switch the movable part 22:

- from an open position (visible in Fig. 2a), in which it allows loading a coil of strip N on the spindle 11 or removing said coil of strip N from the spindle 11,
- to a closed position (visible in Fig. 2b), in which said movable part 22 bears and supports said at least one spindle 11, and vice versa.

[0034] As a consequence, said drive means 23 allow the movable part 22 to switch from a closed position to an open position (and vice versa) by turning the movable part 22 about a first axis Z (indicated by a dashed-dotted line in Figures 2a to 4b), which substantially coincides with the axis of said rotation pin 24.

[0035] As is apparent from the annexed drawings, in an operating condition of the rolling mill 1 the first axis Z is substantially vertical.

[0036] In Figs. 2a and 2b said drive means 23 comprise at least one piston, in particular of the hydraulic type, associated with said fixed part 21 and said movable part 22; it is however clear that, in accordance with the present invention, said drive means 23 may also be realised in alternative ways and/or be associated with the outboard bearing support 20 differently than shown in the annexed drawings.

[0037] As can also be observed in Figures 3 to 4b, in accordance with the present invention the outboard bearing support 20 comprises an actuation system 30 adapted to cause said rotation pin 24 to move along said first axis Z, so as to prevent the movable part 22 from moving relative to the fixed part 21 and to take up any play of the movable part 22 and of the rotation pin 24.

[0038] In particular, said movement of the rotation pin

24 along the first axis Z is appropriate and required especially when the movable part 22 of the outboard bearing support 20 is in said closed position and the support element 22A is supporting the spindle 11.

[0039] Said actuation system 30 comprises a control element 31 associated with the rotation pin 24 and adapted to determine said movement of said rotation pin 24 along the first axis Z in order to switch it:

- from a locking condition, wherein said movable part 22 is locked in said closed position,
- to an unlocking condition, wherein the movable part 22 of the outboard bearing support 20 is free to rotate about said first axis Z to go from a closed position to an open position, and vice versa.

[0040] Particularly when observing Fig. 3, one can see that, in accordance with the present invention, the rotation pin 24 has substantially a rod-like shape and has a body 24C which substantially becomes narrower in the section comprised between a first end 24A and a second end 24B.

[0041] In particular, said rotation pin 24 is substantially cone-shaped or truncated-cone-shaped; it is however clear that the rotation pin 24 may also have a different configuration than shown in the annexed drawings; for example, it may be pyramid-shaped or truncated-pyramid-shaped.

[0042] The special provisions of the present invention allow to provide a rolling mill 1 which is so realised as to prevent the movable part 22 from moving relative to the fixed part 21 and to take up any play of the rotation pin 24, which may be caused by the forces generated by the pulling action of the reel 10A, 10B and by the rolling operations.

[0043] In particular, the provisions of the present invention allow to prevent the rotation of the movable part 22 about the first axis Z, while at the same time taking up the plays of the rotation pin 24 both along a second axis Y (shown in Fig. 2b), substantially perpendicular to the fixed part 21 and to the movable part 22, and along a third axis X (also shown in Fig. 2b), substantially parallel to the fixed part 21 and to the movable part 22.

[0044] It must be pointed out that the expressions "perpendicular to the fixed part 21 and to the movable part 22" and "parallel to the fixed part 21 and to the movable part 22" refer to a condition wherein the movable part 22 is in the closed position and the support element 22A is supporting the spindle 11 (i.e. when the movable part 22 is in the position shown in Fig. 2b).

[0045] The advantageous elimination of the plays of the rotation pin 24 ensures an accurate and adequate positioning of the support element 22A with respect to the spindle 11.

[0046] As a result, said accurate and adequate positioning of the support element 22A allows to obtain an adequate and optimal operation of the whole rolling mill 1, in particular by avoiding any worsening of the quality

of the machining of the strip N as well as any increase in the wear of the reel 10A, 10B and its spindle 11.

[0047] At the same time, the particular realisation of the actuation system 30 allows to exert a force on the rotation pin 24 to prevent the movable part 22 from rotating relative to the first axis Z, thus keeping said movable part 22 in a locked condition.

[0048] Such provisions allow, therefore, to attain a constant and optimal quality of the machining of the strip N, while also allowing to reduce the maintenance and operating costs of the whole rolling mill 1. In particular, this is due to the fact that, thanks to the provisions of the present invention, the components of the rolling mill 1 are not subject to excessive wear caused by the pulling and rolling forces discharged onto the spindle 11.

[0049] In a preferred embodiment, the control element 31 is associated with the first end 24A of the rotation pin 24. In such an embodiment, the control element 31 exerts a thrust (as shown by the dashed arrows F1 in Fig. 4a) on said first end 24A of the rotation pin 24 in order to bring said rotation pin 24 into the locked position; also, the control element 31 exerts a pulling action (as shown by the dashed arrows F2 in Fig. 4b) on said first end 24A of the rotation pin 24 to withdraw said rotation pin 24 and bring it into the unlocked position.

[0050] In a further preferred embodiment, said control element 31 consists of a piston, particularly of the hydraulic type; also, said control element 31 is preferably associated with the rotation pin 24 such that it lies along the first axis Z of said rotation pin 24.

[0051] In Fig. 3 one can see that the actuation system 30 according to the present invention comprises:

- a first coupling element 32 associated with the fixed part 21 of the outboard bearing support 20,
- a second coupling element 33 associated with the movable part 22 of the outboard bearing support 20,

said first coupling element 32 and second coupling element 33 respectively comprising a first seat 32A and a second seat 33A, the shape of which is complementary to that of the body 24C of the rotation pin 24.

[0052] In a preferred embodiment, the actuation system 30 according to the present invention also comprises a third coupling element 34 associated with the fixed part 21 of the outboard bearing support 20, in particular with a support 21S of said fixed part 21, said third coupling element 34 comprising a third seat 34A, the shape of which is complementary to that of the body 24C of the rotation pin 24.

[0053] As a consequence, in a preferred embodiment said first seat 32A, second seat 33A and third seat 34A substantially have a cone or truncated-cone shape, suitable for receiving the rotation pin 24.

[0054] It must also be pointed out that said support 21S allows associating the drive means 23 with the fixed part 21 of the outboard bearing support 20. In particular, the support 21S may without distinction be an element man-

ufactured separately and then joined to the fixed part 21, or it may be made as one piece with said fixed part 21.

[0055] Preferably, the first coupling element 32, the second coupling element 33 and the third coupling element 34 are obtained by creating a single seat (not shown in the drawings) on one piece (also not shown in the drawings) and by subsequently dividing said one piece. This allows said first 32, second 33 and third 34 coupling elements to be so realised as to comprise, respectively, a first seat 32A, a second seat 33A and a third seat 34A having an equal and constant inclination. Besides, making said seats 32A, 33A, 34A on one piece (not shown) from which said coupling elements 32, 33, 34 are obtained is easier and more advantageous compared to making them directly on the fixed part 21, on the support 21S and on the movable part 22.

[0056] Still with reference to Fig. 3, it can be noticed that the actuation system 30 according to the present invention comprises an expandable element 35, which facilitates the locking of the rotation pin 24, in particular in the situation wherein the control element 31 causes the rotation pin 24 to move along the first axis Z in order to bring it into a locked condition.

[0057] In a preferred embodiment, said expandable element 35 comprises a cut bushing, in particular having a cutout running across its whole body and being substantially parallel to the first axis Z when said cut bushing is associated with the outboard bearing support 20; in addition, said expandable element 35 is positioned in a space obtained between the outer surface of the second coupling element 33, the movable part 22 of the outboard bearing support 20, and the lower part of a first flanged bushing 36 integral with said movable part 22. The special provision of the expandable element 35 facilitates the locking of the rotation pin 24 following the thrust exerted on the rotation pin 24 by the control element 31, in particular for the purpose of avoiding any play of said rotation pin 24 relative to the second axis Y and third axis X.

[0058] In Fig. 3 it can also be seen that the actuation system 30 according to the present invention comprises at least one elastic element 37 adapted to facilitate the forcing between the second coupling element 33 and the expandable element 35; in fact, the elastic element 37 exerts on the second coupling element 33 a thrust opposite to that exerted on the rotation pin 24 by the control element 31; therefore, said elastic element 37 allows to facilitate the expansion of the expandable element 35 for the purpose of locking the rotation pin 24, in particular relative to the second axis Y and third axis X.

[0059] In a preferred embodiment, said at least one elastic element 37 comprises a Belleville washer.

[0060] Preferably, said at least one elastic element 37 is positioned between the first coupling element 32 and the second coupling element 33, in particular said at least one elastic element 37 being associated with a flange 37A.

[0061] Said elastic element 37 and/or said flange 37A

are at least partially contained in a second flanged bushing 38 which is integral with the fixed part 21 of the outboard bearing support 20.

[0062] It must be pointed out that, as the drive means 23 are being actuated in order to obtain the rotation of the movable part 22 relative to the fixed part 21, the parts of the outboard bearing support 20 that turn relative to each other are the first flanged bushing 36 on the third coupling element 34 and the second flanged bushing 38 on the second coupling element 33; in fact, the third coupling element 34 is at least partially inserted in the first flange bushing 36, while the second coupling element 33 is at least partially inserted in the second flanged bushing 38.

[0063] The actuation system 30 according to the present invention further comprises stopping means (not shown in the drawings), which prevent the expandable element 35 from rotating and being subject to wear, in particular upon actuating the drive means 23 to obtain the rotation of the movable part 22 relative to the fixed part 21.

[0064] Preferably, said stopping means comprise a tongue (not shown in the drawings) associated with the second coupling element 33 and adapted to be inserted into the cutout (also not shown in the drawings) of the cut bushing that constitutes the expandable element 35.

[0065] Figs. 4a and 4b show that the rolling mill 1 according to the present invention may be so realised as to comprise:

- a first actuation system 30 associated with a rotation pin 24 present on an upper portion of the outboard bearing support 20, and
- a second actuation system 30 associated with a rotation pin 24 present on a lower portion of the outboard bearing support 20.

[0066] Preferably, in this embodiment the first actuation system 30 comprises a control element 31 adapted to cause the rotation pin 24 to move along the first axis Z in a first direction (usually downwards to bring the rotation pin 24 into the locking condition and upwards to bring it into the unlocking condition, as shown by the dashed arrows in Figs. 4a and 4b), whereas the second actuation system 30 comprises a control element 31 adapted to cause the rotation pin 24 to move in a second direction (usually upwards to bring the rotation pin 24 into the locking condition and downwards to bring it into the unlocking condition), opposite to said first direction.

[0067] However, it is clear that the rolling mill 1 according to the present invention may also be so realised as to comprise control elements 31 operating in the same direction.

[0068] Furthermore, the rolling mill 1 according to the present invention may also be so realised as to comprise an actuation system 30 associated with a single rotation pin 24 of the outboard bearing support 20.

[0069] It emerges from the above description that the

particular realisation of the actuation system 30, comprising the control element 31, allows the rotation pin 24 to be moved along the first axis Z so that it can exert a force on the first seat 32A, the second seat 33A and the third seat 34A, such that any rotation of the movable part 22 about the first axis Z is prevented.

[0070] In addition, the movement of the rotation pin 24 along the first axis Z also exerts a force on the first seat 32A, the second seat 33A and the third seat 34A that takes up any play of the movable part 22 and of the rotation pin 24, i.e. that prevents them from moving relative to the second axis Y and third axis X. Moreover, in accordance with the provisions of the present invention, the movement of the rotation pin 24 along the first axis Z causes the expansion of the expandable element 35, which further facilitates the elimination of any play of the movable part 22 and of the rotation pin 24 relative to the second axis Y and third axis X.

[0071] The advantages of a rolling mill 1 and of an outboard bearing support 20 thereof according to the present invention are apparent from the above description.

[0072] Such advantages lie in the fact that the advantageous provision of the actuation system 30 according to the present invention allows to provide a rolling mill 1 which is so realised as to take up any play of the rotation pin 24 that might be caused by the forces generated by the pulling action of the reel 10A, 10B and by the rolling operations.

[0073] In particular, the provisions of the present invention allow to prevent the rotation of the movable part 22 about the first axis Z, while at the same time taking up the plays of the rotation pin 24 both along a second axis Y (shown in Fig. 2b), substantially perpendicular to the fixed part 21 and to the movable part 22, and along a third axis X (also shown in Fig. 2b), substantially parallel to the fixed part 21 and to the movable part 22, particularly when said movable part 22 is in the closed condition.

[0074] The advantageous elimination of the plays of the rotation pin 24 allows to attain an accurate and adequate positioning of the support element 22A, particularly when the movable part 22 is in the closed condition and the support element 22A must support said spindle 11.

[0075] As a result, said accurate and adequate positioning of the support element 22A allows to obtain an optimal operation of the whole rolling mill 1, in particular by avoiding any worsening of the quality of the machining of the strip N as well as any increase in the wear of the reel 10A, 10B and its spindle 11.

[0076] Such provisions allow, therefore, to obtain a constant and optimal quality of the machining of the strip N, while also reducing the maintenance and operating costs of the entire rolling mill 1.

[0077] Another advantage of the present invention is that the provision of the expandable element 35 facilitates the locking of the rotation pin 24 following the thrust exerted on the rotation pin 24 by the control element 31, in particular for the purpose of avoiding any play of said

rotation pin 24 relative to the second axis Y and third axis X.

[0078] Furthermore, the provision of the elastic element 37 allows to maximize the effectiveness of the action of the expandable element 35, since said elastic element 37 facilitates the expansion of the expandable element 35 in order to lock the rotation pin 24, in particular with respect to the second axis Y and third axis X.

[0079] In addition, the presence of the stopping means allows to prevent the expandable element 35 from being subject to wear; in fact, said stopping means prevent the expandable element 35 from turning, particularly when the drive means 23 are actuated in order to obtain the rotation of the movable part 22 about the first axis Z.

[0080] The rolling mill and the outboard bearing support thereof described herein by way of example may be subject to many possible variations without departing from the novelty spirit of the inventive idea; it is also clear that in the practical implementation of the invention the illustrated details may have different shapes or be replaced with other technically equivalent elements.

[0081] It can therefore be easily understood that the present invention is not limited to the above-described rolling mill and outboard bearing support, but may be subject to many modifications, improvements or replacements of equivalent parts and elements without departing from the inventive idea, as clearly specified in the following claims.

Claims

1. A rolling mill (1) equipped with at least one reel (10A, 10B) comprising a spindle (11) for winding and/or unwinding a strip (N) during the rolling operations, said rolling mill (1) being fitted with at least one outboard bearing support (20) comprising:

- a fixed part (21);
- a movable part (22), comprising a support element (22A) adapted to support said spindle (11);
- drive means (23), which are associated with said movable part (22) in such a way as to move said movable part (22) relative to said fixed part (21) and cause it to rotate about at least one rotation pin (24), in particular said drive means (23) being adapted to cause the movable part (22) to switch from an open position to a closed position, and vice versa,

characterized in that

the outboard bearing support (20) comprises an actuation system (30) adapted to cause said rotation pin (24) to move along a first axis (Z), so as to prevent the movable part (22) from moving relative to the fixed part (21) and to take up any play of the movable part (22) and of the rotation pin (24), in particular when the movable part (22)

of the outboard bearing support (20) is in said closed position.

2. A rolling mill (1) according to claim 1, **characterized in that** said actuation system (30) comprises a control element (31) associated with the rotation pin (24) and adapted to determine said movement of the rotation pin (24) along the first axis (Z) in order to switch it:

- from a locking condition, wherein said movable part (22) is locked in the closed position,
- to an unlocking condition, wherein the movable part (22) is free to rotate about said first axis (Z) to go from a closed position to an open position, and vice versa.

3. A rolling mill (1) according to one or more of the preceding claims, **characterized in that** the rotation pin (24) has substantially a rod-like shape and has a body (24C) which substantially becomes narrower in the section comprised between a first end (24A) and a second end (24B).

4. A rolling mill (1) according to claim 3, **characterized in that** said rotation pin (24) is substantially cone-shaped or truncated-cone-shaped.

5. A rolling mill (1) according to one or more of the preceding claims 3 and 4, **characterized in that** the actuation system (30) comprises:

- a first coupling element (32) associated with the fixed part (21) of the outboard bearing support (20),
- a second coupling element (33) associated with the movable part (22) of the outboard bearing support (20), said first coupling element (32) and second coupling element (33) respectively comprising a first seat (32A) and a second seat (33A), the shape of which is complementary to that of the body (24C) of the rotation pin (24).

6. A rolling mill (1) according to claim 5, **characterized in that** the actuation system (30) comprises a third coupling element (34) associated with the fixed part (21) of the outboard bearing support (20), in particular with a support (21S) of said fixed part (21), said third coupling element (34) comprising a third seat (34A), the shape of which is complementary to that of the body (24C) of the rotation pin (24).

7. A rolling mill (1) according to one or more of the preceding claims 5 and 6, **characterized in that** the first coupling element (32), the second coupling element (33) and the third coupling element (34) are obtained by creating a single seat on one piece and

by subsequently dividing said one piece.

8. A rolling mill (1) according to one or more of the preceding claims, **characterized in that** the actuation system (30) comprises an expandable element (35) that facilitates the locking of the rotation pin (24).

9. A rolling mill (1) according to claim 8, **characterized in that** said expandable element (35) comprises a cut bushing, in particular having a cutout running across its whole body and being substantially parallel to the first axis (Z) when said cut bushing is associated with the outboard bearing support (20).

10. A rolling mill (1) according to one or more of the preceding claims 8 and 9, **characterized in that** said expandable element (35) is positioned in a space obtained between the outer surface of the second coupling element (33), the movable part (22) of the outboard bearing support (20), and the lower part of a first flanged bushing (36) integral with said movable part (22).

11. A rolling mill (1) according to one or more of the preceding claims, **characterized in that** the actuation system (30) comprises at least one elastic element (37) adapted to facilitate the forcing action between the second coupling element (33) and the expandable element (35), in particular said elastic element (37) being adapted to exert on the second coupling element (33) a thrust opposite to that exerted on the rotation pin (24) by the control element (31).

12. A rolling mill (1) according to claim 11, **characterized in that** said at least one elastic element (37) is positioned between the first coupling element (32) and the second coupling element (33).

13. A rolling mill (1) according to one or more of the preceding claims 11 and 12, **characterized in that** said at least one elastic element (37) comprises a Belleville washer.

14. A rolling mill (1) according to one or more of the preceding claims, **characterized in that** the actuation system (30) comprises stopping means allowing to prevent the expandable element (35) from rotating, in particular upon actuating the drive means (23).

15. A rolling mill (1) according to one or more of the preceding claims, **characterized in that** it is so realised as to comprise:

- a first actuation system (30) associated with a rotation pin (24) present on an upper portion of the outboard bearing support (20), and
- a second actuation system (30) associated with a rotation pin (24) present on a lower portion of

the outboard bearing support (20).

- 16.** An outboard bearing support (20) of a rolling mill (1) according to one or more of the preceding claims 1 to 15.

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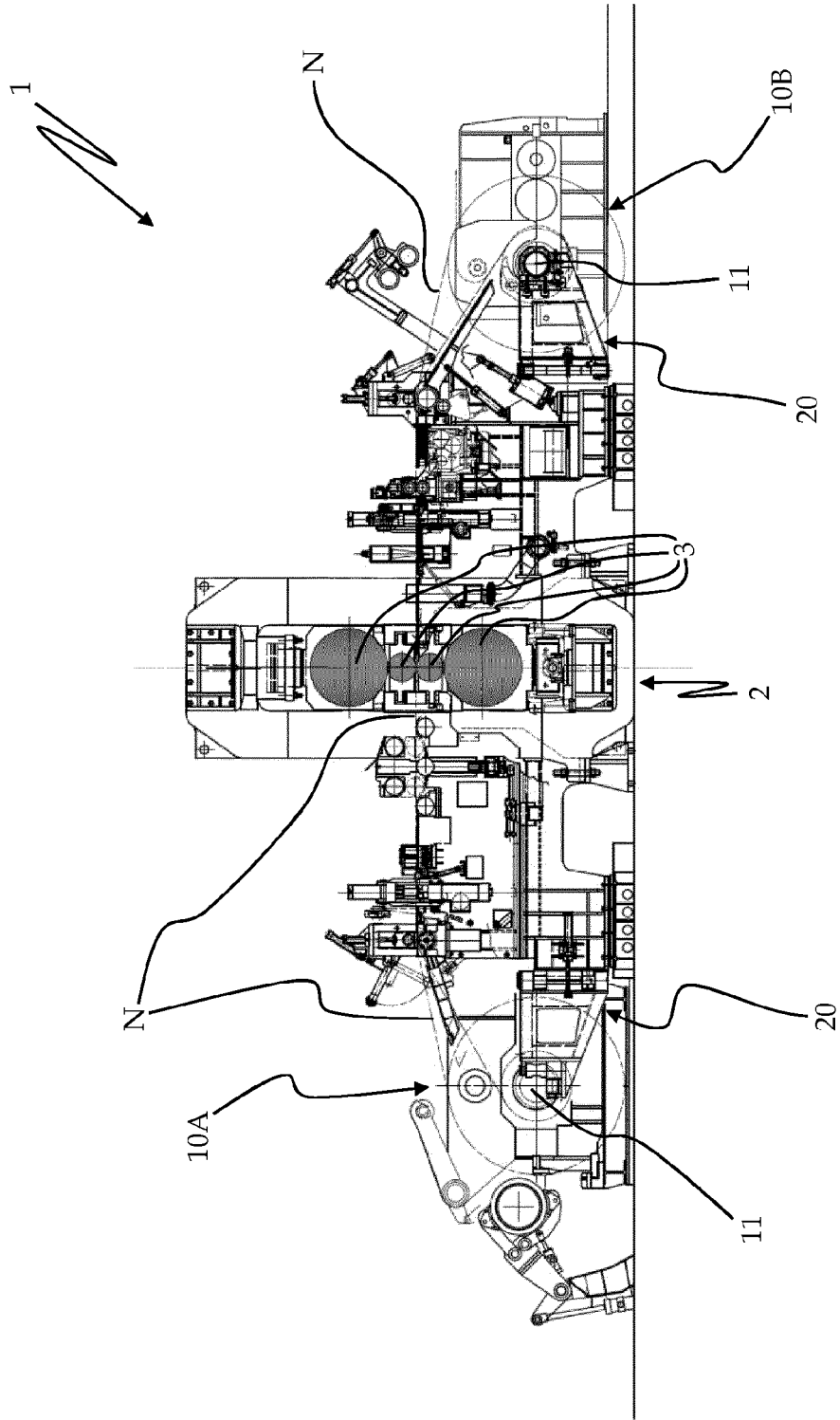


Fig. 1

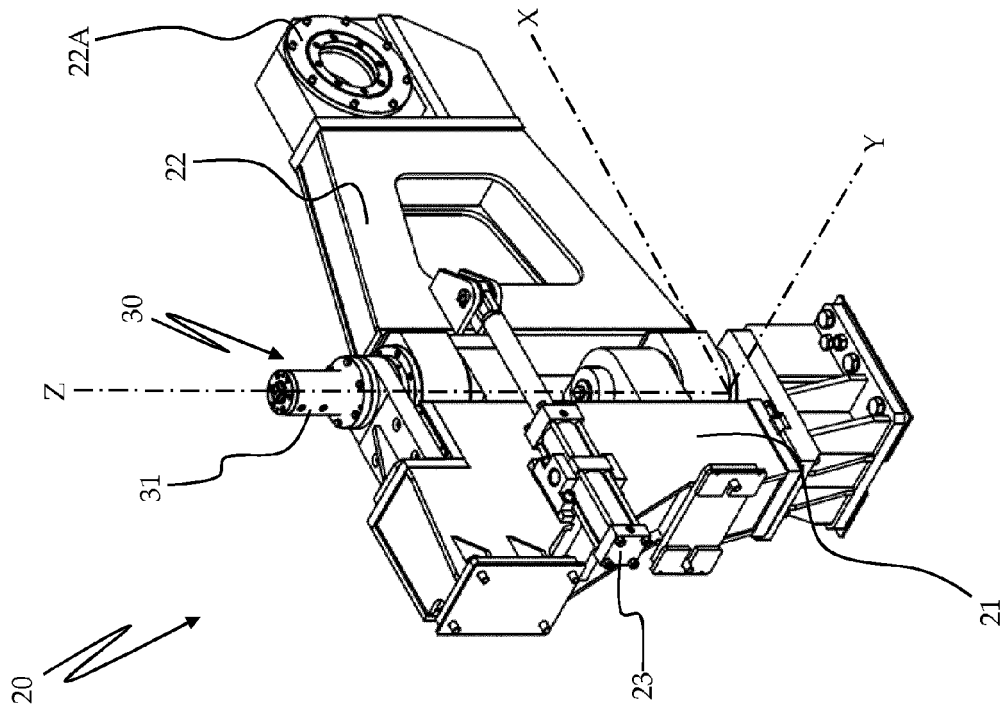


Fig. 2b

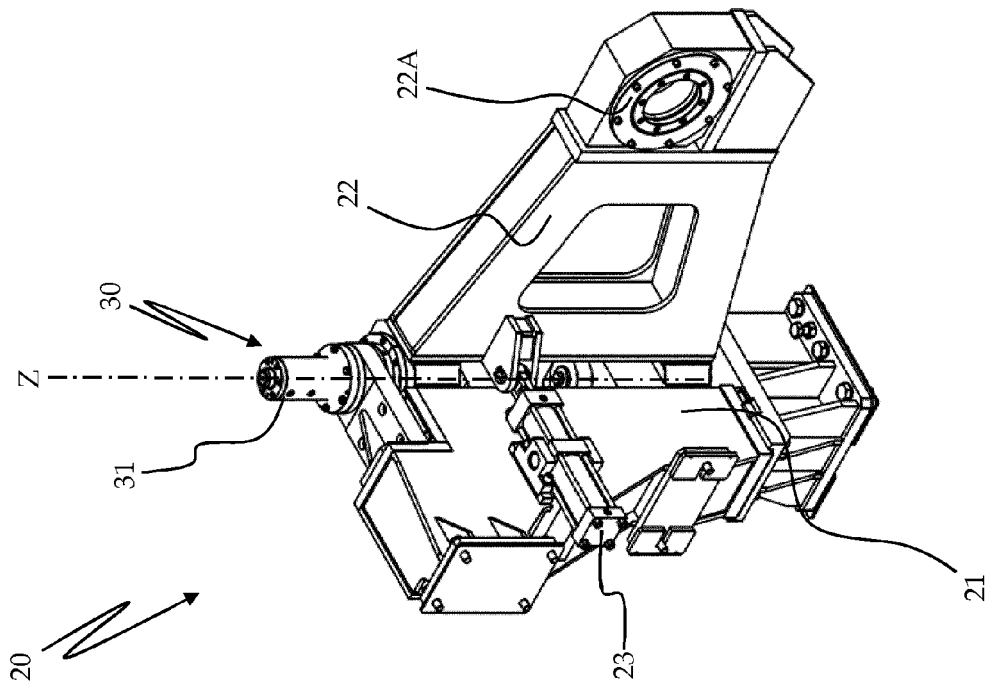


Fig. 2a

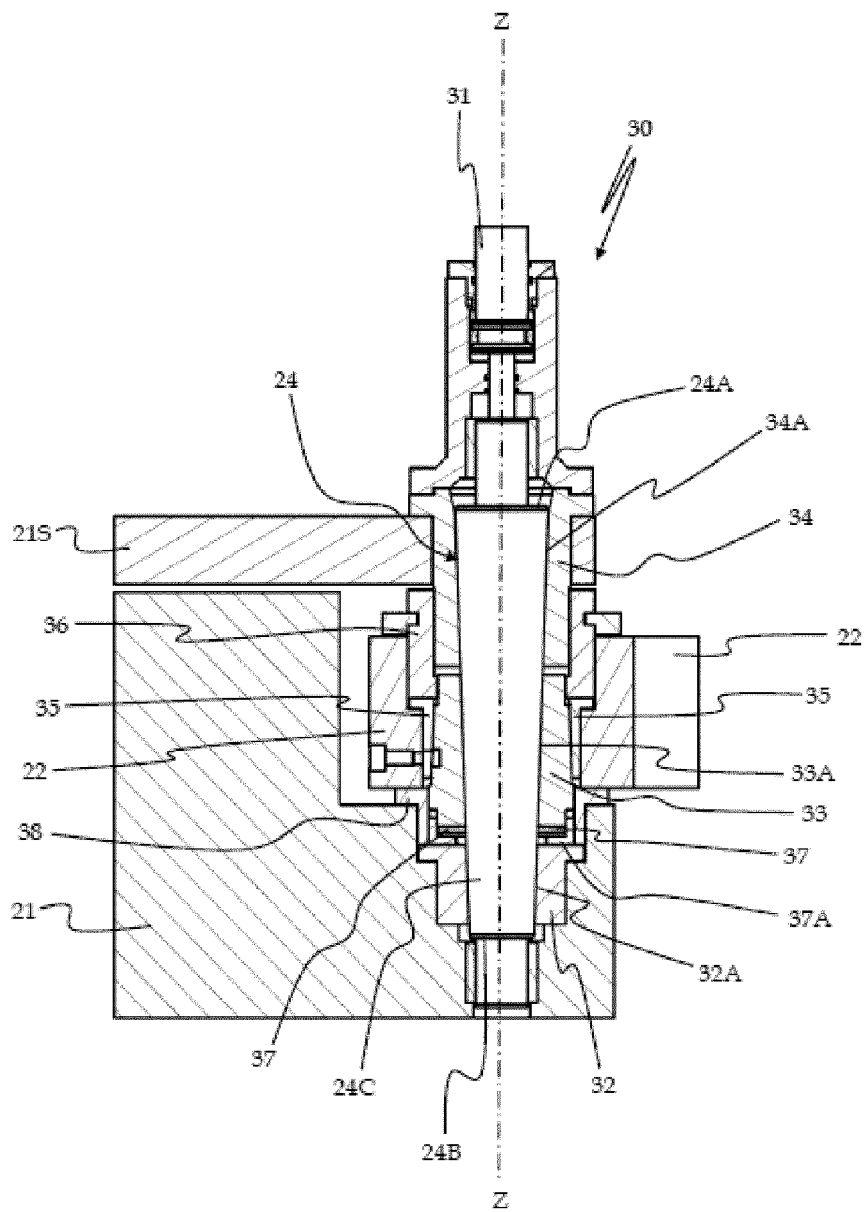


Fig. 3

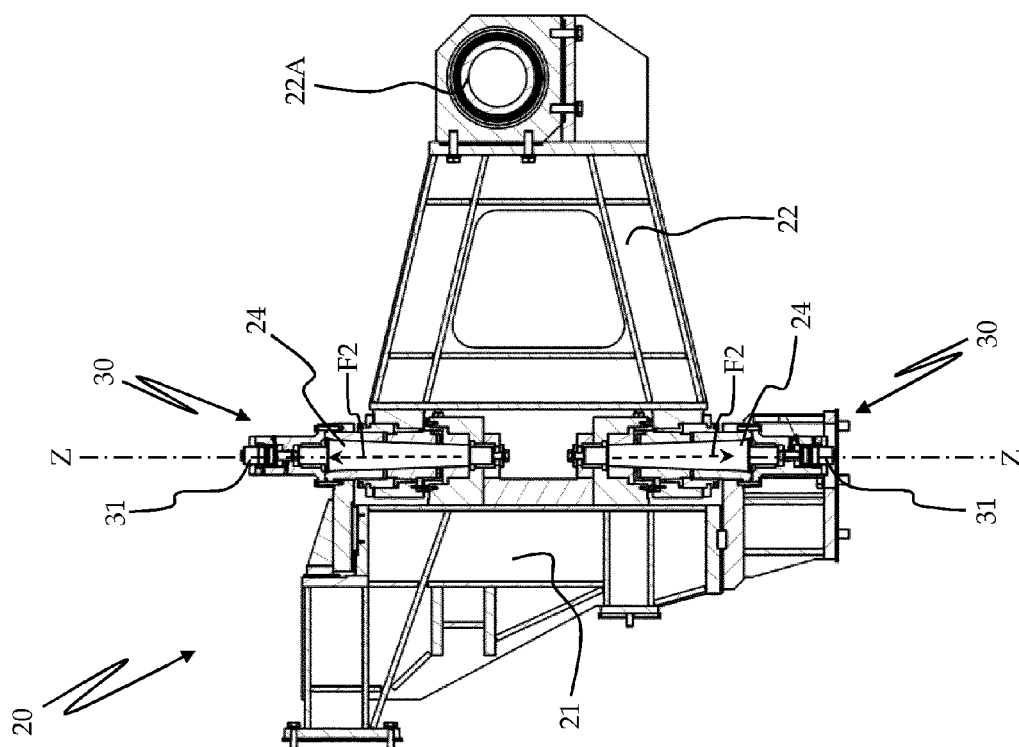


Fig. 4b

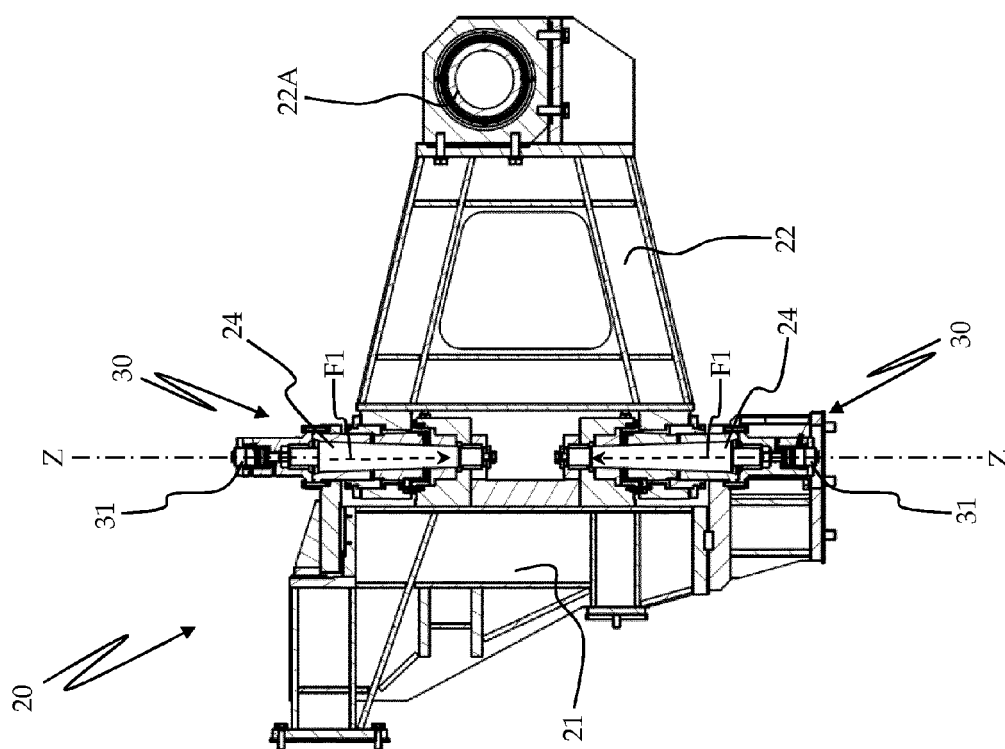


Fig. 4a



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Application Number
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 8 January 2014	Examiner Ritter, Florian
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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