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(54) **ROLLING STAND**

(57) Rolling stand comprising a support structure (25) and at least one roll (24; 28) supported at the opposite ends by respective chocks (40). The chocks (40) are installed sliding on the support structure (25) at least in a direction (D) orthogonal to the axial development of the roll (24), and two linear actuators (30) are associated to said support structure (25), each configured to move one of the chocks (40) on the support structure (25) in the direction (D). In accordance with one aspect of the present invention the rolling stand comprises an interposition element (20), conformed as a plate and interposed between the linear actuators (30) and the chocks (40).

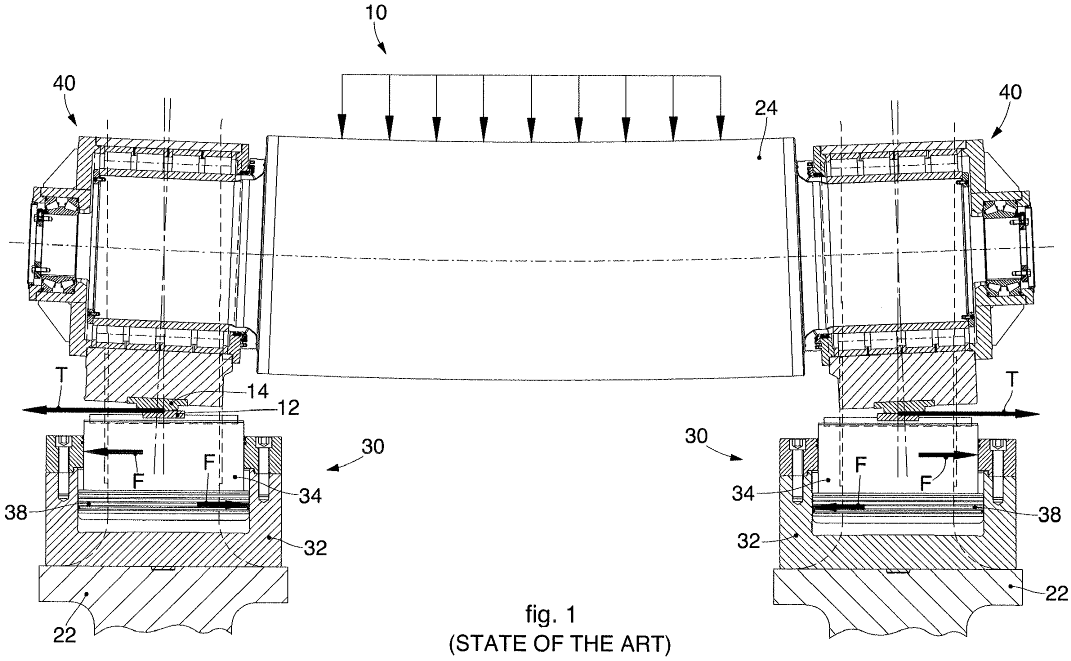

fig. 1
(STATE OF THE ART)

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a rolling stand, usable for example in apparatuses for hot rolling flat products, such as metal strip or sheet.

[0002] The rolling stands to which the present invention is applied can be the traditional or reversing type, without restricting the present invention.

BACKGROUND OF THE INVENTION

[0003] Rolling stands are known, used in apparatuses for hot rolling flat products, which comprise at least two rolls between which a metal strip or sheet transits and is rolled as it advances.

[0004] Rolling stands are also known comprising four rolls, that is, a top work roll, a bottom work roll, a top back-up roll and a bottom back-up roll.

[0005] The rolls are supported at their respective ends by respective chocks installed sliding in an orthogonal direction with respect to the axial development of the rolls, on support structures or shoulders.

[0006] Between the top work roll and the bottom work roll the flat product is made to transit. The top back-up roll rests against the top work roll and the bottom back-up roll rests against the bottom work roll. The top back-up roll and/or the bottom back-up roll are moved against the top work roll and/or the bottom work roll so as to define a predetermined and desired flexion of the latter, such as to contrast the deformation induced by the rolling force.

[0007] The predetermined movement of the top back-up roll and/or the bottom back-up roll is usually controlled by a linear actuator.

[0008] Reversing rolling stands are known for example, which have big apertures between the rolls, wherein the linear actuator is, as commonly called in the field, a hydraulic cap positioned in a lower part of a window of the shoulder, and which adjusts the position of the bottom back-up roll, whereas in the upper part of the window of the shoulder a screw-type mechanical adjustment can be positioned, which adjusts the position of the top back-up roll. Solutions are also known in which the position of the top back-up roll is also adjusted by a linear actuator or hydraulic cap.

[0009] Linear actuators can be the simple-effect or double-effect type.

[0010] As shown in fig. 1, the bottom back-up roll, indicated by the reference number 24, can be supported at the ends by first chocks 40. The first chocks 40 are rested on the respective support structures, or shoulders 22. Each shoulder 22 is also configured to allow a movement of the first chocks 40 in a direction orthogonal to the axis of the bottom back-up roll 24.

[0011] The linear actuators 30 are installed on the shoulders 22, and provide to support, and possibly move the first chocks 40 along the shoulders 22 in a direction orthogonal to the axis of the bottom back-up roll 24. To this purpose, the linear actuators 30 are disposed with their actuation axis orthogonal to the axis of the bottom back-up roll 24.

[0012] This allows to control the thickness of the metal strip or sheet, to adjust the compression/rolling of the latter by means of the rolls, and to determine the deformation action that is imparted to the work rolls, thus obtaining a uniform rolling action over the width of the rolled product.

[0013] It is also known that linear actuators 30 can each comprise a support plate 12 attached in its upper part and on which one of the first chocks 40 rests.

[0014] In particular, thrust plates 14 are attached to the first chocks 40, situated in their lower part and which are positioned resting on the support plate 12.

[0015] One typical disadvantage of known rolling stands 10 is due to the fact that, during the rolling steps, a distributed load acts on the bottom back-up roll 24 which causes a thrust and leads it to bend downward.

[0016] The distributed load acting on the bottom back-up roll 24 is in turn transferred as a stress acting on the linear actuators 30.

[0017] The curvature to which the bottom back-up roll 24 is subjected causes the stresses acting on the linear actuators 30 to be discomposed into a stress acting axially to the linear actuator 30 and a stress acting transversely to the axis of the linear actuator 30, that is, tangential forces indicated by T in fig. 1.

[0018] Due to the friction between the thrust plate 14 and the support plate 12, the tangential forces T are also transferred onto the linear actuator 30, generating an overturning moment given by the pair of forces indicated in fig. 1 by F.

[0019] The overturning moment that acts on the linear actuators 30 can be discharged onto the sealing and guide elements 38 of the linear actuators 30, such as for example seals and guide bands, determining a premature wear and/or damage thereof, which compromises the hydraulic seal of the linear actuators 30, leading to oozing or leakages of oil.

[0020] Furthermore, the overturning moment acting on the linear actuators 30 can also be discharged on the elements that make up the linear actuators 30, such as for example pistons 34 and jackets 32, damaging and/or deforming them, even permanently.

[0021] In the worst hypothesis, the deterioration of the elements and the parts that make up the linear actuators can cause mechanical interferences between the moving parts and the fixed parts, with a consequent blockage of the rolling apparatus or possibly also leading to the breakage of other components or mechanisms of the rolling stand.

[0022] Other examples of these solutions are described in documents US-A-3.596.490, DE-A-38.26.544, EP-A-0.972.582 and US-A-4.083.213.

[0023] In particular, documents US-A-3.596.490 and

DE-A-38.26.544 describe a solution in which, between each linear actuator and each support chock of the bottom back-up rolls, a plate is interposed, selectively movable along a wedge-type profile to adjust the positioning height of the chock. In this solution the wedge-type profiles are integrally associated with the linear actuators and therefore stresses acting on the plate are directly discharged onto the linear actuators since the wedge-type profiles do not allow a reciprocal sliding of the surfaces.

[0024] Document EP-A-0.972.582 describes another solution to adjust the position of the support chocks of the rolling rolls.

[0025] All the solutions described in the documents described above are unable, however, to eliminate the problems that arise due to a transfer of the stresses from the chocks to the linear actuators associated with them.

[0026] There is therefore a need to perfect a rolling stand for rolling apparatuses that can overcome at least one of the disadvantages identified above.

[0027] It is therefore a purpose of the present invention to obtain a rolling stand in which the duration of at least some of its components is increased compared with known solutions.

[0028] Another purpose of the present invention is to obtain a rolling stand that requires fewer maintenance interventions compared with known solutions.

[0029] In particular, one purpose of the present invention is to obtain a rolling stand that allows to reduce or even eliminate the tangential forces that generate overturning moments on the linear actuators.

[0030] Another purpose of the present invention is to obtain a rolling stand that is practical and efficient.

[0031] Another purpose of the present invention is to obtain a rolling stand that is reliable and long-lasting.

[0032] Furthermore, one purpose of the present invention is to obtain a rolling stand that is simple and economical.

[0033] 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

[0034] The present invention is set forth and characterized in the independent claims, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0035] In accordance with the above purposes, a rolling stand for a rolling apparatus comprises a support structure and a roll supported at the opposite ends by respective chocks. The chocks are installed sliding on the support structure at least in a direction orthogonal to the axial development of the roll. At least two linear actuators are associated to the support structure each of which is configured to move a respective chock on the support structure in said direction.

[0036] According to one aspect of the present invention, the rolling stand comprises at least one interposition element, conformed as a plate that extends between both the linear actuators and both the chocks. Furthermore, the interposition element is interposed, in contact, between the linear actuators and the chocks.

[0037] In this way, the stresses that arise during rolling can be discharged directly onto the interposition element which in turn transfers to the linear actuators only the vertical load acting axially to the latter, that is, parallel to said direction.

[0038] The tangential stresses, that is, orthogonal to said direction, due to the inflexion of the bottom back-up roll are instead directly discharged by the interposition element and are not transferred to the linear actuator disposed below.

[0039] Thanks to the fact that the interposition element extends between both the linear actuators and both the chocks, the tangential stresses that are discharged through the chocks are completely absorbed by the interposition element and are not transferred onto the linear actuators, damaging them. The single interposition element associated with the chocks of a roll is in fact able to absorb the tangential stresses generated by the two opposite chocks, which are the same entity but have different senses, and is able to reciprocally cancel them.

[0040] This allows to reduce to a minimum or even cancel the overturning moment on the linear actuators, thus preventing any damage to them. In this way it is possible to increase the duration of the operating components of a rolling stand and to reduce the maintenance operations compared with known solutions.

[0041] According to another aspect of the present invention, the interposition element is a separate element, independent from the linear actuator and the chock, and is not mechanically constrained thereto with mechanical connection means.

[0042] According to a possible solution of the present invention, the rolling stand comprises at least one interposition element positioned resting on the at least one linear actuator. Moreover, the at least one chock is in turn positioned resting on the at least one interposition element.

[0043] In particular, by the term "positioned resting" we mean that the interposition element is an element that is not firmly clamped to the components that interface with it. However, mechanical or other type of connection elements could be provided, so as to constrain the interposition element, in said direction of movement of the chocks, to one or another of either the linear actuator or the chock, without compromising the efficiency thereof, since they do not alter the degrees of freedom required for a correct functioning.

[0044] According to a possible variant, the interposition element is positioned resting on the chock and the linear actuator is configured to thrust the interposition element.

[0045] The present invention also concerns a rolling method for a flat product with at least one roll that comprises:

- supporting the opposite ends of the roll with respective chocks on a support structure;
- selectively moving the chocks with respective linear actuators on the support structure in a direction orthogonal to the axial development of the roll.

[0046] According to one aspect of the present invention, the stress acting on the roll is transferred from the chocks to at least one interposition element interposed between the linear actuators and the chocks. Furthermore, the stress components parallel to said direction are absorbed by the linear actuators, while the stress components orthogonal to said direction are absorbed by the interposition element.

BRIEF DESCRIPTION OF THE DRAWINGS

[0047] 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 cross section of a part of a rolling stand for rolling apparatuses according to the state of the art;
- fig. 2 is a lateral view of a rolling stand for rolling apparatuses according to embodiments described here;
- fig. 3 is a cross section of a part of a rolling stand for rolling apparatuses in a first operating condition, according to embodiments described here;
- fig. 4 is a cross section of a part of a rolling stand for rolling apparatuses in a second operating condition, according to embodiments described here;
- fig. 5 is a section from V to V in fig. 3 of a part of a rolling stand for rolling apparatuses, according to other embodiments described here.

[0048] 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

[0049] Fig. 2 is used to describe example embodiments of a rolling stand 10, used in a rolling apparatus to hot roll flat products 19, such as metal strip or sheet advancing between two rolling stands 10 in a direction of advance R according to the arrow in fig. 2.

[0050] The rolling stand 10 is provided with a support structure 25 comprising one or more shoulders 22, for example two shoulders 22, opposite each other.

[0051] According to variants, a rolling stand 10 can comprise at least two opposite rolls between which the flat product 19 is compressed during its advance in the direction of advance R, to be rolled.

[0052] Each roll is installed with its opposite ends on one of the shoulders 22 of the support structure 25 by connection and support means, also called chocks.

[0053] The chocks are configured to support the rolls rotatably around their axis of rotation.

[0054] According to possible solutions, the chocks are each configured to support the ends of the rolls on the support structure 25, so as to dispose their axes of rotation X all substantially parallel to each other and possibly lying on a common lying plane. According to variants, each shoulder 22 of a rolling stand 10 defines a window 23 in which the chocks can be installed.

[0055] According to the solution shown in fig. 2, the rolling stand 10 comprises a bottom work roll 28 and a top work roll 29 disposed respectively below and above the plane identified by the flat product 19.

[0056] Furthermore, again according to the solution shown in fig. 2, the rolling stand 10 can comprise a bottom back-up roll 24 and a top back-up roll 26, disposed respectively below and above the plane identified by the flat product 19.

[0057] Moreover, the bottom work roll 28 and the top work roll 29 can be disposed between the bottom back-up roll 24 and the top back-up roll 26, so that the top back-up roll 26 rests on the top work roll 29, the latter resting on the bottom work roll 28 and this, in turn, resting on the bottom back-up roll 24.

[0058] The bottom work roll 28, the top work roll 29, the bottom back-up roll 24 and the top back-up roll 26 are cylindrical in shape with an oblong development in a direction parallel to their respective axes of rotation X.

[0059] According to the solution shown in fig. 2, the bottom work roll 28, the top work roll 29, the bottom back-up roll 24 and the top back-up roll 26 are installed on the support structure 25 so as to dispose their axes of rotation X parallel and all lying on a common lying plane Z. The lying plane Z is located transversely, in this case orthogonal to the direction of advance R of the flat product 19.

[0060] According to a possible variant of the present invention, the axes of rotation X of the bottom work roll 28, the top work roll 29, the bottom back-up roll 24 and the top back-up roll 26 can be installed on the support structure 25 disposing their axes of rotation distanced from each other and not lying on a common lying plane, to define a rolling stand 10 also called, in technical terms, crossing rolling stand.

[0061] According to the embodiment of the present invention, the bottom back-up roll 24, the top back-up roll 26, the bottom work roll 28 and the top work roll 29 are supported at their respective ends by chocks, that is, respectively by first chocks 40, second chocks 41, third chocks 48 and fourth chocks 49.

[0062] The chocks, or at least some of the first chocks 40, second chocks 41, third chocks 48 and fourth chocks 49 are installed on the support structure 25, for example in correspondence with the shoulders 22.

[0063] According to one possible solution, the chocks or at least some of the first chocks 40, second chocks 41, third chocks 48 and fourth chocks 49 are installed slidingly in a direction D orthogonal to the axis of rotation X of the rolls and to the direction of advance R, that is, in a direction parallel to the lying plane Z.

[0064] According to variants, the first chocks 40, second chocks 41, third chocks 48 and fourth chocks 49 can comprise at least first support elements 42, such as by way of example hydraulic bearings, configured to support the respective rolls rotatingly around their axis of rotation X.

[0065] According to other variants, the first chocks 40, second chocks 41, third chocks 48 and fourth chocks 49 can also comprise second support elements 44, possibly cooperating with the first support elements 42, and which are configured to allow the rolls to rotate around their respective axes of rotation X and to contain the axial stresses that can occur on the latter. Merely by way of example, the second support elements 44 can be thrust bearings.

[0066] The first support elements 42 and the second support elements 44 can allow the bottom back-up roll 24 and the top back-up roll 26 to rotate around their respective axis of rotation X.

[0067] According to one aspect of the present invention, at least two linear actuators 30 are associated with the support structure 25, each configured to move a respective chock of at least one of the rolls in a direction D orthogonal to the axial development of the latter and orthogonal to the direction of advance R of the flat product 19.

[0068] According to the solutions shown in figs. 2-5, two linear actuators 30 are provided, associated on two opposite sides of the support structure 25 and each of which is configured to at least move, and possibly support, one of the support chocks of the respective roll on the support structure 25 in said direction D.

[0069] According to the solution shown in figs. 2-5, a rolling stand 10 is described comprising two linear actuators 30 associated on two opposite sides of the support structure 25 and each of which is configured to support and move one of the two first support chocks 40 of the bottom back-up roll 24.

[0070] According to a possible variant, not shown, the linear actuators 30 are associated on two opposite sides of the support structure 25 and each of them is configured to move the two second support chocks 41 of the top back-up roll 26. In this case, a substantially symmetrical structure is defined of the rolling stand 10, with respect to the flat product 19 and what is shown in fig. 2. In this embodiment, the first chocks 40 of the bottom back-up roll 24 are disposed resting on the support structure 25.

[0071] According to variants of the present invention, not shown in the drawings, it can be provided that the rolling stand 10 comprises only the bottom work roll 28 and the top work roll 29, and not the top and bottom back-up rolls described above. According to this solution, it is provided that the two linear actuators 30, associated on the two opposite sides of the support structure 25, are each configured to support and move one of the two third chocks 48 of the bottom work rolls 28.

[0072] However, it is not excluded, in variant embodiments not shown, that the two linear actuators 30 are associated on two opposite sides of the support structure 25 and are configured to move the two fourth support chocks 49 of the top work rolls 29.

[0073] According to other variants, not shown in the drawings, it can be provided that the rolling stand 10 comprises not only the bottom work roll 28 and the top work roll 29, but also two or more top back-up rolls and/or two or more bottom back-up rolls. A solution can be provided, for example, in which two bottom back-up rolls act on the bottom work roll and two top back-up rolls act on the top work roll.

[0074] According to a possible solution, the at least one linear actuator 30, in this case both, are installed on the support structure 25 so as to dispose their axes of actuation substantially orthogonal to the direction of advance R of the flat product 19 and to the axes of rotation X of the rolls.

[0075] The linear actuators 30 can comprise a jacket 32, a piston 34 and a flange or head 36.

[0076] According to variants, the piston 34 is provided to slide inside the jacket 32. The flange 36 closes the jacket 32 by attachment elements, with the effect of containing inside it the fluid for driving the piston 34.

[0077] The piston 34 can comprise sealing elements 38 such as elastic bands which surround it circumferentially and which rest against the internal cavity of the jacket 32, obtaining a hydraulic seal.

[0078] According to variants described using fig. 3, at least one support plate 12 can be attached to the upper part of each linear actuator 30.

[0079] According to variants, at least one thrust plate 14 can be attached to the lower part of each first chock 40.

[0080] According to one aspect of the present invention, the rolling stand 10 comprises at least one interposition element 20 which extends between both the linear actuators 30 associated with a roll, in this case shown with the bottom back-up roll 24. The interposition element 20 is positioned resting on both the linear actuators 30. Moreover, both the first chocks 40, in their turn, are positioned resting on the interposition element 20. In this way the interposition element 20 is interposed between the linear actuators 30 and the first chocks 40 but is not constrained to them, that is, it is not attached to the linear actuators 30 or the first chocks 40, but is only put in contact therewith.

[0081] According to a possible solution, the interposition element 20 is substantially conformed as a plate.

[0082] The interposition element 20 extends continuously above the linear actuators 30, covering at least the distance that separates them.

[0083] According to variants, the interposition element

20 has a main development in a direction parallel to the direction identified by the axes of rotation X of the rolls.

[0084] According to a possible embodiment, it is provided that the contact zone of the linear actuators 30 and the chocks with the interposition element 20 is of limited size, and smaller than the overall surface development of the interposition element 20. This solution allows to reduce the friction forces acting between the interposition element 20, the linear actuators 30 and the chocks.

[0085] According to solutions shown in figs. 3, 4 and 5, the first chocks 40 are positioned in contact with, in this case resting on, the interposition element 20 with the thrust plates 14. The thrust plates have a contact surface with the interposition element 20 that has a smaller extension in size than the interposition element 20.

[0086] According to the solution in figs. 2-5, the interposition element 20 can comprise a central body 21 provided with a central segment 11 and expansions 15, greater in thickness than the central segment 11, provided at the ends of the central segment 11 and in correspondence with which the first chocks 40 are disposed resting.

[0087] The expansions 15 thicken the contact zone between the first chocks 40 and the interposition element 20 and between the linear actuators 30 and the interposition element 20, to supply a reinforcement that increases the mechanical resistance to stresses to which the latter is subjected. According to one possible solution, one or more first contact elements 16 can be attached to the interposition element 20, which during use face toward and are positioned in contact with, in this case resting on, the linear actuators 30, for example on the support plate 12.

[0088] According to other variants, one or more second contact elements 18 can be attached to the interposition element 20, positioned in contact in this case, on which the first chocks 40 rest, for example with their thrust plate 14.

[0089] The support plate 12, the thrust plate 14, the first contact element 16 and the second contact element 18 can be made of anti-wear materials, that is, with very hard materials, to allow to resist the wear to which they are subjected during use. Moreover, the support plate 12, the thrust plate 14, the first contact element 16 and the second contact element 18 are removably attached to the first chocks 40, to the interposition element 20 and to the linear actuator 30, to allow them to be replaced.

[0090] The expansion 15 can also be suitable to supply a solid base on which to constrain the first contact element 16.

[0091] Moreover, the expansion 15 can also be suitable to supply a solid base on which to constrain the second contact element 18.

[0092] According to the solution shown in figs. 2-4, the interposition element 20 can also comprise a covering end 17, attached to or made in a single body on a plane substantially transverse to that identified by the central body 21. The covering end 17 is attached on the perimeter of the interposition element 20.

[0093] When the rolling stand 10 is functioning, that is, when the flat product 19 is pressed at least between the bottom back-up roll 24 and the top back-up roll 26 and between the bottom work roll 28 and the top work roll 29, due to the forces of compression in action, a distributed load is generated, above the bottom back-up roll 24, identified by the arrows L (fig. 4).

[0094] The distributed load L, acting on the bottom back-up roll 24, determines a flexion of the latter, which tends to bend.

[0095] The effect of the curvature also affects the first chocks 40 that support the bottom back-up roll 24.

[0096] As a consequence of the flexion, the bottom back-up roll 24 tends to incline the first chocks 40, taking the vertical axis of the first chocks 40, that is, the axis along which the first chocks 40 are moved, to rotate by an angle α on the lying plane Z (fig. 4).

[0097] According to variants, the thrust plate 14, if provided, since it is associated with the first chock 40, also moves as a consequence of the rotation toward the outside of the rolling stand 10, in concordance with the direction identified by arrow T.

[0098] If the thrust plate 14 were directly in contact with the support plate 12, as happens in the state of the art, tangential forces would be generated, identified by arrows T, due to the friction between the thrust plate 14 and the support plate 12. As a consequence of the tangential forces, moreover, an overturning moment would also be generated, acting on the linear actuators 30.

[0099] Unlike what happens in the state of the art, that is, where an overturning moment is caused by the combination of the arrows F acting on the same linear actuator 30 (see fig. 1), the tangential forces T that are generated in the rolling stand 10 do not cause an overturning moment, thanks to the presence of the interposition element 20 (see fig. 4).

[0100] The interposition of the interposition element 20 between the first chocks 40 and the linear actuators 30 allows to discharge the tangential forces T, preventing the linear actuators 30 from being loaded with forces and generating an overturning moment.

[0101] The tangential forces T that act on a first chock 40 are substantially equal and in the opposite sense compared with the tangential stresses acting on the first chock 40 provided to support the opposite end of the bottom back-up roll 24. This causes a reciprocal cancellation of the tangential forces T that are completely absorbed by the interposition element 20. This condition occurs even more if the distributed load L acts on the bottom back-up roll 24 substantially symmetrically with respect to the center line of the axial length of the bottom back-up roll 24. This condition of stress avoids having to associate lateral containing means with the interposition element 20 to prevent the tangential forces T that arise from displacing the interposition element 20 transversely, in a direction parallel to the axis of rotation X.

[0102] According to variants, the interposition element

20 is not allowed to make translation movements in a direction parallel to the axis of rotation X, but is allowed to make only vertical movements in the direction of the vertical axis, in order to allow to discharge the stresses acting axially on the linear actuators 30, that is, parallel to said direction D.

[0103] According to some formulations of the present invention, if the load acting on its surface is not symmetrical, it can be provided that the interposition element 20 is provided with lateral containing elements to contain possible lateral movements of the interposition element 20 to which it may be subjected due to the tangential stresses.

[0104] According to variants described using fig. 5, the interposition element 20 can be associated with containing and guide elements 46 which allow to move the interposition element 20 only in a direction parallel to said direction D and instead block its movement in a direction parallel to the axis of rotation X or in directions different from said direction D. The containing and guide elements 46 can be installed on the support structure 25 and therefore allow to discharge the tangential forces T to which the interposition element 20 is possibly subjected. Although the presence of the containing and guide elements 46 has been described with reference to the configuration shown in figs. 2-5, it is not excluded that they can also be provided, with the necessary adaptations, also for the other solutions described here and not shown.

[0105] According to the solution described in fig. 5, the containing and guide elements 46 comprise at least a guide pin 50 and a guide cavity 51 in which the guide pin 50 is slidingly positioned, guided and controlled. The guide pin 50 and guide cavity 51 are provided on the interposition element 20 and respectively on a fixed part of the rolling stand 10, for example in correspondence with the support structure 25, or vice versa to define a substantially dual guide configuration.

[0106] According to the solution described in fig. 5, the guide pin 50 is attached to the interposition element 20 protruding cantilevered with respect to the latter, for example in correspondence with a perimeter edge thereof. On the contrary, the guide cavity 51 is made on a support bracket 52, attachable to the support structure 25, in this case to the shoulder 22.

[0107] During the activation of the linear actuator 30, the guide pin 50 slides guidedly in the guide cavity 51, constrained to remain substantially parallel to the vertical axis Z.

[0108] The guide pin 50 can also be configured to prevent a movement of the interposition element 20 in a direction other than that defined by the vertical axis Z, that is, other than said direction D.

[0109] It is clear that modifications and/or additions of parts may be made to the rolling stand 10 as described heretofore, without departing from the field and scope of the present invention.

[0110] For example, although in the present description the interposition element 20 has been described as associated with the bottom back-up roll 24, that is, to the chocks 40 and the linear actuators 30 associated with the bottom back-up roll 24, it is not excluded that the interposition element 20 can be associated with one or the other or a combination of the top back-up roll 26, the bottom work roll 28 or the top work roll 29, or the respective chocks and actuators associated with them.

[0111] 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 rolling stand, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

Claims

1. Rolling stand comprising a support structure (25) and at least one roll (24; 28) supported at the opposite ends by respective chocks (40), said chocks (40) being installed sliding on said support structure (25) at least in a direction (D) orthogonal to the axial development of said roll (24), and two linear actuators (30) being associated to said support structure (25) each configured to move one of said chocks (40) on said support structure (25) in said direction (D), **characterized in that** it comprises one interposition element (20) conformed as a plate and that extends between both said linear actuators (30) and said chocks (40), said interposition element (20) being interposed, in contact, between said linear actuators (30) and said chocks (40).

2. Rolling stand as in claim 1, **characterized in that** said interposition element (20) is positioned resting on said linear actuators (30), and **in that** said chocks (40) are positioned resting on said one interposition element (20).

3. Rolling stand as in claim 1, **characterized in that** said interposition element (20) is positioned resting on said chocks (40), and **in that** said linear actuators (30) are configured to thrust said interposition element (20).

4. Rolling stand as in any claim hereinbefore, **characterized in that** said interposition element (20) is mobile only in said direction (D) and is constrained in its movement in a direction parallel to the axis of rotation (X) of said roll (24).

5. Rolling stand as in any claim hereinbefore, **characterized in that** a respective thrust plate (14), positioned in contact with said interposition element (20), is attached to each of said chocks (40).

6. Rolling stand as in any claim hereinbefore, **charac-**

terized in that one or more first contact elements (16) are attached to said interposition element (20), and face, during use, toward and are positioned in contact with the linear actuators (30).

7. Rolling stand as in claim 6, **characterized in that** one or more second contact elements (18) are attached to said interposition element (20) and positioned in contact with the first chocks (40).

8. Rolling stand as in any claim hereinbefore, **characterized in that** it comprises a bottom work roll (28) and a top work roll (29) supported at the ends by respective chocks (48, 49) and between which, during use, a flat product (19) to be rolled passes.

9. Rolling stand as in claim 8, **characterized in that** a respective linear actuator (30) is associated to at least the support chocks (48) of said bottom work roll (28), and **in that** said at least one interposition element (20) is interposed between said chocks (48) and said linear actuator (30).

10. Rolling stand as in claim 8, **characterized in that** it comprises a bottom back-up roll (24) and a top back-up roll (26) between which the bottom work roll (28) and the top work roll (29) are disposed and supported at the ends by respective chocks (40, 41), **in that** a respective linear actuator (30) is associated at least to the support chocks (40) of said bottom back-up roll (24), and **in that** said at least one interposition element (20) is interposed between said chocks (40) and said linear actuator (30).

11. Rolling stand as in any claim hereinbefore, **characterized in that** containing and guide elements (46) are associated to said at least one interposition element (20) and are configured to allow a movement of said interposition element (20) only in a direction parallel to said direction (D).

12. Rolling method for a flat product (19) with at least one roll (24; 28) that provides to support the opposite ends of said roll (24; 28), with respective chocks (40) on a support structure (25) and to selectively move said chocks (40) on said support structure (25), with respective linear actuators (30) in a direction (D) orthogonal to the axial development of said roll (24), **characterized in that** the stress acting on said roll (24; 28) is transferred from said chocks (40) toward at least one interposition element (20) interposed between said linear actuators (30) and said chocks (40), and **in that** the components of said stress parallel to said direction (D) are absorbed by said linear actuators (30), while the components of said stress orthogonal to said direction (D) are absorbed by said interposition element (20).

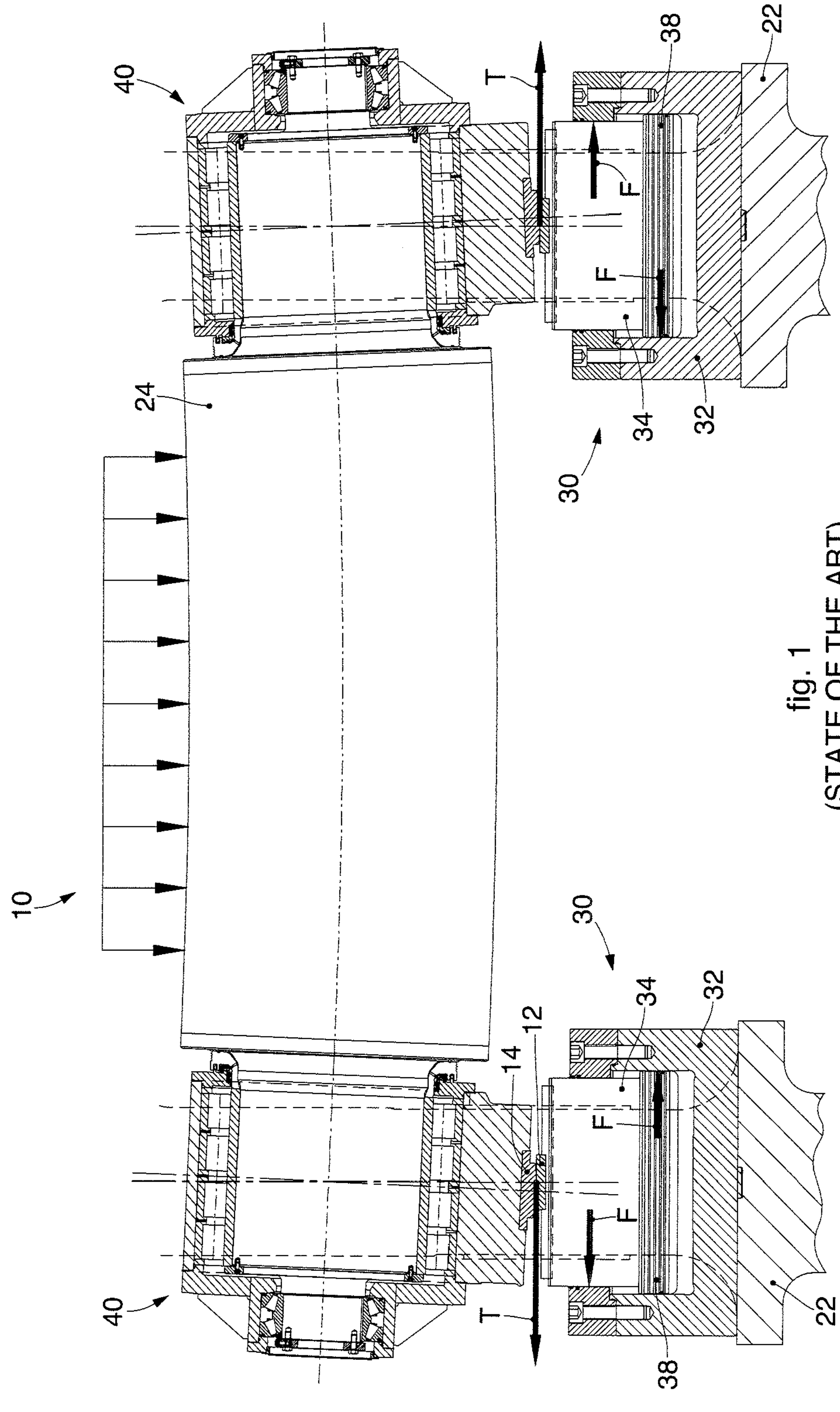

fig. 1
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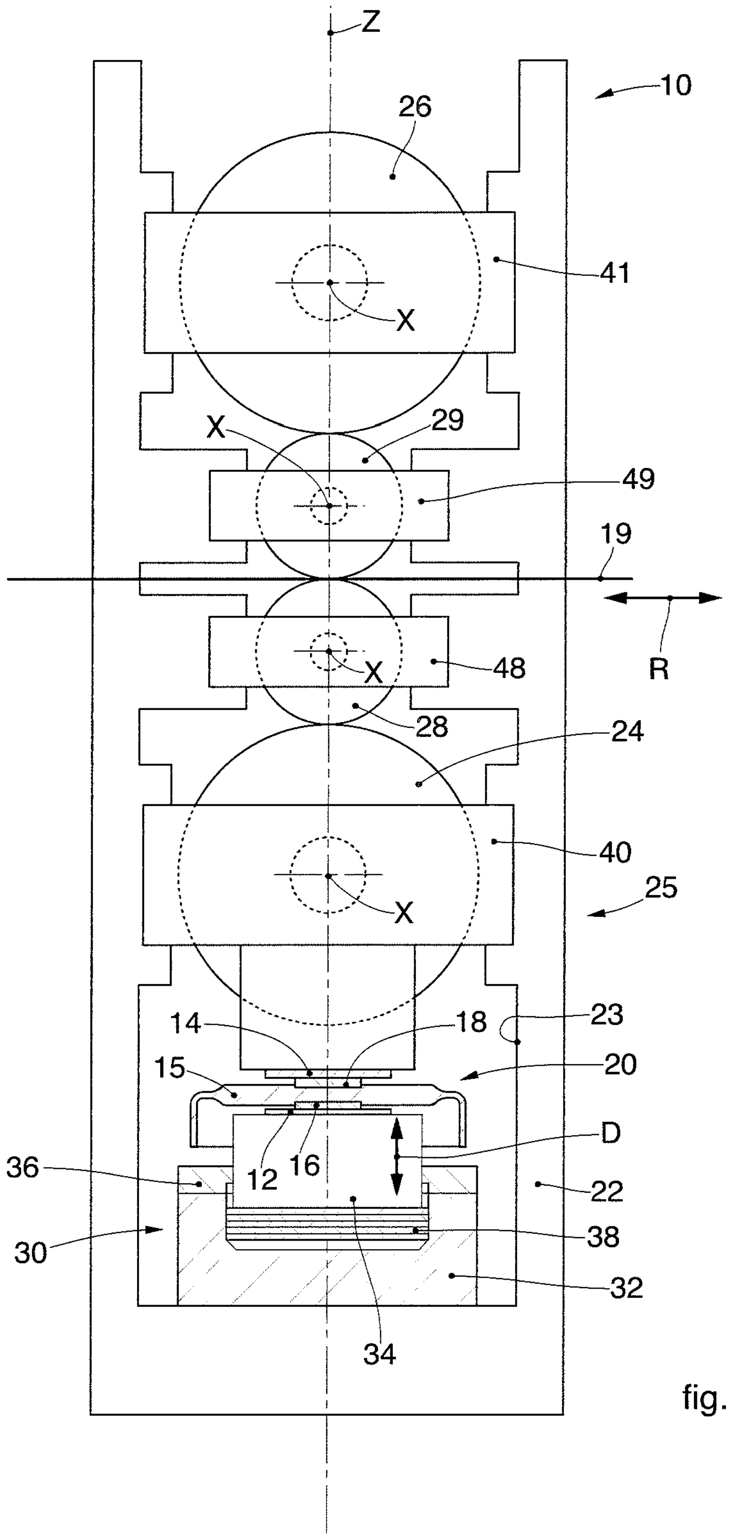
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fig. 2

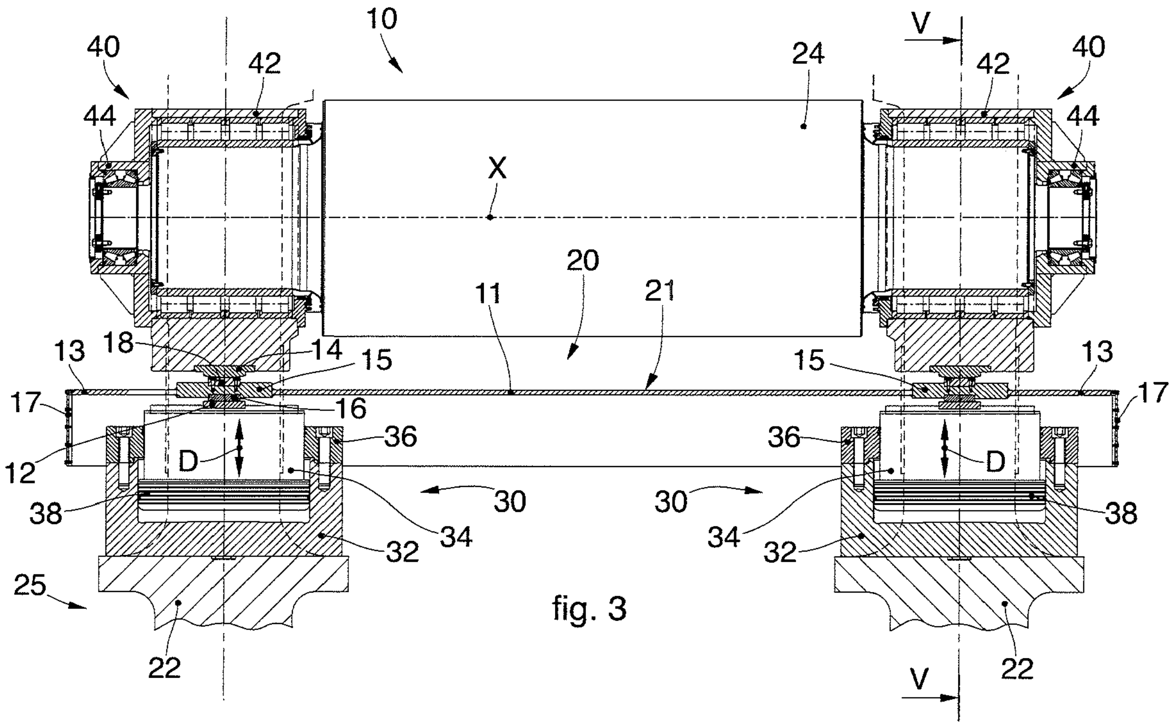
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fig. 3

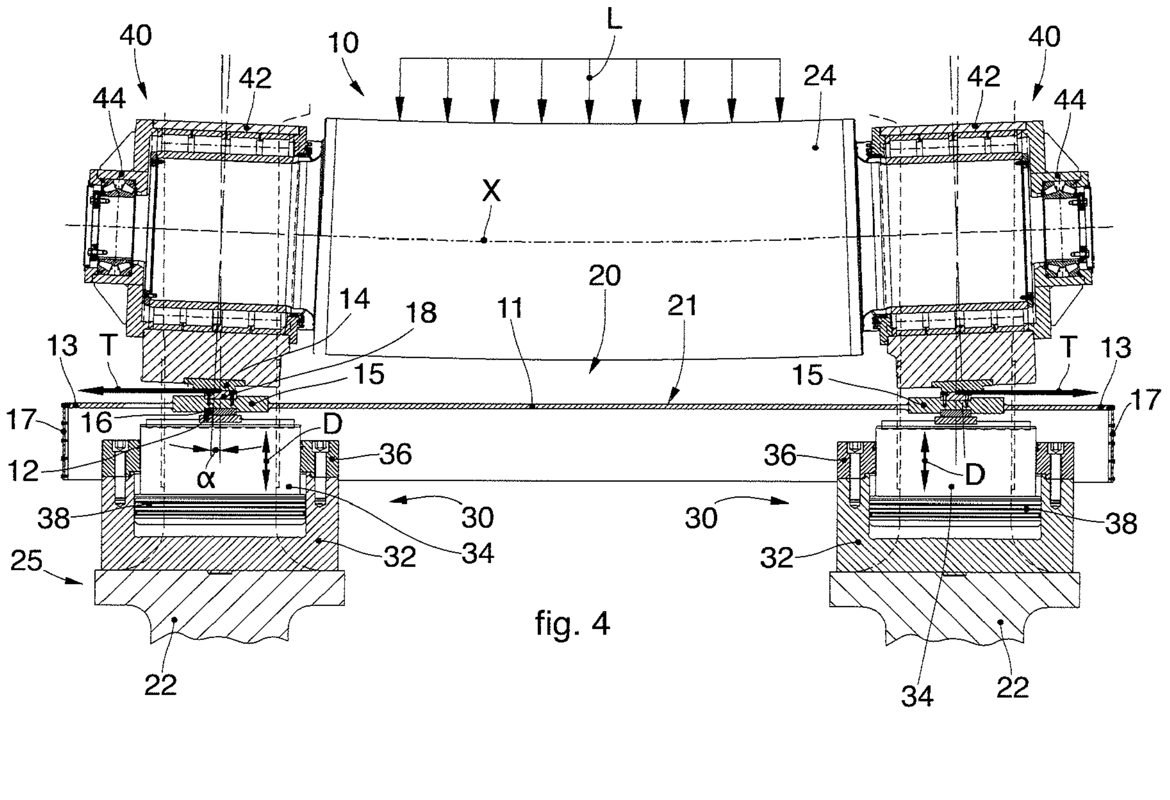
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fig. 4

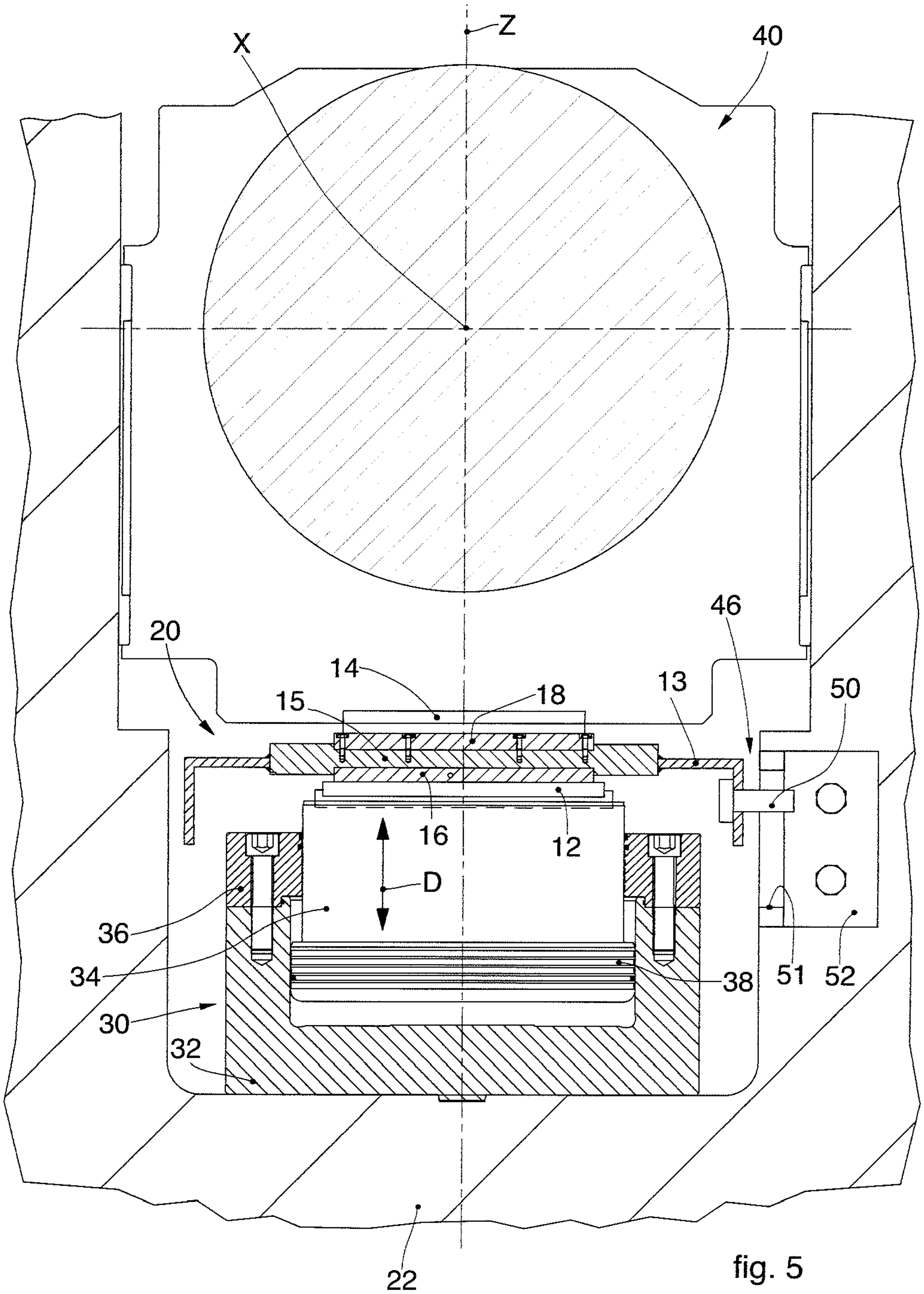

fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 16 17 5233

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B21B

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 August 2016	Forciniti, Marco

CATEGORY OF CITED DOCUMENTS

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