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(54) **ROLL STRIPPER DEVICE AND METHOD**

ROLLENABSTREIFER UND VERFAHREN

DISPOSITIF DE DÉVÊTISSAGE À CYLINDRES ET PROCÉDÉ

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Description

[0001] This invention relates to a roll stripper device and method, in particular for aluminium rolling mills, see e.g. DE 10 2007 048747 A1.

[0002] In the field of metal rolling it is well known that the metal being rolled can stick to the surface of the roll and therefore a device known as a stripper is used to peel, or strip the metal away from the surface of the roll and guide it out of the rolling mill. In some types of mills contact between the stripper and the work roll is acceptable, but in aluminium rolling for example, it is important that the stripper does not contact the roll surface otherwise it will damage the surface layer of the roll. Therefore the stripper has to be set with a small gap between the stripper and the roll surface. The gap needs to be small enough to ensure that even the thinnest material that is rolled cannot force its way between the stripper and the roll and therefore precise alignment and positioning of the stripper is required. Even on a large plate mill it is common for the gap between the stripper and the roll to be only about 2mm.

[0003] In many rolling mills the strippers are fixed between the roll chocks. An example is shown in US3258953. The gap between the strippers and the work roll surface is preset when the rolls and chocks are assembled. Various means are used to set the position of the strippers relative to the work roll including shims, bolts and eccentrics, but, whatever the means used to adjust the stripper positions, they are fixed relative to the roll chocks and therefore the gap stays constant when the roll assembly moves in the mill. Consequently, in this type of design, the movement of the chocks relative to the housing due to the clearances does not affect the stripper to roll gap.

[0004] However there are some designs for strippers in which the stripper is not attached to the roll chocks, but is attached to equipment - usually the feed roller assembly - which is in turn attached to the mill housing. Examples are DE102007048747 and our co-pending patent application GB1106138.9. These designs have certain advantages over chock mounted strippers, but a significant disadvantage is that any movement of the chocks within the housing clearances, or any inaccuracy in the calculated position of the roll, either vertically, or horizontally, leads to inaccurate setting of the stripper to roll gap. Since the clearances are of a similar size to the desired gap it would be possible to end up with either no gap at all, which would lead to damage to the surface layer of the roll, or with a gap which is much larger than desired and which would allow thin material to force itself between the stripper and the roll.

[0005] DE102007048747 discloses a design in which the strippers are mounted on the feed roller assembly and the whole stripper and feed roll assembly can be moved horizontally. By linking horizontal movement of the feed roller and stripper assembly with the vertical movement of the bottom work roll, it is possible to set the

position of the stripper relative to the work roll and thus set the gap between the stripper and the roll.

[0006] Co-pending patent application GB1106138.9 relates to a design in which the strippers are mounted on the feed roller assembly and the whole stripper and feed roll assembly can be moved vertically, or pivoted on its support making it possible to set the entry and exit side strippers at different heights relative to the top of the work roll and also to set the gaps between the strippers and the roll. This design is illustrated in Figs. 1 and 2.

[0007] However, as mentioned, in these types of prior art design, particularly where the stripper is attached to the feed roll assembly, inaccuracies can arise in setting the stripper to roll gap.

[0008] In accordance with a first aspect of the present invention a roll stripper device comprises a stripper mounted on a stripper support; a sensor; and a processor; wherein the sensor is adapted to provide a measure of distance to a work roll; and wherein the processor is adapted to determine the position of a tip of the stripper relative to the work roll, using the distance provided by the sensor.

[0009] Preferably, the sensor is mounted at a predetermined distance from a tip of the stripper.

[0010] Preferably, the sensor is mounted on one of the stripper, stripper support, a feed roll assembly, feed roller support, mill housing or a roll chock.

[0011] Preferably, at least one sensor is mounted at the centre of the device.

[0012] This allows bending of the work roll to be determined and compensated for.

[0013] Preferably, a sensor is mounted facing one or more roll grinding support areas of a work roll.

[0014] Preferably, the device comprises two or more sensors, spaced apart along the length of the device.

[0015] Preferably, a sensor is mounted at each end of the device.

[0016] Preferably, the device comprises two or more sensors spaced apart around a circumference of the work roll.

[0017] Preferably, the or each sensor is adapted to determine distance from a lower work roll of a pair of work rolls.

[0018] Preferably, the sensor comprises one of a contact or non-contact inductive or capacitive sensor, a mechanical distance sensor, a transducer, or an optical range finder.

[0019] In accordance with a second aspect of the present invention, a method of determining distance of a stripper from a work roll comprises using a sensor to determine a distance of the sensor from a point on the work roll; extracting stored data relating to the relative position of the sensor and the stripper; and calculating a position of a tip of the stripper, relative to the work roll, from the determined distance and the stored location of the sensor.

[0020] In accordance with a third aspect of the present invention method of controlling a relative position of a

stripper and a work roll comprises determining a gap representing the distance of the stripper from the work roll according to the method of the second aspect; comparing the gap with a required gap; determining if the result of the comparison is outside an acceptable range of tolerance and, if so, adapting the position of the stripper according to the result of the comparison.

[0021] The invention enables the position of the stripper to be determined, checked for compliance with preset tolerances and corrected, if required, whatever the cause of the non-compliance may be, so it is useful both at set up and during operation, if outside influences change the stripper position after set-up.

[0022] Preferably, the method further comprises placing a sensor at each end of the work roll; and adapting the position of the stripper at each end accordingly.

[0023] Preferably, the method comprises determining the distance for each of the sensors; calculating an average, minimum or maximum distance using each of the determined distances; and adapting the position of the stripper based on the result of the comparison between the required distance and the average, minimum or maximum distance.

[0024] Preferably, the method comprises automatically repeating the steps of determining and comparing the distance and adapting the position of the stripper.

[0025] This helps maintain accuracy, even if the loading changes during the rolling process.

[0026] Preferably, the method further comprises applying a delay between repeats when the result of the comparison is within an acceptable range of tolerance.

[0027] Preferably, the method comprises determining when a head end of an article being rolled has passed the stripper onto the feed roll assembly on the exit side and then causing an actuator to move the stripper further from the work roll than the maximum range of tolerance of the required gap.

[0028] The maximum range of tolerance is the maximum gap that is acceptable during strip threading to prevent the strip forcing itself between the stripper and the roll, but once the head end has passed the stripper, i.e. strip threading is completed, then it is acceptable for the gap to be increased beyond this limit without risk of the article getting between the stripper and the work roll. This means that the risk of the stripper coming into contact with the work roll due to unexpected forces is reduced.

[0029] Preferably, deflection of the stripper is calculated from load measurements and the position of the stripper is adjusted in response to the determined distance and the load measurement.

[0030] Preferably, the method further comprises measuring roll load cylinder position in combination with determining distance from sensor measurement.

[0031] Preferably, the method further comprises one or more actuators for adjusting the position of the stripper.

[0032] Preferably, the device further comprises load sensors to calculate deflection of the stripper.

[0033] Preferably, the load sensors comprise one of

pressure transducers in the actuators or loadcells.

[0034] An example of a roll stripper device and an associated method in accordance with the present invention will now be described with reference to the accompanying drawings in which:

Figure 1 illustrates the overall arrangement of a millstand to which the invention can be applied;

Figure 2 illustrates in more detail the type of feed roll assembly to which the invention can be applied;

Figure 3 is a detailed view of one implementation of the present invention in the assembly of Fig. 1;

Figure 4 is a flow diagram illustrating the method of operating the device of the present invention;

Figure 5 illustrates an alternative embodiment of a device according to the present invention; and,

Figure 6 illustrates an alternative view of the embodiment of Fig.5.

[0035] Figure 1 illustrates a millstand and feed roll assembly in which the present invention may be applied. The millstand comprises a housing having top and bottom beams 33a, 33b and side posts 38a, 38b. Roll chocks 41, 42 are fitted within the millstand for the back-up rolls.

The roll assemblies in a rolling mill have to be able to move vertically in the mill housings for the purpose of accommodating different roll diameters, setting the roll gap, controlling the thickness and setting the pass line height etc. Upper and lower back-up rolls 39, 40 are mounted in chocks 41, 42 and wear plates 31a, 31b are provided on the outside faces of the roll chocks. On the inside facings of the mill housing corresponding wear plates 35a, 35b are provided and the chocks are allowed to slide on these wear plates. Similarly, for the work roll assemblies, with work rolls 21, 22 (Fig.2), work roll chocks 43, 44 have wear plates 36a, 36b on their outer surface and corresponding supports 45, 46 (in this example, roll bend/balance blocks) fixed to the millstand housing with wear plates 37 on their inside facing surfaces. In practice, there has to be a certain amount of clearance 32a, 32b, 32c, 32d between the dimensions of the chocks and the mill housings or chock supports. This clearance is necessary for several reasons including housing nip, allowance for thermal expansion and the fact that the roll assemblies need to be changed regularly. Housing nip is the phenomenon whereby the shape of the housing window changes slightly between the unloaded and loaded states. For most mills, the inner faces of the housings move inwards when the rolling load is applied, i.e. top and bottom beams 33a, 33b bend and so cause the side posts 38a, 38b to bend as well and if there is insufficient clearance between the chocks and the housing then the housing will nip the chock and prevent free movement. Typically the design clearances between the chocks and the mill housings are 1 to 2mm, but if the wear plates are allowed to wear excessively the clearance can easily become more than 2mm. Typically, the wear plates have a few millimetres clearance be-

tween them.

[0036] In the example shown in Fig. 2, a stripper 27 is provided on the exit side of a bottom workroll 21. Normally, the stripper to roll gap is only 2mm to satisfy the twin requirements of preventing thin materials getting between the stripper and the work roll and avoiding contact of the stripper with the work roll, which may cause damage to the surface. It can be seen that if the work roll moves by 2mm or more, then, depending upon the direction of movement, this can result in either no clearance, or 4mm clearance, both of which may cause problems.

[0037] Another aspect is that when roll change takes place, the wear plates after the change may be more or less worn than a previous set, so it is not possible to guarantee the correct clearance of the stripper has been maintained.

[0038] Fig. 2 illustrates in more detail, the example of Fig. 1. In this embodiment, the strippers 26 and 27 are fixed to feed roller assemblies 3 and 4, supporting feed rollers 25, 28. The feed roller assemblies 3 and 4 are mounted on slides 5 and 6 so that the assemblies can move relative to feed roller supports 7 and 8. In this example, this movement is achieved by hydraulic cylinders 9 and 10, although other types of actuators can be used and the invention is not limited to this specific example. The hydraulic cylinders 9 and 10 also contain external position transducers (although either internal or external transducers may be used) and the stroke of each of these cylinders may be independently position controlled by hydraulic servo-valves and controllers (not shown). The feed roller supports 7 and 8 are pivoted about pivots 11 and 12 which are fixed to the mill housing. The feed roller supports 7 and 8 can be moved about the pivots 11 and 12 by hydraulic cylinders 13 and 14. Clevises 15 and 16 of the hydraulic cylinders 13 and 14 are connected to pivots which are mounted on the mill housing. The hydraulic cylinders 13 and 14 also contain position transducers and the strokes of these cylinders are independently controlled by hydraulic servo-valves and controllers which are not shown.

[0039] With stripper designs such as those in DE102007048747 and GB1106138.9, in order to set the stripper to roll gap accurately, the position of the work roll must be known accurately.

[0040] To address this problem, it is necessary to determine the distance of the stripper tip from the work roll. The vertical position of the work roll is known with reasonably good accuracy from the stroke of the roll load cylinder 30, the roll diameters and the dimensions of any packers 34 etc., but even if the stripper to roll gap is calibrated, e.g. by a manual measurement when the equipment is first installed, it is difficult to be certain that the vertical position of the roll is known absolutely accurately after roll changes, roll wear etc. This is why mills still have to do a mill zeroing calibration after a roll change. In theory it should be possible to calculate the new zero position accurately, but in practice a calibration is required.

[0041] The horizontal position of the roll assembly within the housing clearances is not known accurately and therefore it has to be assumed. Generally mills have an offset between the vertical centre lines of the backup rolls and the work rolls in order to force the rolls across to one side of the mill. Some mills even have small hydraulic cylinders to push the roll chocks across onto one side of the housing. However, even if it is assumed that the roll chocks are up against one side of the housing, there are still unknowns such as exactly how much the chock and the mill wear plates have worn, whether the dimensions are exactly the same between different sets of rolls, thermal growth of both work rolls and chocks, etc., and so there is still some uncertainty with regard to the horizontal position of the roll chock. Any horizontal movement of the work roll 21 due to clearances, or wear of the wear plates, or differences between different sets of chocks and any inaccuracy in the assumed vertical position of the work roll may lead to errors in the stripper to roll gap.

[0042] Currently, for the stripper designs similar to DE102007048747 and GB1106138.9 the control system which controls the position of the strippers has to make certain assumptions. For the vertical position the control system assumes that this can be accurately determined from the measured roll load cylinder position, the roll diameters and the nominal dimensions of any packers etc. For the horizontal position of the roll the control system assumes that this is constant. In general these systems assume that the chock is up against one side of the mill all the time. A manual check on the stripper to roll gap is done during the initial installation, or during maintenance and an offset is incorporated into the control system, but subsequently the control system has to assume that the horizontal position does not change. In general, it is too time consuming to do a manual check of the stripper to roll gap after a roll change so either the system has to assume that the new roll assembly has exactly the same dimensions between the roll centre and the chock wear plates as the old roll assembly, or a manual measurement might be made in the roll shop and entered into the control system.

[0043] Another solution which has been considered for setting the stripper to roll gap is to move the stripper in until it touches the roll and then move it out by the right distance to set the gap. The contact between the stripper and the roll can be detected by force measurement in the cylinders which move the stripper assembly, for example, or by a force sensor or contact sensor in the stripper. This method has the disadvantage that the stripper can damage the roll surface.

[0044] In the present invention as illustrated in Fig.3, the distance of the stripper tip from the work roll may be derived by a processor (not shown) in a control system 49 of the mill from data from a sensor 47 at a known position relative to the stripper tip 42 and the geometry of the assembly. This allows the control system to calculate the stripper to roll gap 48 much more accurately than is currently possible. The sensor may be of any conven-

ient type from which distance can be derived or obtained directly, such as a mechanical distance sensor, transducer, linear variable differential transducer (LVDT) in contacting or non-contacting configuration, an ultrasonic range meter, or optical or laser distance sensor. For example, the transducer may be a mechanical device with, for example, a roller on the end, or an optical device, but for reasons of robustness and the environment it is preferable to use either an inductive, or a capacitive type device. Examples of other possible transducers include eddy-current, magneto-inductive or laser sensors.

[0045] From the sensor data, the distance to the roll, or a known point relative to the surface of the roll, from a known point relative to the tip of the stripper, is determined. As indicated, the measurement of distance from the sensor does not have to be to the roll itself, but could be made to some other part of the roll assembly with a known relationship to the roll, such as the grinding surfaces.

[0046] Although the actual gap is between the tip of the stripper and the work roll, a sensor put on the tip may be wiped off by the passing plate, so the sensor is put in a safer position, a known distance away from the tip, rather than putting the sensor right at the tip of the stripper in order to measure the roll gap directly. Another practical problem with putting the sensor at the tip is that there is not much space in this region and the sensor could easily be damaged, so it is preferred that the sensor is mounted away from the tip. By combining the sensor measurement with the known geometry of the assembly and the sensor and the vertical position of the work roll, it is then possible to determine the actual stripper to roll gap at the tip with good accuracy. In cases where the geometry of the stripper is well known, the sensor may be mounted on the feed roller assembly 4, instead of on the stripper assembly 27, so that the stripper can be changed without disturbing the sensor.

[0047] An initial manual checking and setting of the stripper to roll gap may still be done, if desired, but subsequently the sensor allows the system to automatically maintain the correct stripper to roll gap distance even if the roll moves within the clearances, or the wear plates become worn, or a new roll assembly is installed with different dimensions.

[0048] It is preferable to have at least two sensors on each stripper, stripper support assembly, or feed roll assembly to take account of differences across the full width of the roll- for example, one sensor at each end of whichever device the sensor is mounted on - because the horizontal movements of the rolls may be different at each end of the roll. If the sensors 47 measure different gaps 48 at each end of the stripper 27 then the control system 49 may be setup to either adjust each end independently, or to set the average, or the minimum gap. The control system may also be set up to give an alarm if there is an excessive stripper to roll gap, or an excessive difference between the two ends of the stripper, or a stripper to roll distance which is too small.

[0049] In general, it is preferable for the sensor to measure the distance between the stripper and the roll at the edges of the roll outside of the area where the metal is normally rolled because this part of the roll is less affected by metal deposits etc. However, on certain types of mill it might be desirable to measure the stripper to roll gap in the centre, or elsewhere across the roll width, in order to correct the gap for roll wear, or for metal build up on the surface of the roll.

[0050] As mentioned above, another option is for the sensors to measure the distance to the roll grinding support areas. Many work rolls are manufactured with areas outside of the roll barrel (i.e. outside of the working area) which are accurately ground for use as support areas during roll grinding. If the gap to these grinding support areas is measured by the sensor then it is simple to calculate the roll to stripper gap from the geometry.

[0051] Providing a sensor in the centre of the roll, instead of, or as well as, at the edges, may be useful, but a sensor in this position may be difficult to maintain. Therefore, a further enhancement of the invention is to use the loads measured in some or all of the cylinders 9, 13, 10, 14 to compensate for deflection of the stripper and stripper support assembly under load. It is possible that the stripper to roll gap is not the same in the centre of the stripper as at the edges, because the load from material being rolled on the entry side, or the exit side causes deflection of the stripper 26, 27 and stripper support assembly. The calculation of the deflection for a given load and width of material may be done by the control system 49 using finite element calculations, or similar methods providing that some assumptions about the load distribution are made. By using the loads measured at the cylinders the system can therefore estimate how much the stripper has deflected in the centre compared to the deflection where the sensors are positioned and thereby make an adjustment to get the correct gap in the centre. In this way the system can estimate the stripper to roll gap in the centre of the roll, whilst only having sensors at the edges. Using the cylinder loads is simple because the pressures can be easily measured, but it would also be possible to use loadcells, or other load measurement devices.

[0052] For the purpose of this application, the preferred embodiment and the detailed descriptions have referred to the bottom roll and stripper, but the invention is equally applicable in embodiments which use a similar sensor arrangement on the stripper for the top roll.

[0053] The sensor does not necessarily have to be mounted on the stripper assembly or feed roller assembly itself in order to provide information about the position of the roll. In principle, the sensor may be mounted on the housing or some other point so long as the geometry between the sensor and the roll and the sensor and the stripper is known. Further, the sensor could be mounted on the roll assembly e.g. on the chock and detect the distance to the stripper or stripper support, but this solution is not ideal because the roll assembly would then

have to have cables or some other method of getting the signal from the sensor to the controller.

[0054] Fig. 4 illustrates an example of how the device is used to determine and maintain a stripper gap. Either during an initial set-up, or after a work roll change 50, the control system 49 needs to check that the stripper gap is set at an acceptable distance away from the work roll to prevent damage to the surface of the roll, or the head end of the article being rolled from getting between the stripper and the work roll on the exit side. The control system 49 receives 51 a signal from sensor 47 and knowing the geometry of the device on which the sensor is mounted, this information is used to determine the distance of the sensor from the work roll 21. The control system then derives the position of the tip 42 of the stripper 27 from known data about its position in relation to the sensor 47 to determine a gap 48 between the work roll 21 and the tip 42 of the stripper. This then allows the current work roll to stripper tip gap 48 to be calculated 52. This gap is compared 53 with a known maximum and minimum permitted value of the gap and if the result of the comparison is outside a preset range 54, then the controller sends a signal to an actuator to cause 55 the position of the stripper tip 42 to be modified. Typically, for this example, this involves operating cylinders 10 and/or 14 to move the tip by the required amount, either closer to or further from the work roll.

[0055] Having carried out the requisite adjustment, the steps 51 to 54 are repeated to check that the new position is acceptable. If the method is only used during set-up, then it terminates at this point. However, it is preferred that there should be checks, either in response to a specific issue, such as an adverse load being sensed as part of general roll or mill movement, or as part of a regular check. For example, when there is a change in the derived distance of the tip to the work roll, compared with the desired separation, for example when a load first comes on, then suitable adjustment of their relative positions may be applied to compensate for the change. In the case where the gap is not outside the range of tolerance tested at step 53, then the cycle may be repeated. The repeat may have a delay applied 56, or may be related to specific events such as movement of the strippers in readiness for a reverse pass of the article in a reversing mill.

[0056] A further enhancement is to use two or more sensors at the each end of the roll as illustrated in Fig. 5. Provided that the two sensors 47 and 47a are arranged to detect different points around the roll circumference, then the control system 49 can determine both the horizontal and vertical position of the roll accurately. Fig. 6 shows an alternative view of Fig. 5 from which the relative positions of the sensors 47 and 47a and other components can be seen more clearly.

[0057] In view of the limits on space in the stripper area and concerns about damage to the roll when the tolerances are not correct, operation of the rolling mill may be further enhanced by positioning the stripper at the

minimum gap only long enough for the head end of the material to pass through the work roll gap. Once the stripper is threaded and the head end has been safely passed through the roll gap, then the stripper is backed off out of the way. The sensor of the present invention enables this enhancement because the stripper can be accurately placed back near the work roll with the required gap for each subsequent pass, but moved out of the way of the work roll other than during passage of the head end. This protects the work roll against adverse loading which occurs after the head end of the article being rolled has been safely threaded. The determination of the correct time to back-off the stripper may be based on tracking the article, detection of load on the mill stand or the stripper, tracking speed and time for the article to determine when the head end has passed through or some combination of these parameters. The gap is then actively opened sufficiently, once the head end has passed the stripping point, to give additional protection against roll contact in case of adverse loading.

[0058] Of the various methods which may be used for determining the state for feedtable retraction to safer state, the simplest is to apply a time delay after load detection on the millstand, after which the stripper is retracted. The alternatives, that after load detection on the millstand, a calculation is made of slab nose end position based on mill speed and time from load detect such that slab nose is determined to be past the stripper nose and thereafter, the stripper is retracted; or the option of using a sensor, such as a laser, photo-cell or hot metal detector, to detect slab nose at a safe distance from the roll bite are not essential, but may be useful.

[0059] In one embodiment, the exit stripper may be reset to the correct vertical location for the next pass, once the stripper has been retracted, but this is optional. Usually, final positioning, ready for the next pass, particularly for the stripper on the exit side of the pass, takes place after the roll load cylinder is in 'gap set' state. However, if by positioning the stripper on the entry side of the pass well clear of the work roll, then final positioning can take place immediately following slab exit from the roll bite (load detection lost).

[0060] This backoff on entry or exit side may be implemented solely by vertical movement of respective cylinders 13, 14 to move the stripper away from the work roll surface. Alternatively, movement of cylinders 9, 10 is possible. A combination of movement caused by pairs of cylinders 9, 13; 10, 14 is also practical. It is not essential for this feature to be provided at both entry and exit side, as typically the entry side can be set up to have a larger safe gap than on the exit side, so the back off is only implemented on the exit side. However, an embodiment which implements back-off on either or both sides is not excluded.

[0061] The stripper is returned to the small gap position when the mill reverses for the next pass or when the mill reverses for the next but one pass when this stripper will be on the exit side again. On the entry side the gap is

less critical so this could be set to a larger gap even before the strip threads. On the exit side it is important that the gap is significantly smaller than the strip exit thickness for that pass initially, but once the head end has gone past the stripper then the gap can be increased.

[0062] In summary, the invention provides one or more sensors, mounted in the stripper, or on the stripper support assembly or in another location whose position relative to the stripper is known, which measure the distance between the stripper, or the stripper support assembly or the known location and the roll surface, or the roll grinding area, or any other part of the roll assembly whose geometry relative to the work roll surface is known. The measurement by the sensor in combination with the geometry of the arrangement may then be used to adjust the position of the stripper in order to set the optimum stripper to roll gap. A sensor at each end of the roll may be used and the system may either set the gap at each end separately, or use a combination of the two measurements to set the optimum gap. The sensors may be mounted at the edges of the roll outside of the normal rolling width so that they are not affected by metal build up on the roll etc. Where one or more sensors are mounted within the normal rolling width, this enables detection of roll wear, or metal build up. The loads on the stripper assembly may be measured by either the pressures in the cylinders, or by loadcells and the deflection of the stripper assembly due to these loads is calculated and the stripper position is adjusted to compensate for this deflection.

Claims

1. A roll stripper device, the device comprising a stripper (26, 27) mounted on a stripper support (4); a sensor (47); and a processor; **characterised in that:** the sensor is adapted to provide a measure of distance to a work roll (21); and **in that** the processor is adapted to determine the position of a tip (42) of the stripper relative to the work roll, using the distance provided by the sensor (47).
2. A device according to claim 1, wherein the sensor (47) is mounted at a predetermined distance from a tip (42) of the stripper (26, 27).
3. A device according to claim 1 or claim 2, wherein the sensor (47) is mounted on one of the stripper, stripper support, a feed roll assembly, feed roller support, mill housing or a roll chock.
4. A device according to any preceding claim, wherein at least one sensor (47) is mounted at the centre of the device.
5. A device according to any preceding claim, wherein a sensor (47) is mounted facing one or more roll

grinding support areas of a work roll (21).

6. A device according to any preceding claim, wherein the device comprises two or more sensors (47), spaced apart along the length of the device.
7. A device according to claim 6, wherein a sensor (47) is mounted at each end of the device.
8. A device according to any preceding claim, wherein the device comprises two or more sensors (47, 47a) spaced apart around a circumference of the work roll (21).
9. A device according to any preceding claim, wherein the or each sensor (47, 47a) is adapted to determine distance from a lower work roll (21) of a pair of work rolls (21, 22).
10. A device according to any preceding claim, wherein the sensor (47, 47a) comprises one of a contact or non-contact inductive or capacitive sensor, a mechanical distance sensor, a transducer, or an optical range finder.
11. A method of determining distance of a stripper (26, 27) from a work roll (21), the method **characterised by:** using a sensor (47, 47a) to determine a distance of the sensor from a point on the work roll; extracting stored data relating to the relative position of the sensor and the stripper; and calculating a position of a tip (42) the stripper, relative to the work roll, from the determined distance and the stored location of the sensor.
12. A method of controlling a relative position of a stripper (26, 27) and a work roll (21), the method comprising determining (52) a gap representing the distance of the stripper from the work roll according to the method of claim 11; comparing the gap with a required gap (53); determining (54) if the result of the comparison is outside an acceptable range of tolerance and, if so, adapting (55) the position of the stripper according to the result of the comparison.
13. A method according to claim 12, wherein the method further comprises placing a sensor (47) at each end of the work roll (21); and adapting the position of the stripper (26, 27) at each end accordingly.
14. A method according to claim 12 or claim 13, wherein the method comprises determining the distance for each of the sensors (47); calculating an average, minimum or maximum distance using each of the determined distances; and adapting the position of the stripper (26, 27) based on the result of the comparison between the required distance and the average, minimum or maximum distance.

15. A method according to any of claims 12 to 14, wherein the method comprises automatically repeating the steps of determining and comparing the distance and adapting the position of the stripper (26, 27).
16. A method according to any of claims 12 to 15, wherein the method further comprises applying a delay between repeats when the result of the comparison is within an acceptable range of tolerance.
17. A method according to any of claims 12 to 16, wherein the method comprises determining when a head end of an article being rolled has passed the stripper (26, 27) onto the feed roll assembly on the exit side and then causing an actuator to move the stripper further from the work roll than the maximum range of tolerance of the required gap.
18. A method according to any of claims 12 to 17, wherein deflection of the stripper (26, 27) is calculated from load measurements and the position of the stripper is adjusted in response to the determined distance and the load measurement.
19. A method according to any of claims 12 to 17, further comprising measuring roll load cylinder position in combination with determining distance from sensor measurement.
20. A device according to any of claims 1 to 10, further comprising one or more actuators for adjusting the position of the stripper (26, 27).
21. A device according to claim 20, wherein the device further comprises load sensors to calculate deflection of the stripper.
22. A device according to claim 21, wherein the load sensors comprise one of pressure transducers in the actuators or loadcells.

Patentansprüche

1. Walzenabstreifervorrichtung, die einen an einer Abstreiferhalterung (4) angebrachten Abstreifer (26, 27), einen Sensor (47) und einen Prozessor umfasst, **dadurch gekennzeichnet, dass:** der Sensor so ausgelegt ist, dass er ein Maß für den Abstand zu einer Arbeitswalze (21) liefert, und dass der Prozessor so ausgelegt ist, dass er unter Verwendung des von dem Sensor (47) gelieferten Abstands die Position einer Spitze (42) des Abstreifers in Bezug zu der Arbeitswalze bestimmt.
2. Vorrichtung nach Anspruch 1, bei der der Sensor (47) in einem vorgegebenen Abstand zu einer Spitze (42) des Abstreifers (26, 27) angebracht ist.

3. Vorrichtung nach Anspruch 1 oder 2, bei der der Sensor (47) an dem Abstreifer, der Abstreiferhalterung, einer Vorschubwalzenbaugruppe, einer Vorschubwalzenhalterung, einem Walzenständer oder einem Einbaustück angebracht ist.
4. Vorrichtung nach einem der vorhergehenden Ansprüche, bei der mindestens ein Sensor (47) in der Mitte der Vorrichtung angebracht ist.
5. Vorrichtung nach einem der vorhergehenden Ansprüche, bei der ein Sensor (47) so angebracht ist, dass er einem oder mehreren Walzenschleifhalbereichen einer Arbeitswalze (21) zugewandt ist.
6. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Vorrichtung zwei oder mehr Sensoren (47) umfasst, die entlang der Länge der Vorrichtung beabstandet sind.
7. Vorrichtung nach Anspruch 6, bei der an jedem Ende ein Sensor (47) angebracht ist.
8. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Vorrichtung zwei oder mehr Sensoren (47, 47a) umfasst, die um einen Umfang der Arbeitswalze (21) herum beabstandet sind.
9. Vorrichtung nach einem der vorhergehenden Ansprüche, bei der der oder jeder Sensor (47, 47a) so ausgelegt ist, dass er einen Abstand von einer unteren Arbeitswalze (21) eines Paares Arbeitswalzen (21, 22) bestimmt.
10. Vorrichtung nach einem der vorhergehenden Ansprüche, bei der der Sensor (47, 47a) einen induktiven oder kapazitiven Berührungssensor oder berührungslosen Sensor, einen mechanischen Abstandssensor, einen Wandler oder einen optischen Entfernungsmesser umfasst.
11. Verfahren zum Bestimmen des Abstands eines Abstreifers (26, 27) von einer Arbeitswalze (21), das durch Folgendes gekennzeichnet ist: Benutzen eines Sensors (47, 47a) zum Bestimmen eines Abstands des Sensors von einem Punkt an der Arbeitswalze, Extrahieren gespeicherter Daten bezüglich der Relativlage des Sensors und des Abstreifers und Berechnen einer Position einer Spitze (42) des Abstreifers in Bezug zur Arbeitswalze aus dem bestimmten Abstand und der gespeicherten Lage des Sensors.
12. Verfahren zum Steuern einer Relativlage eines Abstreifers (26, 27) und einer Arbeitswalze (21), das Folgendes umfasst: Bestimmen (52) eines Spalts, der den Abstand des Abstreifers von der Arbeitswalze repräsentiert, gemäß dem Verfahren nach An-

- spruch 11, Vergleichen des Spalts mit einem erforderlichen Spalt (53), Bestimmen (54), ob das Vergleichsergebnis außerhalb eines zulässigen Toleranzbereichs liegt, und, wenn ja, Anpassen (55) der Position des Abstreifers gemäß dem Vergleichsergebnis.
13. Verfahren nach Anspruch 12, wobei das Verfahren ferner das Anordnen eines Sensors (47) an jedem Ende der Arbeitswalze (21) und das entsprechende Anpassen der Position des Abstreifers (26, 27) an jedem Ende umfasst.
14. Verfahren nach Anspruch 12 oder 13, wobei das Verfahren Folgendes umfasst: Bestimmen des Abstands für jeden der Sensoren (47), Berechnen eines durchschnittlichen, minimalen oder maximalen Abstands unter Verwendung der bestimmten Abstände und Anpassen der Position des Abstreifers (26, 27) auf der Grundlage des Ergebnisses des Vergleichs zwischen dem erforderlichen Abstand und dem durchschnittlichen, minimalen oder maximalen Abstand.
15. Verfahren nach einem der Ansprüche 12 bis 14, wobei das Verfahren das automatische Wiederholen des Bestimmens und des Vergleichens des Abstands und des Anpassens der Position des Abstreifers (26, 27) umfasst.
16. Verfahren nach einem der Ansprüche 12 bis 15, wobei das Verfahren ferner das Anwenden einer Verzögerung zwischen Wiederholungen umfasst, wenn das Vergleichsergebnis innerhalb eines zulässigen Toleranzbereichs liegt.
17. Verfahren nach einem der Ansprüche 12 bis 16, wobei das Verfahren das Bestimmen, wann ein vorderes Ende eines gewalzten Artikels an dem Abstreifer (26, 27) vorbei auf der Ausgangsseite zur Vorschubwalzenbaugruppe durchgelaufen ist, und das Bewirken umfasst, dass ein Stellelement dann den Abstreifer weiter als den maximalen Toleranzbereich des erforderlichen Spalts von der Arbeitswalze weg bewegt.
18. Verfahren nach einem der Ansprüche 12 bis 17, bei dem aus Belastungsmesswerten eine Durchbiegung des Abstreifers (26, 27) berechnet und als Reaktion auf den bestimmten Abstand und den Belastungsmesswert die Position des Abstreifers angepasst wird.
19. Verfahren nach einem der Ansprüche 12 bis 17, das ferner das Messen einer Walzlastzylinderposition zusammen mit dem Bestimmen des Messwerts für den Abstand zum Sensor umfasst.
20. Vorrichtung nach einem der Ansprüche 1 bis 10, die ferner ein oder mehrere Stellelemente zum Anpassen der Position des Abstreifers (26, 27) umfasst.
21. Vorrichtung nach Anspruch 20, wobei die Vorrichtung ferner Lastsensoren zum Berechnen der Durchbiegung des Abstreifers umfasst.
22. Vorrichtung nach Anspruch 21, bei der die Lastsensoren einen der Druckwandler in den Stellelementen oder Kraftmessdosen umfassen.

Revendications

- Dispositif racleur de cylindre, le dispositif comprenant un racleur (26, 27) monté sur un support de racleur (4) ; un capteur (47) ; et un processeur ; **caractérisé en ce que** le capteur est conçu pour fournir une mesure de la distance à un cylindre de travail (21) ; et **en ce que** le processeur est conçu pour déterminer la position d'une pointe (42) du racleur par rapport au cylindre de travail, à l'aide de la distance fournie par le capteur (47).
- Dispositif selon la revendication 1, dans lequel le capteur (47) est monté à une distance prédéterminée d'une pointe (42) du racleur (26, 27).
- Dispositif selon la revendication 1 ou la revendication 2, dans lequel le capteur (47) est monté sur un parmi le racleur, le support de racleur, un ensemble cylindre d'alimentation, un support de cylindre d'alimentation, un logement de broyeur ou une cale de cylindre.
- Dispositif selon n'importe quelle revendication précédente, dans lequel au moins un capteur (47) est monté au centre du dispositif.
- Dispositif selon n'importe quelle revendication précédente, dans lequel un capteur (47) est monté faisant face à une ou plusieurs zones de support de meulage de cylindre d'un cylindre de travail (21).
- Dispositif selon n'importe quelle revendication précédente, le dispositif comprenant deux capteurs (47) ou plus, espacés dans le sens de la longueur du dispositif.
- Dispositif selon la revendication 6, dans lequel un capteur (47) est monté à chaque extrémité du dispositif.
- Dispositif selon n'importe quelle revendication précédente, le dispositif comprenant deux capteurs (47, 47a) ou plus espacés autour d'une circonférence du cylindre de travail (21).

9. Dispositif selon n'importe quelle revendication précédente, dans lequel le ou chaque capteur (47, 47a) est conçu pour déterminer la distance d'un cylindre de travail inférieur (21) d'une paire de cylindres de travail (21, 22). 5
10. Dispositif selon n'importe quelle revendication précédente, dans lequel le capteur (47, 47a) comprend un parmi un capteur inductif ou capacitif à contact ou sans contact, un capteur de distance mécanique, un transducteur, ou un télémètre optique. 10
11. Méthode de détermination de la distance d'un racleur (26, 27) d'un cylindre de travail (21), la méthode étant **caractérisée par** : le fait d'utiliser un capteur (47, 47a) pour déterminer une distance du capteur d'un point sur le cylindre de travail ; le fait d'extraire des données stockées concernant la position relative du capteur et du racleur ; et le fait de calculer une position d'une pointe (42) du racleur, par rapport au cylindre de travail, à partir de la distance déterminée et de l'emplacement stocké du capteur. 15 20
12. Méthode de régulation d'une position relative d'un racleur (26, 27) et d'un cylindre de travail (21), la méthode comprenant le fait de déterminer (52) un espace représentant la distance du racleur du cylindre de travail selon la méthode de la revendication 11 ; le fait de comparer l'espace avec un espace requis (53) ; le fait de déterminer (54) si le résultat de la comparaison s'inscrit à l'extérieur d'une gamme acceptable de tolérance et, le cas échéant, le fait d'adapter (55) la position du racleur selon le résultat de la comparaison. 25 30
13. Méthode selon la revendication 12, la méthode comprenant en outre le fait de placer un capteur (47) à chaque extrémité du cylindre de travail (21) ; et le fait d'adapter la position du racleur (26, 27) à chaque extrémité en conséquence. 35 40
14. Méthode selon la revendication 12 ou la revendication 13, la méthode comprenant le fait de déterminer la distance pour chacun des capteurs (47) ; le fait de calculer une distance moyenne, minimale ou maximale à l'aide de chacune des distances déterminées ; et le fait d'adapter la position du racleur (26, 27) sur la base du résultat de la comparaison entre la distance requise et la distance moyenne, minimale ou maximale. 45 50
15. Méthode selon n'importe lesquelles des revendications 12 à 14, la méthode comprenant le fait de répéter automatiquement les étapes consistant à déterminer et à comparer la distance et à adapter la position du racleur (26, 27) . 55
16. Méthode selon n'importe lesquelles des revendications 12 à 15, la méthode comprenant en outre le fait d'appliquer un délai entre les répétitions lorsque le résultat de la comparaison s'inscrit au sein d'une gamme acceptable de tolérance.
17. Méthode selon n'importe lesquelles des revendications 12 à 16, la méthode comprenant le fait de déterminer quand une extrémité de tête d'un article qui est laminé a fait passer le racleur (26, 27) sur l'ensemble cylindre d'alimentation sur le côté sortie et ensuite le fait d'amener un actionneur à déplacer le racleur plus loin du cylindre de travail que la gamme maximale de tolérance de l'espace requis.
18. Méthode selon n'importe lesquelles des revendications 12 à 17, dans laquelle une déviation du racleur (26, 27) est calculée à partir de mesures de charge et la position du racleur est ajustée en réponse à la distance déterminée et à la mesure de charge.
19. Méthode selon n'importe lesquelles des revendications 12 à 17, comprenant en outre le fait de mesurer la position du vérin de charge du cylindre en combinaison avec le fait de déterminer la distance à partir de la mesure du capteur.
20. Dispositif selon n'importe lesquelles des revendications 1 à 10, comprenant en outre un ou plusieurs actionneurs pour ajuster la position du racleur (26, 27).
21. Dispositif selon la revendication 20, le dispositif comprenant en outre des capteurs de charge afin de calculer le cédage du racleur.
22. Dispositif selon la revendication 21, dans lequel les capteurs de charge comprennent un des transducteurs de pression dans les actionneurs ou les cellules de charge.

FIG 1

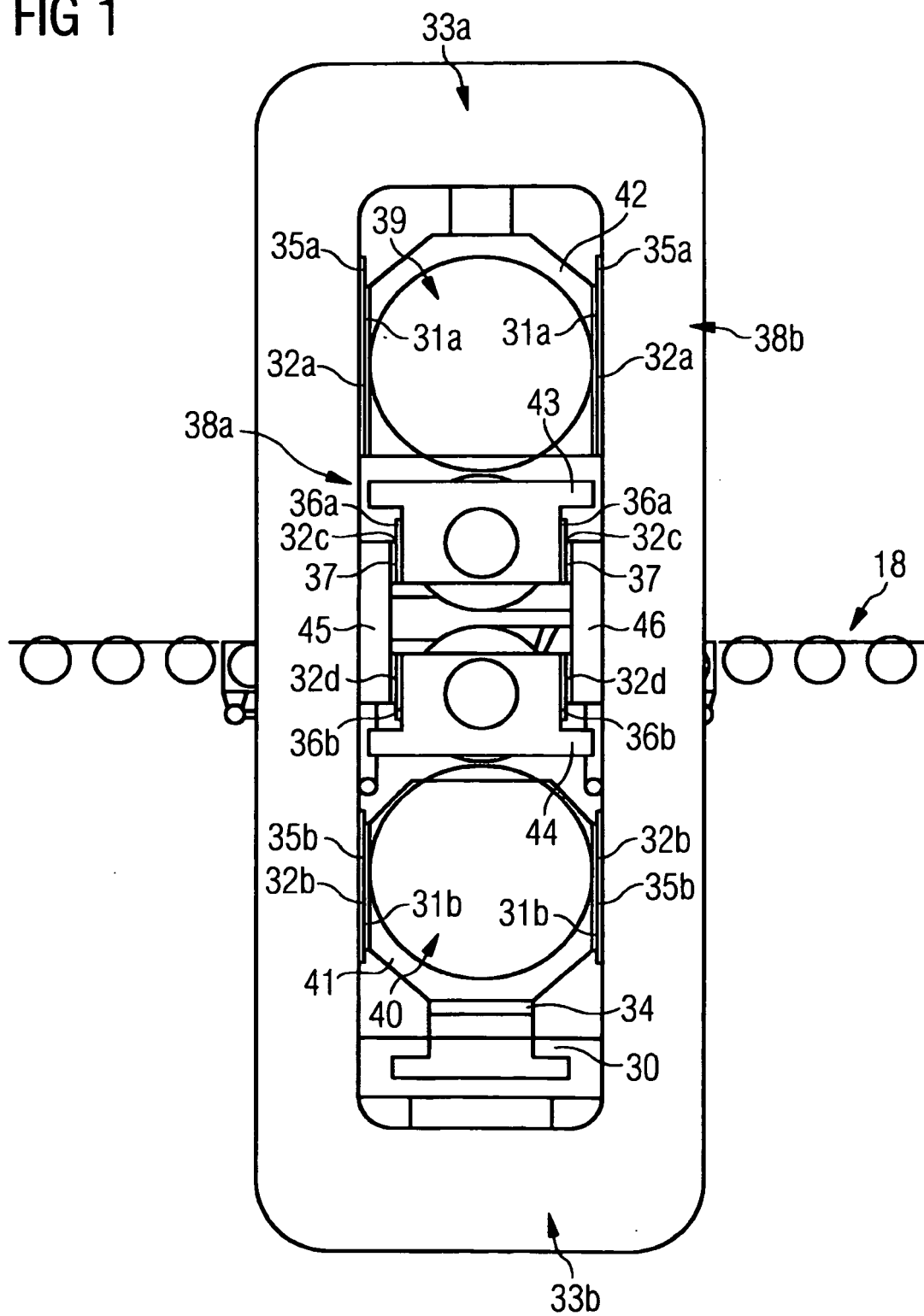
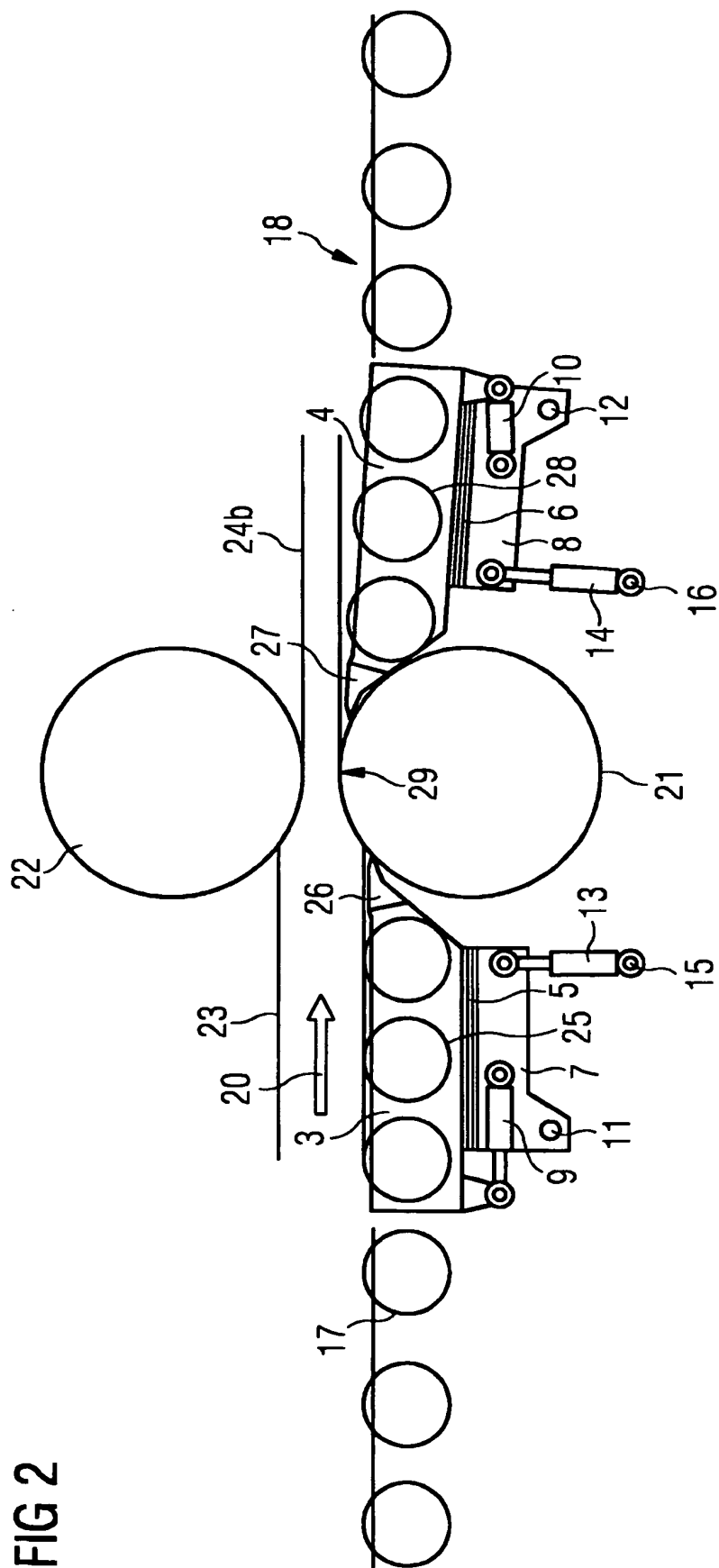


FIG 2



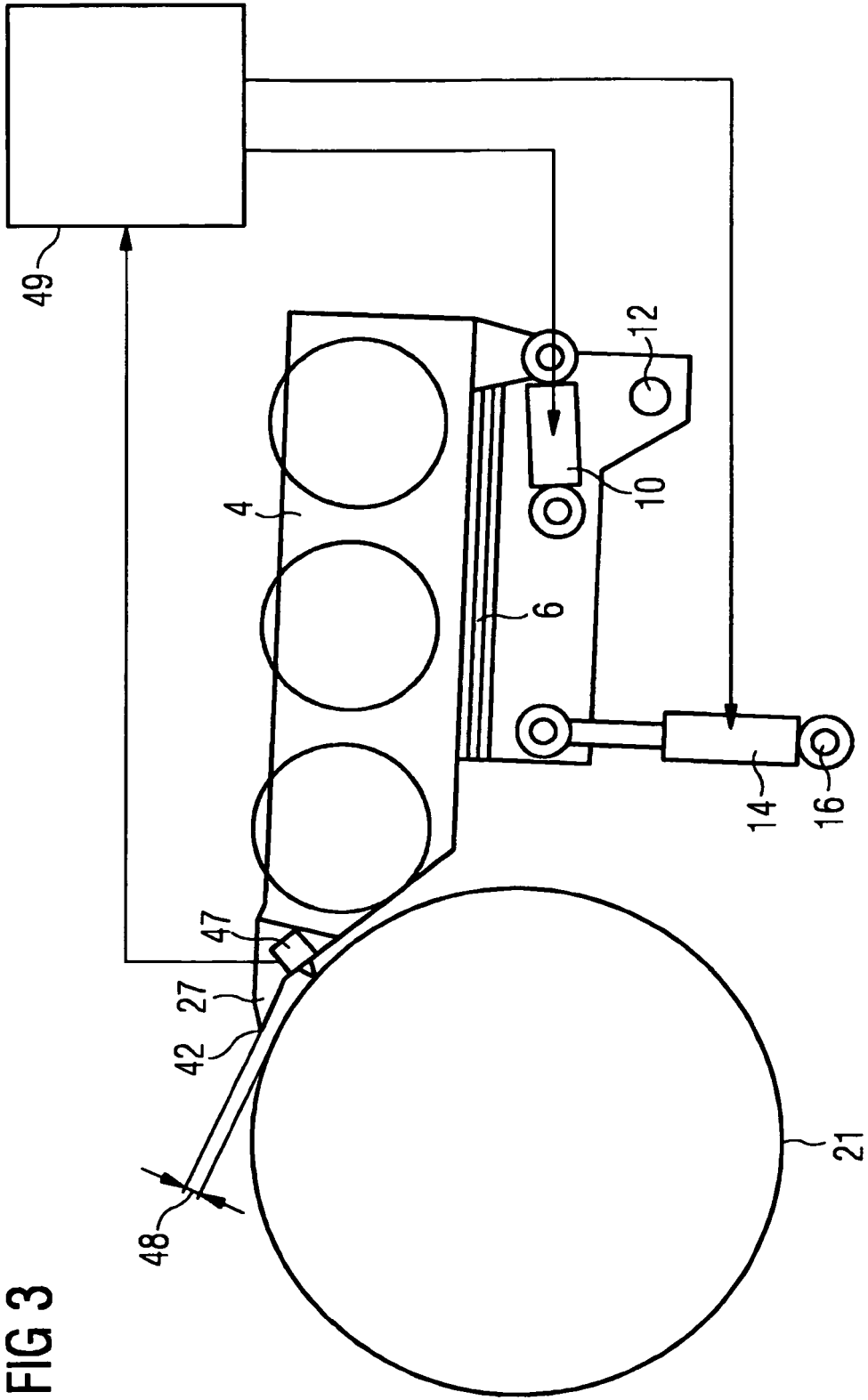


FIG 3

FIG 4

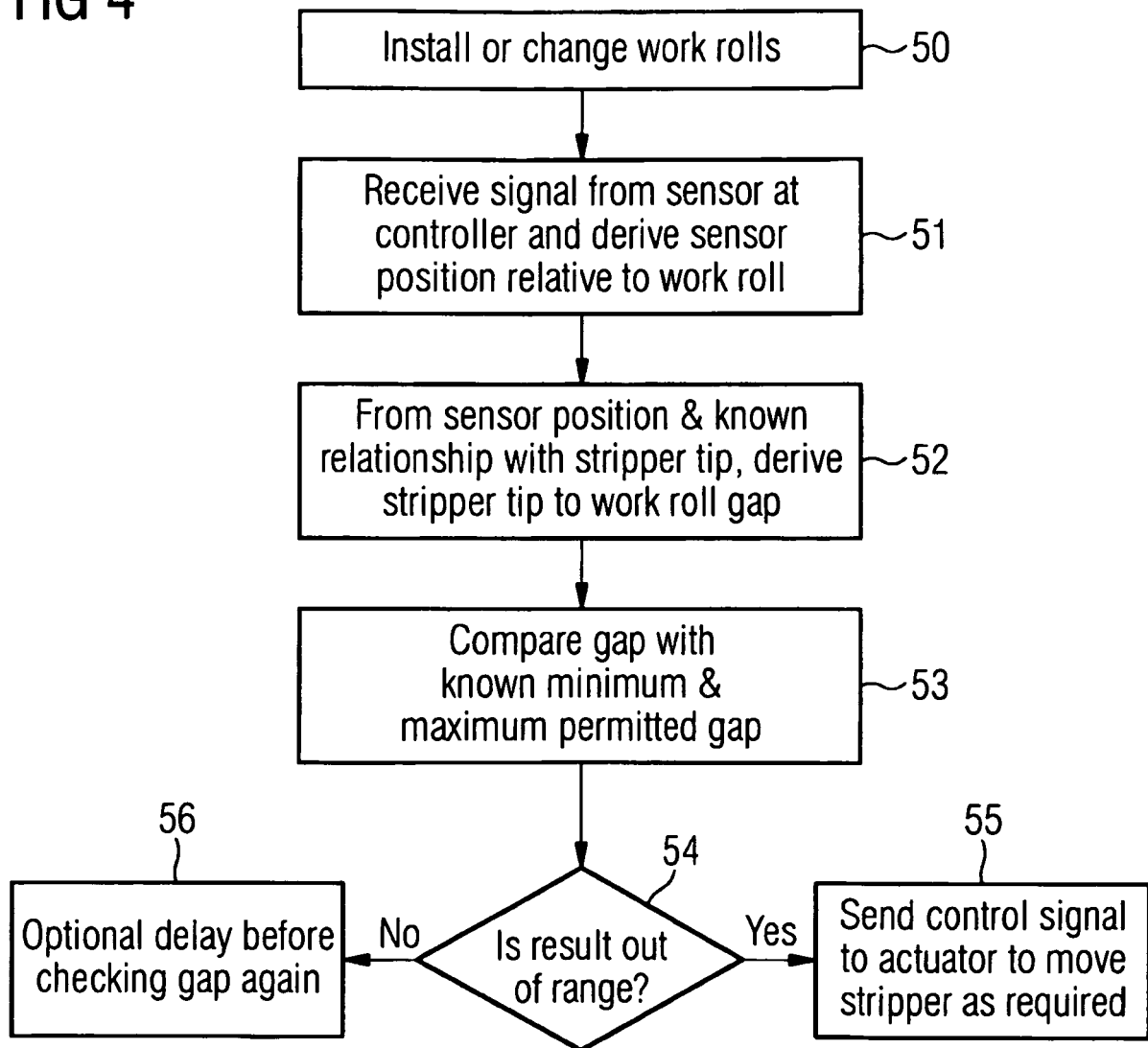
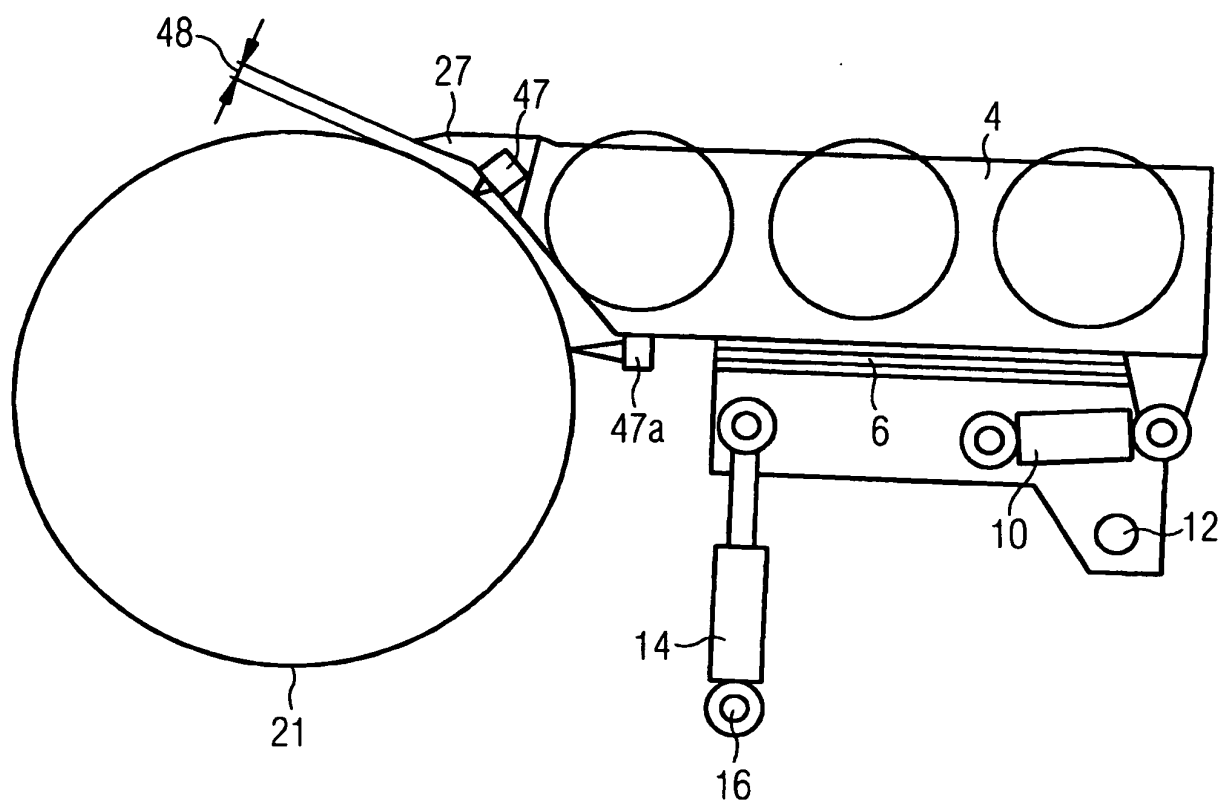


FIG 5



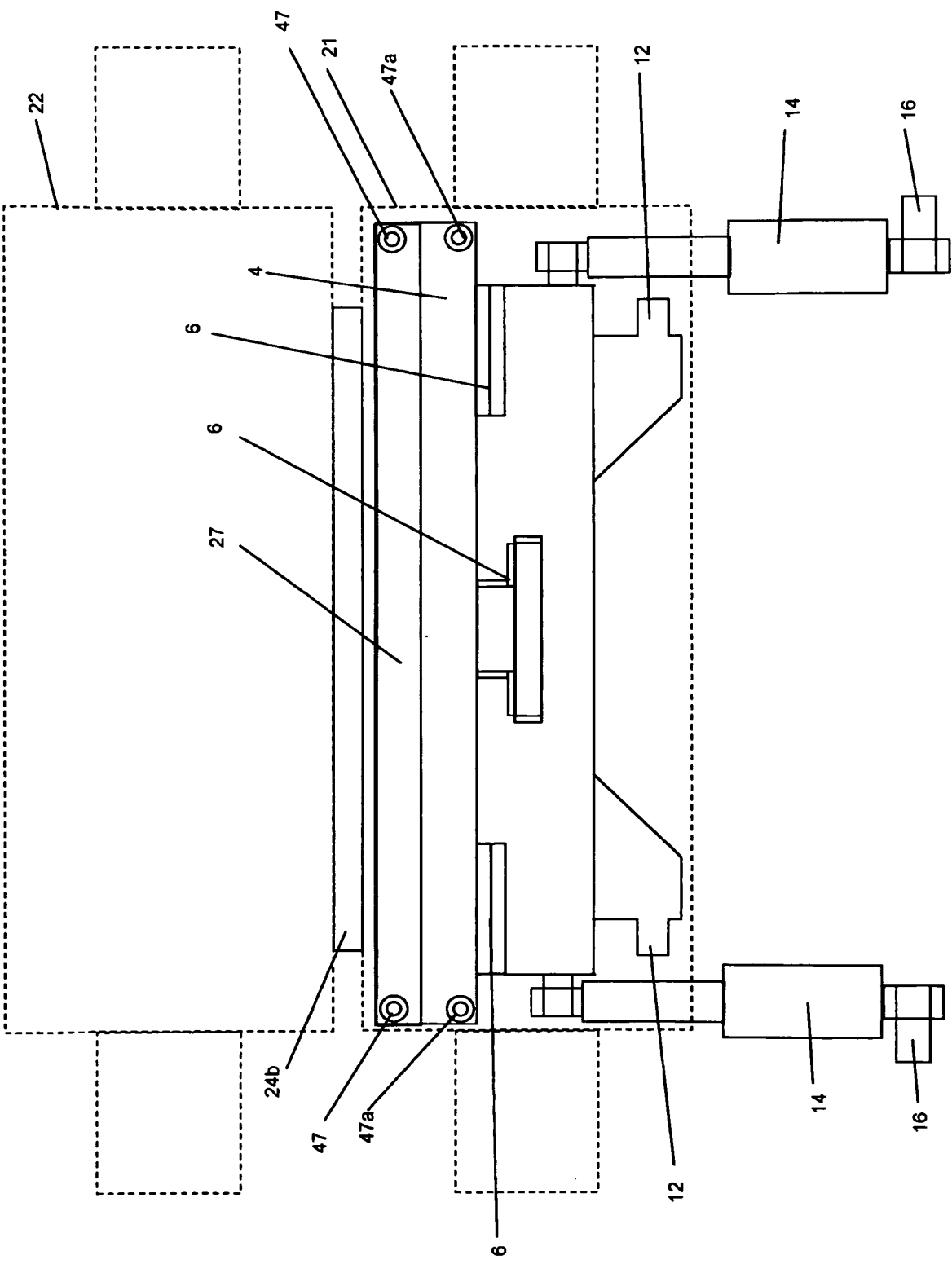


Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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