



(19)

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 740 967 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
06.11.1996 Bulletin 1996/45

(51) Int. Cl.⁶: B21B 39/16

(21) Application number: 96106828.5

(22) Date of filing: 30.04.1996

(84) Designated Contracting States:
AT BE DE ES FR GB IT SE

(30) Priority: 04.05.1995 IT UD950080

(71) Applicant: DANIELI & C. OFFICINE MECCANICHE
S.p.A.
33042 Buttrio (UD) (IT)

(72) Inventors:
• Aengenvoort, Friedrich
47802 Krefeld (DE)

• Schoessler, Volker
47802 Krefeld (DE)
• Ciani, Lorenzo
33100 Udine (IT)
• Bombardelli, Bruno
33100 Udine (IT)

(74) Representative: Petraz, Gilberto Luigi
GLP S.r.l.
Piazzale Cavedalis 6/2
33100 Udine (IT)

(54) Method for the automatic adjustment of the rolls to guide rolled stock and relative device

(57) Method for the automatic adjustment of the rolls (11) to guide rolled stock in a guide box (10) located upstream of a rolling mill stand (19) and in direct cooperation with that stand (19), these guide rolls (11) cooperating centrally and symmetrically with means (15) to adjust their position in relation to the rolling pass (29) of the stand (19), thus defining a required gap for the rolled stock (22), these adjustment means (15) being able to be of a type such as an axially movable wedge (115) or as a rotary cam (32) or as screw-threaded means (30a, 30b), the momentary reciprocal positions of the guide rolls (11) being governed by an adjustment unit (20) connected to a source of power (18), which conditions the actuation of the adjustment means (15), an instrument (21) being included to measure the actual dimensions of the rolled stock (22) upstream of the guide rolls (11), the actuation signals sent to the adjustment unit (20) for the positioning of the guide rolls (11) being correlated with the position of the rolling rolls (24) of the rolling mill stand (23) positioned upstream of the guide box (10).

Device for the automatic adjustment of the guide rolls (11) to guide rolled stock in a guide box (10) located upstream of a rolling mill stand (19) and in direct cooperation with that stand (19), these guide rolls (11) being supported by oscillatory arms (12) and cooperating centrally and symmetrically with means (15) to adjust their position in relation to the rolling pass (29) of the stand (19), thus defining a required gap for the rolled stock (22), a source of power (18) being included for actuation of the adjustment means (15) and being governed by an adjustment unit (20), which conditions the actuation of

the source of power (18) according to the required positioning of the guide rolls (11), the adjustment means (15) being able to consist of an axially movable wedge element (115) or of a rotatably movable cam element (32) or of screw-threaded means (30), an instrument (21) being included to measure dimensions of the rolled stock (22) and being positioned at least upstream of the guide rolls (11), a system (27) being included for the memorised setting of the rolling rolls (24) of the rolling mill stand (23) positioned upstream of the guide rolls (11) and being functionally associated with the adjustment unit (20) for the determination of the actuation of the adjustment means (15) according to the required positioning of the guide rolls (11).

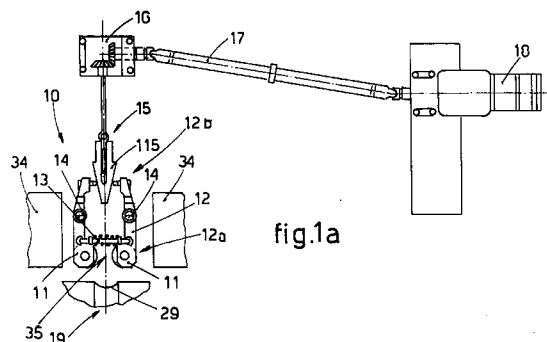


fig.1a

EP 0 740 967 A1

Description

This invention concerns a method for the automatic adjustment of the rolls to guide rolled stock and the relative device, as set forth in the respective main claims.

To be more exact, this invention is employed to determine and condition the trim and position of the rolls automatically in the guide boxes prearranged to guide and direct correctly the passing rolled stock into the rolling pass of a specific rolling mill stand.

This invention also enables the correct trim of the rolls during the passing of the rolled stock to be checked and possibly corrected in the event of excursions from the preset position taking place.

The state of the art covers the guide boxes for rolled stock which are located upstream of a rolling mill stand for the purpose of guiding and directing in the most correct manner the rolled stock arriving from the previous upstream rolling mill stand or from another working station into the rolling pass of the rolling mill stand.

These guide boxes generally include one or more pairs of opposed guide rolls defining between them a gap adjustable according to the geometric and structural characteristics of the product being processed.

The guide rolls of the state of the art are normally associated with supporting arms, which can oscillate on pivots by means of leverage and adjustment systems to make possible the initial setting of the gap.

These adjustment systems are normally laid out in such a way as to act centrally and parallel on both the rolls or pairs of rolls so as to act with one single control and to obtain equal displacements.

The state of the art covers many examples of embodiments which provide different systems to adjust the gap between the rolls.

For instance, DE-A-1.048.251 discloses that between the pair of supporting arms of the rolls there is a tension spring which thrusts the rear ends of the arms inwards against each other.

Between these rear ends of the supporting arms of the rolls is an adjustment nut secured to a shaft perpendicular to the rolling axis.

The distance between the guide rolls installed on the respective arms is adjusted by rotating the adjustment nut about its axis to one side or the other according to the desired reduction or increase of the gap.

DE-A-2.023.728 includes an adjustment system between the rolls and rolled stock, the system comprising an upper panel solidly fixed to the device feeding the rolled stock and supported by two wedge-shaped mating supports on the lower plate of a sliding frame.

According to this document of the state of the art the facing and inclined wedge-shaped surfaces are displaced in relation to each other so as to raise and lower the wedge and the upper plate.

The sliding frame is displaced transversely on a support in relation to the path of the rolled stock and is fixed in any desired position on the support by means of an adjustable clamping device.

These adjustment mechanisms are not only rather complex and bulky but are also characterised by poor accuracy, restricted versatility and great working complexity of their adjustment and functioning.

US-A-4,483,169 provides for the guide rolls to be fitted at the ends of pivoted arms at a substantially intermediate stationary point.

So as to adjust the gap between the rolls, this document of the state of the art discloses a cam element the rotation of which causes a variation of the reciprocal positioning of the rolls by determining a fixed gap which cannot be altered before a new alteration of the position of the cam element.

A screw element is included and prevents the cam element from rotating during functioning, that is to say, during the passing of the rolled stock between the guide rolls.

The adjustment of the gap is carried out by hand by the machine operator during the initial pre-arrangement of the machine and entails drawbacks such as the need to halt the machine, relatively long execution times, the use of a labour force and operational difficulties.

Moreover, this type of adjustment is normally characterised by poor accuracy and, above all, by the inability to perform a quick adaptation of the position of the rolls according to the existing working conditions, for instance, according to the excursions between the nominal measurements and the actual measurements of the rolled stock being processed.

This adjustment can also not be corrected during the passing of the rolled stock.

Another shortcoming of these adjustment systems arises from the fact that they are not functionally connected to the systems which adjust the reciprocal positions of the rolls of all the rolling mill stands of the rolling train; this situation prevents the establishment of a precise functional relationship, for instance, between the positions of the rolling rolls of the rolling mill stand positioned upstream and the guide rolls for the rolled stock which are positioned downstream.

FR-A-2.253.576 discloses a system for adjustment of the gap between the guide rolls, this system using the monitoring of the actual width of the rolled stock entering the guide rolls.

JP-A-4-33714 and JP-A-57-28609 disclose systems to adjust the gap between the rolls which employ an axially movable wedge element cooperating with the rear ends of the roll-bearing arms.

DE-A-664.743 discloses adjustment of the positions of the guide rolls by means of actuation of screw means having inverted pitches as between one roll and the other.

JP-A-6-47424 discloses adjustment of the positions of the guide rolls by means of actuation of hydraulic cylinders cooperating with the rear ends of the roll-bearing arms.

All these systems entail the above shortcomings, that is to say, basically the absence of correlation between the trim of the upstream rolling mill stand and

the positions of the guide rolls to guide the rolled stock for the downstream rolling mill stand and the substantial inability to correct during the working cycle, and therefore during the passage of the rolled stock, the positions of the guide rolls so as to eliminate any excursions from the pre-set positions.

The present applicants have designed, tested and embodied this invention to overcome these shortcomings of the state of the art and to adopt an automated and simplified adjustment method characterised by great accuracy and versatility of use and able to confer on the guide system also a function of pre-straightening and/or pre-rolling the rolled stock passing through.

This invention is set forth and characterised in the respective main claims, while the dependent claims describe variants of the idea of the main embodiment.

The purpose of the invention is to provide a method and relative device for the automatic adjustment of the rolls to guide the rolled stock in a guide box positioned upstream of, and in direct cooperation with, a rolling mill stand.

In particular, the invention provides a servo-assisted adjustment system automatically controlled by the automation system which controls the rolling train and which makes possible the automatic positioning of the guide rolls and also the correction in feedback of the position of the rolls and their trim according to the existing situations which may occur during the rolling process.

Moreover, this invention enables the positions of the guide rolls to be corrected during the working cycle according to any excursions found from the pre-set position.

This invention is applied in particular to rolling trains for long products, such as bars, sections or rod, and to one or more of the guide boxes positioned along the train.

According to the invention the rolls to guide the rolled stock are fitted to the front ends of two opposed supporting arms, which are resiliently constrained to each other and of which the rear ends cooperate symmetrically with adjustment means capable of being moved axially and/or rotatably.

The adjustment means according to a first embodiment of the invention consist of an axially movable wedge-shaped element.

According to another embodiment the adjustment means consist of a rotatably movable cam.

According to yet another embodiment the adjustment means consist of screw threaded means with a righthand thread and a lefthand thread, in which each thread cooperates with a respective rear end of the supporting arms of the guide rolls.

According to a further embodiment the adjustment means consist of a system of levers.

These adjustment means are connected to a source of power by a transmission system.

This source of power is associated with an adjustment unit able to receive a sequence of actuation sig-

nals, to process those signals and to condition the actuation of the source of power by adjusting the reciprocal positions of the guide rolls according to the actuation signals received.

According to the invention the rolls to guide the rolled stock cooperate with a position monitor by means of which is verified continuously or at pre-determined intervals the real trim and positions of the rolls so as to make possible corrections in feedback with regard to possible excursions from the set positions.

According to a variant the supports of the guide rolls are associated with load cells for the periodic or continuous monitoring of the force exerted on the guide rolls by the rolled stock passing through.

By means of this monitoring any incorrect positioning of the guide rolls as shown by a too high or too low value of this force as monitored by the load cells can be altered by sending a signal to the source of power for restoration of the correct positioning of the guide rolls.

According to another variant speed sensors associated with the guide rolls are included as an alternative to, or in cooperation with, the load cells.

These sensors, during the passage of the rolled stock, monitor the speed of rotation of the guide rolls in relation to the reference value corresponding to the speed of passage of the rolled stock.

If this signal of speed does not correspond to the value which there should be, the signal is used either to correct in feedback any incorrect positioning of the guide rolls or to program maintenance work such as the replacement of the bearings, for instance.

According to a first embodiment of the invention the signals to actuate the set positioning of the guide rolls of the specific guide box come from an instrument measuring the actual dimensions of the rolled stock passing through; this measurement instrument acts on the same plane as that on which is determined the gap between the guide rolls, and at least at a position upstream of those rolls.

This measurement instrument makes it possible to follow the fine dimensional variations within a pre-determined dimensional range linked to the characteristics of the specific rolling process, such as the wear of the grooves, the differences of temperature, the different plastic behaviour of the specific material being processed, etc.

According to a variant the actuation signals come from an instrument to measure the positions of the rolls of the rolling mill stand located upstream of the rolls to guide the rolled stock.

According to another variant the actuation signals come directly from the servo-assisted setting system memorised by the automation system which controls the rolling train, the setting system being that which sets the positions of the rolls of the rolling mill stand positioned upstream of the specific rolls to guide the rolled stock.

According to another variant of the invention a control cycle is provided during the passing of the rolled

stock in cooperation with the above positioning methods, which are based on dimensional measurements and/or correction in feedback, and is based on checking the value of pressure exerted by the guide rolls on the rolled stock passing through.

This control cycle makes possible a check that the value of pressure exerted by the rolls on the rolled stock corresponds actually to the pre-set value correlated with the positioning of the rolls established with one of the above methods.

This control of the pressure is based on measurements of current absorbed by the source of power which adjusts the positioning of the guide rolls; this control is carried out advantageously periodically at pre-set intervals.

This control cycle is employed generally to compensate anomalies which cannot be easily encountered, such as the wear of hollows in the rolls to guide the rolled stock, inaccuracy in the mechanical chain connected to those rolls and yet other anomalies; in fact, these anomalies have the effect that the actual positioning of the rolls is different from the established value set according to the dimensional evaluation.

According to another variant of the invention the actuation of the source of power which adjusts the position of the rolls to guide the rolled stock is set according to a pre-determined value of current proportional to the required force of pressure which those rolls exert on the rolled stock passing through.

In this embodiment the positioning of the guide rolls is determined directly in terms of applied pressure corresponding to a given delivered current and is substantially free of the dimensional parameters found upstream of the rolls.

According to this embodiment the pre-determined value of current is compared in feedback with the actual value of absorption of current by the source of power, and the supply to that source of power is possibly re-modulated to bring the actual value back to the pre-determined value.

The attached figures are given as a non-restrictive example and show some preferred embodiments of the invention as follows:-

Fig.1a shows a possible lay-out of a guide box with rolls to guide the rolled stock, which uses the adjustment method according to the invention;
 Fig.1b shows partly a variant of Fig.1a;
 Fig.1c shows partly another variant of Fig.1a;
 Fig.2 shows a block diagram of a first embodiment of the invention;
 Fig.3 shows a block diagram of another embodiment of the invention;
 Fig.4 shows a variant of Fig.3;
 Fig.5 is a diagram of a variant of the invention;

Fig.6 is a block diagram of another variant of the invention;
 Figs.7, 8 and 9 show diagrams of a further variant of the invention.

A guide box 10 for rolled stock shown in Fig.1a comprises a pair of rolls 11 to guide the rolled stock which are fitted parallel and opposite to each other at the front ends 12a of two oscillatory arms 12.

The oscillatory arms 12 are constrained towards each other by resilient means 13 and are pivoted on relative pivots 14 at a substantially intermediate position.

The rear ends 12b of the oscillatory arms 12 cooperate symmetrically and centrally with adjustment means 15 movable axially and/or rotatably.

In the example of Fig.1a the adjustment means 15 consist of an axially movable wedge-shaped element 115, which cooperates with a mitre-gear box 16 associated with a flexible articulated transmission shaft 17 of a type with a universal joint, or of another desired type.

This transmission shaft 17 is actuated by a source of power 18 consisting of an electrical step motor or a hydraulic motor with a relative control valve, or a pneumatic actuation system or another desired type of actuation system.

In the variant of Fig.1b the adjustment means 15 consist of screw-threaded means 30 which have a right-hand thread 30a and a lefthand thread 30b inverted in relation to each other and cooperating respectively with one and the other rear ends 12b of the oscillatory arms 12.

The screw-threaded means 30 are set in rotation by a transmission 31 connected to the desired source of power 18.

In the example of Fig.1c the adjustment means 15 consist of a cam 32 cooperating centrally with the rear ends 12b of the oscillatory arms 12, the cam 32 being set in rotation by a gear 33 associated with the source of power 18.

Rotation of the cam 32 causes the required conditioning of the reciprocal positions of the rear ends 12b of the oscillatory arms 12 and thus of the reciprocal positions of the rolls 11 to guide the rolled stock.

Other adjustment systems too can be included within the scope of the invention, such as lever systems or still other systems.

The guide box 10 for the rolled stock, of which only the guide rolls 11 are shown diagrammatically in Figs.2, 3, 4 and 6, is positioned immediately upstream of a rolling mill stand 19, which normally will have the axis of its relative rolls rotated by 90° to the axis of the rolls of the rolling mill stand 23 positioned upstream.

The axis of positioning of the guide rolls 11 coincides with the axis of positioning of the rolls of the upstream rolling mill stand 23.

According to the invention the actuation of the source of power 18 conditioning the reciprocal positions of the guide rolls 11 is governed by a relative adjustment

unit 20, which receives and processes signals of actuation and servo-assisted adjustment.

In the embodiment of Fig.2 is included an instrument 21 to measure dimensions which is positioned at least upstream of the guide rolls 11 and monitors the actual dimensions of the rolled stock 22 passing through, thus determining any excursions from the nominal value determined by the adjustment of the rolling rolls 24 of the upstream rolling mill stand 23.

The instrument 21 to measure the dimensions acts substantially on the same plane 35 (Fig.1a) as that containing the rolling axis on which is measured the gap between the guide rolls 11 for the rolled stock.

This instrument 21 to measure the dimensions sends these data to an adder unit 25 which governs the adjustment unit 20.

The adjustment unit 20 conditions according to these data the actuation of the source of power 18 and therefore the value of the positioning of the adjustment means 15 and the resulting adjustment of the reciprocal positions of the guide rolls 11.

The guide rolls 11 to guide the rolled stock 22 cooperate with a measurement and processing unit 26 associated with the actual value of the gap.

This measurement and processing unit 26 can obtain the value of the gap from indirect measurements, for instance from the distance between the outer periphery of the guide rolls 11 and the lateral shoulders 34, or from measurements of the distance between centres on the basis of knowledge of the diameter of the guide rolls 11.

According to a variant the measurement and processing unit 26 can obtain the value of the gap from direct measurements, for instance from optical measurements.

The actual value of the gap is sent to the adder unit 25, which compares it with the set value and possibly corrects the actuation signal to the adjustment unit 20 if there is an excursion "e" between the set value and the actual value.

In the embodiment of Figs.6, 7 and 8 load cells 36 are included in cooperation with each of the supports of the guide rolls 11 at the ends 12a of the oscillatory arms 12 and are associated with set screws 41 and are connected to a processing and display unit 37.

These load cells 36 make possible the monitoring, and therefore the display with relative display means 38, of the intensity of the load force which the rolled stock 22 passing through exerts on the rolls 11, and therefore make possible the checking of the correctness of the set positioning of the guide rolls 11 by means of this value in comparison with a reference value.

This signal monitored by the load cells 36 is sent to the adjustment unit 20, which possibly actuates the source of power 18 to correct the position of the guide rolls 11 and to restore the correct conditions of force exerted by the rolled stock 22 passing through.

In this case, sensors 39 are included in cooperation with the guide rolls 11 and also are connected to the

processing and display unit 37 and to relative displays 40; these sensors 39 monitor the actual speed of rotation of the guide rolls 11 during the passing of the rolled stock 22.

This signal of speed is sent to the adjustment unit 20, which according to this signal either corrects the positions of the guide rolls 11 if the speed monitored during the passing of the rolled stock 22 identifies an incorrect position the guide rolls 11 or identifies a condition requiring maintenance action.

According to the embodiment shown in Figs.3 and 4 the reciprocal positioning of the guide rolls 11 is adjusted according to the set position of the rolling rolls 24 of the upstream rolling mill stand 23.

In the example of Fig.3 the adjustment comes from a memorised setting system 27, which conditions the positioning of the rolling rolls 24 in relation to each single rolling process.

The memorised setting system 27 cooperates, in adjustment of the position of the rolling rolls 24, with an adder unit 125 associated with its own adjustment unit 120 able to condition the adjustment of the upstream rolling mill stand 23 by means of the source of power 118.

The rolling rolls 24 of the upstream rolling mill stand 23 cooperate with a measurement and processing unit 126 which obtains the actual gap between the rolling rolls 24 and which cooperates with the adder unit 125 for the correction in feedback of possible excursions from the set value.

The memorised setting system 27 governs in this case also the adjustment of the positions of the guide rolls 11 through the relative adder unit 25, adjustment unit 20 and source of power 18.

This type of adjustment enables the positioning of the guide rolls 11 to be conditioned on the basis of the adjustment of the rolling rolls 24 of the upstream rolling mill stand 23; this situation provides an accurate determined dimensional correlation between the measurement of the rolled stock 22 leaving the upstream rolling mill stand 23 and the positions of the guide rolls 11 to guide the rolled stock 22.

Any excursions of position from the set values is corrected in feedback by means of monitoring by the measurement and processing unit 26.

In the variant of Fig.4 the adjustment of the guide rolls 11 is based directly on signals coming from the measurement and processing unit 126 which monitors the actual positions of the rolling rolls 24 of the upstream rolling mill stand 23.

According to the invention, in cooperation with one of the positioning methods described above, which are based on dimensional parameters obtained upstream of the guide rolls 11, a position control cycle is provided and is based on the value of pressure which the guide rolls 11 actually exert on the rolled stock 22 passing through.

This position control cycle is advantageously carried out periodically at predetermined intervals and has

the purpose of checking the correctness of the positioning of the guide rolls 11 in relation to anomalies which cannot be easily found, such as for instance, wear of the guide rolls 11, inaccuracies in the mechanical transmission chain and yet other anomalies.

According to the diagram of Fig.5, in which the initial gap of the guide rolls 11 determined with one of the above methods is indicated with "g" and corresponds to a substantially nil value of current delivered to the source of power 18, the position control cycle according to the invention includes during the passage of the rolled stock 22 a preliminary slight opening of the guide rolls 11 so as to evaluate the absorption in the loadless state of the source of power 18.

This opening of the guide rolls 11 entails the delivery of a current of a negative sign to the source of power 18.

Thereafter the guide rolls 11 are closed progressively against the rolled stock 22 by feeding the source of power 18 with a current of a positive sign, which first takes on a substantially constant value up to the moment of contact and then quickly increases when the guide rolls 11 press against the rolled stock 22.

This progressive closure proceeds until the desired value of pressure corresponding to the correct positioning of the guide rolls 11 set at the start of the cycle is obtained.

When this threshold value is reached, the guide rolls 11 are clamped and kept in that position, for instance by braking means with a nil delivered current, or else by keeping constant the value of delivered current and therefore of delivered torque.

According to the further variant of Fig.6 the positioning of the guide rolls 11 is set and adjusted according to a value of current delivered to the source of power 18, this value corresponding to a required value of pressure of the guide rolls 11 against the rolled stock 22.

According to this solution, in the initial setting step an established value of supply current I_{set} is determined.

The current delivered to the source of power 18 is kept constantly equal to this value I_{set} , which corresponds to the required value of pressure exerted by the guide rolls 11 against the rolled stock 22 passing through.

Any excursions of the absorbed current, as detected by the measurement and processing unit 26, from the value I_{set} are corrected in feedback to keep the pressure of the guide rolls 11 constant without considering variations of positions induced in the guide rolls 11 by the passing of the rolled stock 22.

This method based on maintaining a constant value of pressure on the rolled stock 22 can be used either as an alternative or in combination with the methods based on the control of the dimensional parameters, as described above.

In particular, the methods based on the control of the dimensional parameters can be used to determine the conditions of adjustment, that is to say, before intro-

duction of the rolled stock 22 and after the latter 22 has passed through, whereas the method based on a constant value of the delivered current, that is to say, a constant pressure exerted by the guide rolls 11, can be used during the passage of the rolled stock 22 within the guide box 10.

Claims

1. Method for the automatic adjustment of the rolls (11) to guide rolled stock in a guide box (10) located upstream of a rolling mill stand (19) and in direct cooperation with that stand (19), these guide rolls (11) cooperating centrally and symmetrically with means (15) to adjust their position in relation to the rolling pass (29) of the stand (19), thus defining a required gap for the rolled stock (22), these adjustment means (15) being able to be of a type such as an axially movable wedge (115) or as a rotary cam (32) or as screw-threaded means (30a, 30b), the momentary reciprocal positions of the guide rolls (11) being governed by an adjustment unit (20) connected to a source of power (18), which conditions the actuation of the adjustment means (15), an instrument (21) being included to measure the actual dimensions of the rolled stock (22) upstream of the guide rolls (11), the method being characterised in that the actuation signals sent to the adjustment unit (20) for the positioning of the guide rolls (11) are correlated with the position of the rolling rolls (24) of the rolling mill stand (23) positioned upstream of the guide box (10).
2. Method as in Claim 1, in which the actuation signals sent to the adjustment unit (20) come from a memorised setting system (27), which adjusts in an automatic and pre-determined manner the positions of the rolling rolls (24) of the upstream rolling mill stand (23).
3. Method as in Claim 1, in which the actuation signals sent to the adjustment unit (20) come from a measurement and processing unit (126) which monitors the actual position of the rolling rolls (24) of the upstream rolling mill stand (23).
4. Method as in any claim hereinbefore, which includes a control cycle to check the actual value of pressure exerted by the guide rolls (11) on the rolled stock (22) and therefore to check the reciprocal positions at which the guide rolls (11) are brought against the rolled stock (22) with a value of pressure increasing by means of a progressive increase of the current fed to the source of power (18) until a value of pressure is reached which corresponds to the required positioning of the guide rolls (11), and when this value of pressure is reached, the feed to the source of power (18) is kept constant.

5. Method as in any claim hereinbefore, in which the adjustment of the pressure of the guide rolls (11) against the rolled stock (22) passing through is set by determining a value of setting (I_{set}) of current delivered to the source of power (18) which is a function of the obtaining of that constant value of required pressure. 5
6. Method as in Claim 5, in which the value of current delivered to the source of power (18) is corrected in feedback according to excursions found by measurements of actual absorbed current as compared to that value of setting (I_{set}) so as to keep constant the pressure irrespective of variations of the positions of the guide rolls (11) caused by the passage of the rolled stock (22). 10 15
7. Method as in any claim hereinbefore, in which the positions of the guide rolls (11) are checked and possibly corrected in feedback during the passage of the rolled stock (22) according to the signals of actual force monitored by load cells (36) associated with the ends (12a) of the supporting arms (12). 20
8. Method as in any claim hereinbefore, in which the positions of the guide rolls (11) are checked and possibly corrected in feedback during the passage of the rolled stock (22) according to the signals of actual speed of the guide rolls (11) themselves as monitored by sensors (39) located in the proximity of the guide rolls (11). 25 30
9. Device for the automatic adjustment of the guide rolls (11) to guide rolled stock in a guide box (10) located upstream of a rolling mill stand (19) and in direct cooperation with that stand (19), these guide rolls (11) being supported by oscillatory arms (12) and cooperating centrally and symmetrically with means (15) to adjust their position in relation to the rolling pass (29) of the stand (19), thus defining a required gap for the rolled stock (22), a source of power (18) being included for actuation of the adjustment means (15) and being governed by an adjustment unit (20), which conditions the actuation of the source of power (18) according to the required positioning of the guide rolls (11), the adjustment means (15) being able to consist of an axially movable wedge element (115) or of a rotatably movable cam element (32) or of screw-threaded means (30), an instrument (21) being included to measure dimensions of the rolled stock (22) and being positioned at least upstream of the guide rolls (11), the device being characterised in that a system (27) is included for the memorised setting of the rolling rolls (24) of the rolling mill stand (23) positioned upstream of the guide rolls (11) and is functionally associated with the adjustment unit (20) for the determination of the actuation of the adjustment means (15) according to the required positioning of the guide rolls (11). 35 40 45 50 55
10. Device for the automatic adjustment of the guide rolls (11) to guide rolled stock in a guide box (10), as in the pre-characterising part of Claim 9, the device being characterised in that it comprises an instrument (126) that measures and processes the gap between the rolling rolls (24) of the rolling mill stand (23) positioned upstream of the guide rolls (11), that instrument (126) being functionally associated with the adjustment unit (20) for the determination of the actuation of the adjustment means (15) according to the required positioning of the guide rolls (11).
11. Device as in Claim 9 or 10, which comprises a measurement and processing instrument (26) associated functionally, through an adder unit (25), with the adjustment unit (20) and suitable to measure the actual gap defined by the guide rolls (11) for the correction in feedback of the set value of gap.
12. Device as in any of Claims 9 to 11 inclusive, which comprises means to check the actual pressure of the guide rolls (11) on the rolled stock (22) passing through, these means being functionally associated with the source of power (18) for the checking of the required nominal value of gap defined by means of the dimensional parameters obtained upstream of the guide rolls (11).
13. Device as in any of Claims 9 to 12 inclusive, which comprises means to set the delivered current (I_{set}) which are functionally governed by the source of power (18), the delivered current (I_{set}) corresponding to a required value of pressure of the guide rolls (11) against the rolled stock (22) passing through.
14. Device as in Claim 13, which comprises means (28) to measure the real current absorbed by the source of power (18), these means (28) being functionally associated with the means setting the delivered current (I_{set}) for correction in feedback of the delivered current in the event of excursions from the set value.
15. Device as in any of Claims 9 to 14 inclusive, in which the oscillatory arms (12) supporting the guide rolls (11) include at their ends load cells (36) associated with a unit (37, 38) performing processing and display of the intensity of the actual force exerted by the rolled stock (22) passing through on the guide rolls (11), this processing and display unit (37, 38) being functionally connected to the adjustment unit (20) for the checking and possible adjustment of the correct positions of the guide rolls (11).

16. Device as in any of Claims 9 to 15 inclusive, in which the oscillatory arms (12) supporting the guide rolls (11) include at their ends sensors (39) associated with a unit (37, 40) performing processing and display of the actual speed of the guide rolls (11) during the passage of the rolled stock (22), this processing and display unit (37, 40) being functionally connected to the adjustment unit (20) for the checking and possible adjustment of the correct positions of the guide rolls (11).

5

10

15

20

25

30

35

40

45

50

55

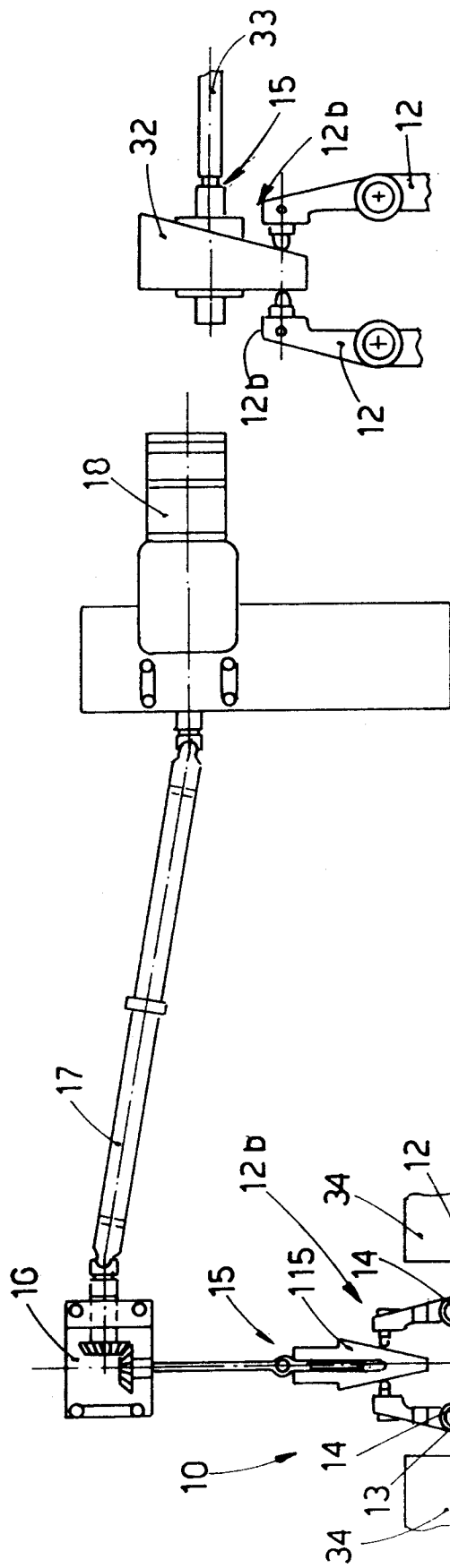


fig.1a

fig.1c

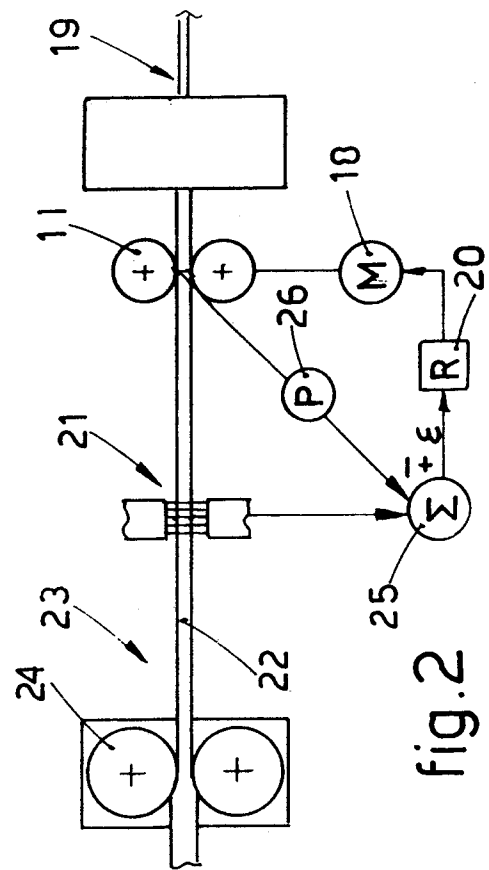


fig.2

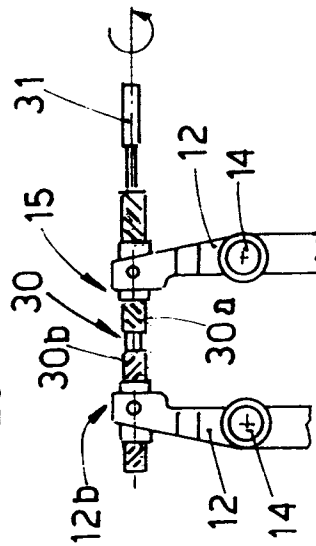


fig.1b

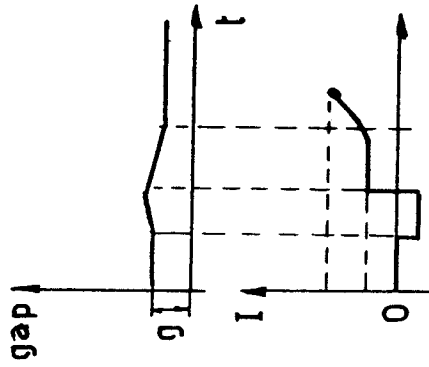


fig. 5

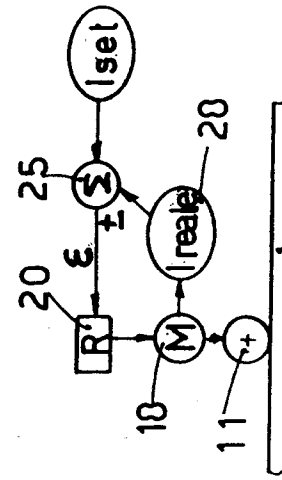


fig. 6

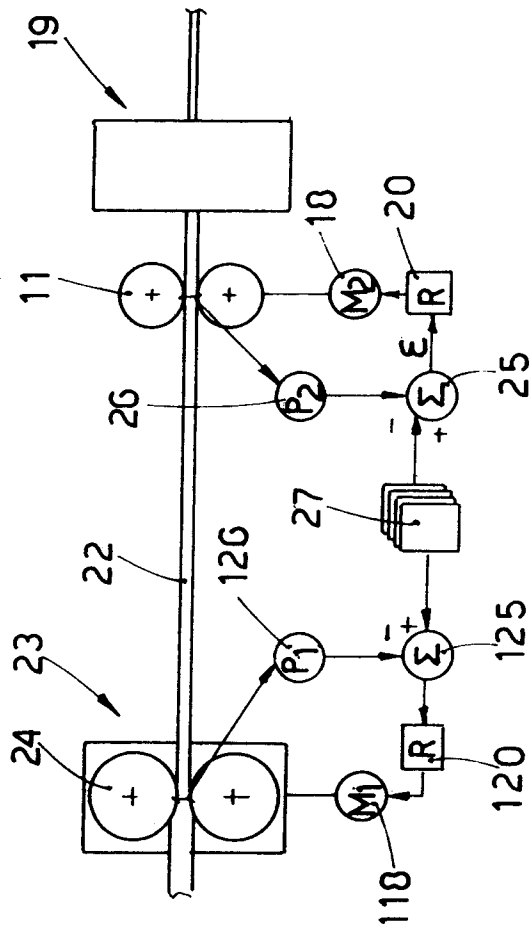


fig. 3

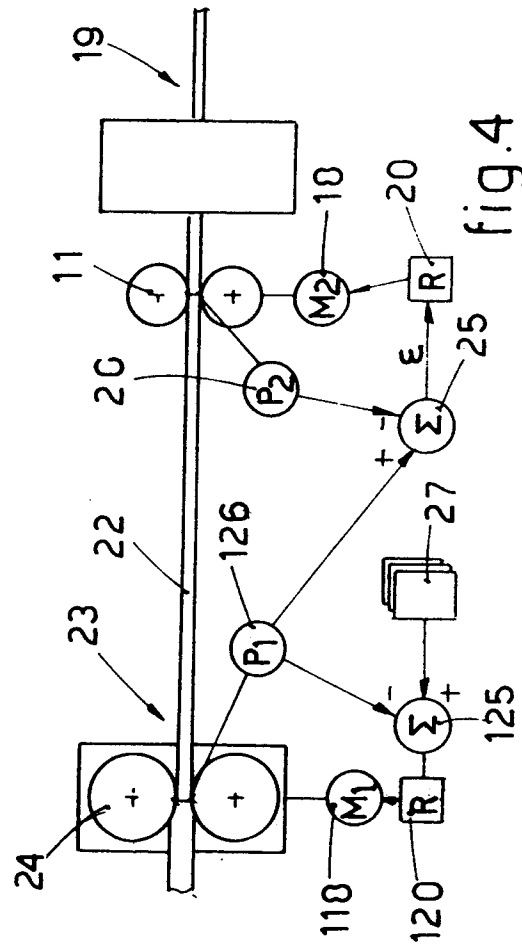


fig. 4

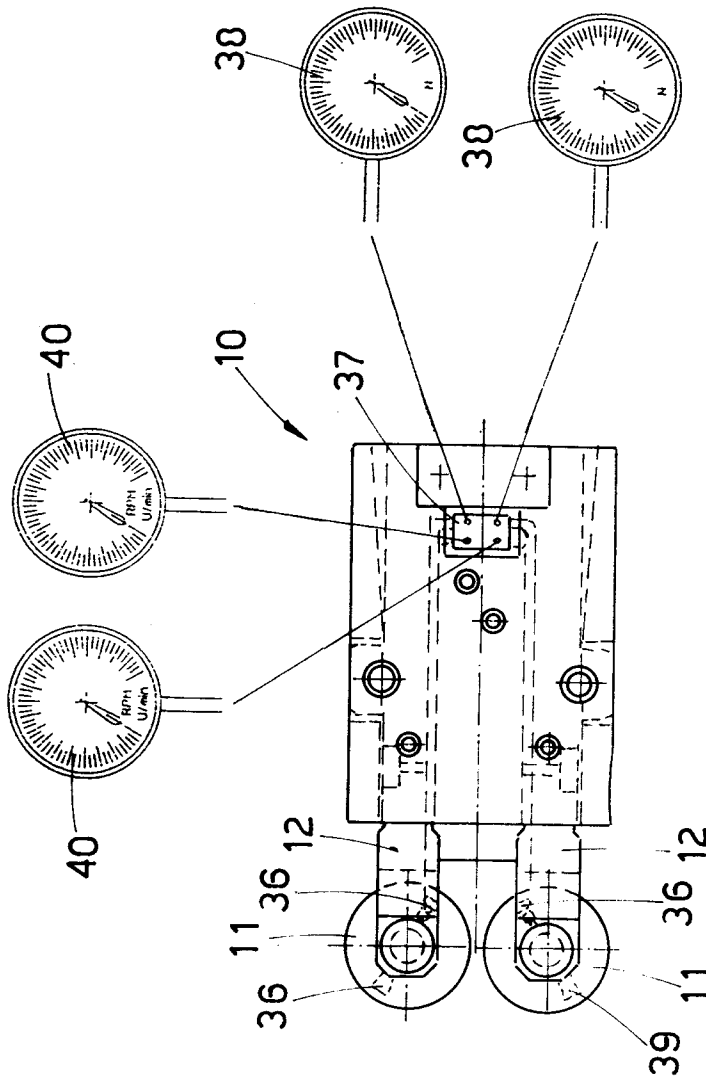


fig.7

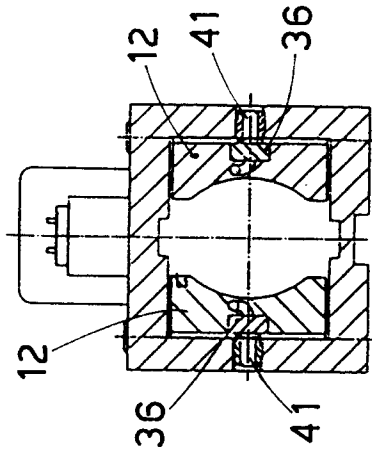


fig.8

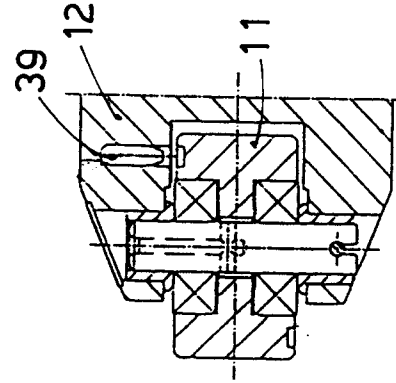


fig.9



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 10 6828

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,A	FR-A-2 253 576 (NIPPON STEEL CORP.) * page 13, line 19 - line 30; figures *	1,9	B21B39/16
D,A	--- PATENT ABSTRACTS OF JAPAN vol. 16, no. 208 (M-1249), 18 May 1992 & JP-A-04 033714 (NIPPON STEEL CORP.), 5 February 1992, * abstract; figures *	1,9	
D,A	--- US-A-4 483 169 (JAHR ET AL) * column 2, line 37 - column 3, line 22; figure 1 *	1,9	
A	--- PATENT ABSTRACTS OF JAPAN vol. 94, no. 010 & JP-A-06 297023 (KOTOBUKI SANGYO), 25 October 1994, * abstract; figures *	1,9	
A	--- PATENT ABSTRACTS OF JAPAN vol. 18, no. 314 (M-1621), 15 June 1994 & JP-A-06 071323 (KOTOBUKI SANGYO), 15 March 1994, * abstract; figures *	1,2,9	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
D,A	--- PATENT ABSTRACTS OF JAPAN vol. 18, no. 272 (M-1610), 24 May 1994 & JP-A-06 047424 (KOTOBUKI SANGYO), 22 February 1994, * abstract; figures *	1-6,9, 12-14	B21B
A	--- PATENT ABSTRACTS OF JAPAN vol. 15, no. 393 (M-1165), 4 October 1991 & JP-A-03 161112 (KOTOBUKI SANGYO), 11 July 1991, * abstract; figures *	1,9	
		-/--	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 16 July 1996	Examiner Plastiras, D
CATEGORY OF CITED DOCUMENTS		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	
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			

EPO FORM 1503 03.82 (P/M/C/D)



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 10 6828

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,A	PATENT ABSTRACTS OF JAPAN vol. 6, no. 93 (M-133), 29 May 1982 & JP-A-57 028609 (SHIN NIPPON SEITETSU), 16 February 1982, * abstract; figures *	1,9	
A	DE-A-42 27 842 (MANNESMANN AG) * column 1, line 23 - line 45; claim 1; figures *	1,9	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 16 July 1996	Examiner Plastiras, D
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			

EPO FORM 1503 03.82 (P04C01)