INTEGRATED BENDING AND BALANCING APPARATUS FOR ROLLING STANDS
INTEGRIERTE BIEGUNGS- UND AUSWUCHTUNGSVORRICHTUNG FÜR WALZGERÜSTE
APPAREIL DE CINTRAGE ET D’ÉQUILIBRAGE INTÉGRÉ POUR CAGES DE LAMINAGE

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Description

Field of the invention

[0001] The present invention relates to an integrated bending and balancing system for rolling stands for flat metal products, in particular suited for bending or curving work rolls or rolling rolls, and for balancing the top back-up roll in a rolling stand provided with a shifting device for axially shifting the work rolls under load.

State of the art

[0002] The use of bending devices for bending or curving work rolls and the use of balancing devices for balancing the top back-up rolls are known in rolling stands for flat metal products, such as strips or sheets. The function of said bending devices, by means of their hydraulic pistons, is to bend the work roll so as to contrast the deformation caused by the rolling force or to provide the work rolls with a predetermined deformed shape.

[0003] It is further known the use of a shifting device for axially shifting the work rolls, which allows, on one hand, to distribute the wear of the work roll itself tending to be located at the colder edges of the rolled strip in the case ofcampaigns with the same width, and, on the other hand, allows to control the output thickness of the product in a better manner if rolls with particular non-cylindrical profiles are used. One of the current solutions requires the bending device to be fixed to the housing of the rolling stand. The top and bottom hydraulic bending pistons operate directly on the horn of the respective top or bottom work chock. A hydraulic cylinder is used to shift a work roll, which axially shifts the respective work chock and the respective work roll therewith, operating by means of a movable support guided in a frame fixed to the housing of the rolling stand.

[0004] US4907439, US4934166, US4967582 and US7895871 show some examples of rolling stands provided with bending devices and shifting devices. In all the known solutions, the top back-up roll balancing devices are distinct and separate from the bending devices and are provided with one or more pistons which, either with or without levers, operate on beams with support the top back-up chocks. The solution works but has some limits because of its considerable dimensions and costs.

[0005] A further document, JP62009708A, describes instead a rolling stand in which the balancing device is fixed to the bending device. Such a document discloses an integrated bending and balancing apparatus corresponding to the preamble of claim 1.

[0006] Another problem of the known solutions is that, during the axially shifting of the work rolls, opposite forces are induced in the axial shifting direction due to the friction which is inevitably generated between the bending pistons and the work roll chocks; said forces, operating on the bending pistons, can damage said bending pistons, in particular when said bending pistons are in extended position. Similarly, damage may occur to the sealing systems (packings and guide rings) of the bending cylinders.

Summary of the invention

[0007] It is thus felt the need to provide an integrated bending and balancing system for rolling stands which allows to overcome the aforesaid drawbacks while allowing the axial shifting under load of at least one of the work rolls.

[0008] It is a main object of the present invention to provide an integrated bending or curving and balancing apparatus for rolling stands which is, as a whole, more compact and cost-effective than the currently marketed solutions.

[0009] It is a further object of the present invention to provide a bending and balancing system including four integrated apparatuses, which once installed in the rolling stand, protects the bending cylinder pistons from the axial forces due to the friction generated by the shifting of the work rolls, thus allowing the system to be also applied to rolling stands with large openings between the two work rolls, and allowing the axially shifting under load.

[0010] The present invention thus aims to achieve the above-discussed objects by providing an integrated bending and balancing apparatus for bending and balancing rolls of a rolling stand which, in accordance with claim 1, is adapted to bend work rolls and to balance a top back-up roll of the rolling stand once the apparatus has been installed in the rolling stand, the apparatus comprising:

- a bending device, provided with at least one top bending cylinder, adapted to operate on a chock of a top work roll, and with at least one bottom bending cylinder, adapted to operate on a chock of a bottom work roll,
- and a balancing device, provided with at least one balancing cylinder, adapted to operate on a chock of the top back-up roll, said balancing device being fixed to the bending device,

characterized in that a bending piston of said at least one top bending cylinder is integrally fixed to a top movable slider sliding on a first end portion of the balancing device, whereby the bending piston can push through the top movable slider onto the chock of the top work roll, and in that a bending piston of said at least one bottom bending cylinder is integrally fixed to a bottom movable slider sliding on a second end portion of the balancing device, whereby the bending piston can push through the bottom movable slider onto the chock of the bottom work roll.

[0011] Advantageously, the balancing device is directly fixed to the bending device.

[0012] A second aspect of the present invention includes an integrated system for bending and balancing the rolls of a rolling stand comprising four integrated apparatuses according to claim 8.
A third aspect of the present invention includes a rolling stand comprising the aforesaid bending and balancing system in accordance with claim 10. Advantageously, the invention includes a number of advantages over the traditional solutions of the prior art, in particular:

- the new integrated solution allows to have in a single apparatus, with dimensions slightly larger than those of the traditional bending devices, both the balancing device of the top back-up roll and the bending device of the work rolls, the rolling stand being able to carry out the shifting during the rolling operation by virtue of the presence of means for axially shifting at least one of the work rolls, configured to cooperate with the integrated bending and balancing apparatuses provided in said rolling stand;
- the tangential force, which is developed due to friction between the work roll chocks and a respective movable support of the bending devices during the axial shifting of the work roll, is relieved by means of said movable support on the balancing device of the top back-up roll and therefore does not bear on the bending pistons avoiding them or the oil sealing system from damaging;
- the robustness of the integrated system allows to perform the axial shifting of the work rolls also during the rolling operation without bending the bending pistons;
- the new solution allows to reduce costs and dimensions of the single balancing device of the top back-up roll as it is integrated in a respective bending device;
- it is also possible to apply the new system to rolling stands with large openings between top work roll and bottom work roll because, in all cases, the bending pistons of the work rolls are not subject to loads with a direction that does not coincide with their axes.

The dependent claims describe preferred embodiments of the invention.

Detailed description of a preferred embodiment of the invention

Further features and advantages of the invention will become more apparent in the light of the detailed description of a preferred, but not exclusive, embodiment of an integrated bending and balancing system for a rolling stand, shown by way of non-limitative example, with reference to the accompanying drawings, in which:

Figure 1 is a section view of a rolling stand comprising systems according to the present invention, where the left part of the view refers to an opening position of the work rolls, while the right part of the view refers to a closing position of the already partially worn work rolls;
Figure 2 is a section view taken along the H-H plane of the rolling stand in Figure 1;
Figure 3 is a side view of an integrated system according to the invention;
Figure 4 is a section view taken along the A-A plane of the system in Figure 3;
Figure 5 is a section view taken along the B-B plane of the system in Figure 3;
Figure 6 is a section view taken along the E-E plane of the system in Figure 3;
Figure 7 is a section view taken along the C-C plane of the system in Figure 3;
Figure 8 is a section view taken along the D-D plane of the system in Figure 3;
Figure 9 is a section view taken along the F-F plane of the system in Figure 3;
Figure 10 is a perspective view of a rolling stand comprising the system according to the invention.

The same reference numbers in the figures denote the same elements or components.

The figures show a preferred embodiment of an integrated system for bending work rolls and balancing the top back-up roll in a rolling stand, configured so as to allow the axial shifting under load of at least one of the work rolls.

Generally a rolling stand for rolling flat metal products, indicated as a whole by reference numeral 1 in Figure 10, comprises:

- a top work roll 2;
- two chocks 3 of the top work roll 2, one arranged on the drive side and the other on the operator side;
- a bottom work roll 2';
- two chocks 3' of the bottom work roll 2', one arranged on the drive side and the other on the operator side;
- a top back-up roll 4;
- two chocks 5 of the top back-up roll 4, one arranged on drive side and other on operator side;
- a bottom back-up roll 4';
- two chocks 5' of the bottom back-up roll 4', one arranged on the drive side and the other on the operator side.

The work rolls 2, 2' and the back-up rolls 4, 4' are arranged within a housing of the window or internal space of the rolling stand.

The rolling stand according to the invention is advantageously provided with actuating means for actuating the work rolls 2, 2', configured to transmit to at least one of the work rolls 2, 2' at least one translation motion along the respective longitudinal axis X.

Such actuating means comprise, for example, four shifting devices 7, 7' provided with a respective hydraulic cylinder 27. However, other types of actuating
The first two shifting devices 7 are associated with the top work roll 2, while the two shifting devices 7’ are associated with the bottom work roll 2’ (Figure 10).

Means of screws 20 or other suitable fastening means may be included.

In particular, Figure 2 shows the two shifting devices 7 of the top work roll 2. Each shifting device 7 comprises a main frame 26 fixed to an upright 6 of the housing of the rolling stand. The axial shifting of the top work roll 2 occurs by means of the shifting cylinders 27, which by operating on a respective movable shifting block 28 by means of a locking bracket 29 which, if required when replacing the rolls, may be opened by releasing the chock and thus the work roll.

Similarly, the bottom work roll 2’ is shifted by means of the shifting devices 7’, which are similar to the shifting devices 7 just described above.

An alternative variant (not shown) may include only one shifting device for the top work roll 2 and only one shifting device for the bottom work roll 2’.

Before proceeding with this axial shifting, the work rolls 2, 2’ are opened, i.e. the work rolls are mutually spaced apart, at least sufficiently to allow the axial shifting of at least one of the work rolls, thus avoiding interferences between the components of said work rolls, e.g. between an annular protrusion of a work roll and the lining of the other work roll.

Such shifting devices allow, on one hand, to distribute the wear of the work rolls which is located at the coldest edges of the product being rolled in case of campaigns of the same width, and on the other hand, to control the output thickness of the product in a better manner if work rolls with particular profiles are used.

The rolling stand advantageously comprises a bending and balancing system provided with four integrated bending and balancing apparatuses 10, subject of the present invention.

Each integrated bending and balancing apparatus 10 is preferably arranged at a respective upright 6 of the housing of the rolling stand.

Each integrated bending and balancing apparatus, subject of the present invention, comprises:

- a bending device 8 provided with two top bending cylinders 9 adapted to operate with respective pistons 11 on a chock 3 of the top work roll 2, and two bottom bending cylinders 9’ adapted to operate with respective pistons 11’ on a chock 3’ of the bottom work roll 3,
- and a balancing device 12, provided with at least one balancing cylinder 13, adapted to operate with a respective piston 14 on a chock 5 of the top back-up roll 4.

Advantageously, the bending device 8 is integrally fixed to the respective balancing device 12, e.g. by means of screws 20 or other suitable fastening means, making the entire apparatus more compact. In turn, the balancing device 12 is fixed to the respective upright 6 of the housing of the rolling stand, e.g. by means of screws 19 or other suitable fastening means.

A first pair of cylinders, consisting of a top bending cylinder 9 and of a bottom bending cylinder 9’, and a second pair of cylinders, consisting of the other top bending cylinder 9 and the other bottom bending cylinder 9’, are symmetrically arranged with respect to the middle plane of the bending device 12, which also divides the balancing cylinder 13 in half.

The top bending cylinders 9 are arranged opposite the respective bottom bending cylinders 9’.

A further advantage is that the balancing piston 14 of the cylinder 13 is configured to work directly on the chock 5 of the top back-up roll 4, without requiring intermediate levers which operate on support beams of the top back-up roll chocks.

The balancing pistons 14, fitted on the balancing devices 12 and operating directly on the top back-up roll chocks 5, thus balance the weight of the chocks 5 themselves and of the top back-up roll 4.

Furthermore, an innovative configuration provides that the pistons 11 of the top bending cylinders 9 are integrally fixed to a top movable slider or support 15 sliding on a first end portion of the balancing device 12. Similarly, the pistons 11’ of the bottom bending cylinders 9’ are integrally fixed to a bottom movable slider or support 15’ sliding on a second end portion of the balancing device 12. This configuration allows to protect the pistons of the bending cylinders from the axial forces due to the friction generated by the shifting of the work rolls, thus allowing the system to be also applied to rolling stands with large openings between the two work rolls and allowing to carry out the axial shifting under load.

In the variant shown in the Figures, piston 11 is integrally fixed to the top movable slider 15, by means of a screw 18 or other suitable fastening means, and is used to transmit a translation motion to said slider 15. Similarly, piston 11’ is integrally fixed to the bottom movable slider 15’, by means of a screw 18’ or other suitable fastening means, and is used to transmit a translation motion to said slider 15’. Therefore, the top pistons 11, fitted on the bending devices 8, push through the top movable slider 15 on the top work roll chocks 3 thus curving the top work roll 2; while the bottom pistons 11’, fitted on the bending devices 8, push through the bottom movable slider 15’ on the bottom work roll chocks 3’ thus curving the bottom work roll 2’.

Moreover, since the movable sliders 15, 15’ have at least one surface facing the balancing device 12, having a profile substantially mating with and adjacent to the profile of said end portions of the balancing device 12, this configuration allows that, when one of said top work roll 2 and said bottom work roll 2’ is translated by means of the shifting devices along a longitudinal axis thereof, the friction which is generated between the horns 30, 30’ of the chocks 3, 3’ of the work roll 2, 2’ and said
top movable slider 15 or said bottom movable slider 15' produces a force tangent to said top movable slider 15 or bottom movable slider 15', which is entirely relieved through said movable slider on the balancing device 12 and not on the pistons 11 or 11' of the bending cylinders. [0039] This advantageous technical effect is even more effectively achieved by providing, in a preferred variant, for the top movable support 15 and the bottom movable support 15' having a C-shaped cross section along a horizontal plane such as to accommodate a segment of said first end portion and a segment of said second end portion of the balancing device 12, respectively, in their cavity.

[0040] With reference to Figure 9, the top movable slider 15 has five faces 21, 22, 23, 24, 25, facing the balancing device 12, defining a profile substantially mating with and adjacent to the profile of the corresponding faces of the first end portion of the balancing device 12. Faces 22, 23 and 24 define the C-shaped cavity which accommodates a segment of the balancing device 12 crossed by the balancing cylinder 13. Grooves, preferably filled with lubricant to reduce the wear which may occur when the movable slider 15 slides on the balancing device 12, are arranged at the edges of the faces 21, 22, 23, 24 and 25. The above also applies to the bottom movable slider 15', with the difference that the segment of the balancing device 12 on which the slider 15' slides is not crossed by the balancing cylinder because this is not provided for the bottom back-up roll 4'.

[0041] Another advantage of the invention consists in providing, in every integrated apparatus 10, a protective plate 16, 17, interposed between a chock (3, 3') of at least one top bending cylinder (9), adapted to operate on a chock (3) of a top work roll (2), and with at least one bottom bending cylinder (9'), adapted to operate on a chock (3') of a bottom work roll (2'), and having a profile substantially mating with and adjacent to the profile of said end portions of the balancing device (12).

[0042] If such a plate 16 is a distinct element fixed to the body of the bending device 8 or to the movable slider 15, said plate 16 can be removed if the amount of water and scale concerning the device is deemed such not to impair the operation thereof.

[0043] A further similar protective plate 17 can also be provided between the bottom work roll chock 3 and the bending device 8, and sized so as to prevent water and scale from depositing between the bottom movable slider 15' and the bending device 8 when piston 11' is at least partially outside the chamber of the bending cylinder 9'.

[0044] The elements and features shown in the various preferred embodiments can be combined without departing from the scope of protection of the application as defined by the appended claims.

Claims

1. An integrated bending and balancing apparatus (10) for bending and balancing rolls of a rolling stand, adapted to bend work rolls (2, 2') and to balance a top back-up roll (4) of the rolling stand once the apparatus has been installed in the rolling stand, the apparatus comprising:

   - a bending device (8), provided with at least one top bending cylinder (9), adapted to operate on a chock (3) of a top work roll (2), and with at least one bottom bending cylinder (9'), adapted to operate on a chock (3') of a bottom work roll (2'),

   and in that a bending piston (11') of said at least one bottom bending cylinder (9') is integrally fixed to a bottom movable slider (15') onto the chock (3') of the bottom work roll (2'),

   characterized in that a bending piston (11) of said at least one top bending cylinder (9) is integrally fixed to a top movable slider (15) sliding on a first end portion of the balancing device (12), whereby the bending piston (11) can push through the top movable slider (15) onto the chock (3) of the top work roll (2),

   - and a balancing device (12), provided with at least one balancing cylinder (13), adapted to operate on a chock (5) of the top back-up roll (4), said balancing device (12) being fixed to the bending device (8),

   - a further similar protective plate (16, 17), interposed between a chock (3, 3') of at least one top bending cylinder (9), adapted to operate on a chock (3) of a top work roll (2), and with at least one bottom bending cylinder (9'), adapted to operate on a chock (3') of a bottom work roll (2'),

2. An apparatus according to claim 1, wherein the top movable slider (15) and the bottom movable slider (15') have at least one surface facing the balancing device (12) and having a profile substantially mating with and adjacent to the profile of said end portions of the balancing device (12).

3. An apparatus according to claim 2, wherein the top movable slider (15) and the bottom movable slider (15') have a C-shaped cross section along a horizontal plane so as to accommodate within its cavity a segment of said first end portion and of said second end portion, respectively.

4. An apparatus according to claim 2 or 3, wherein each bending piston (11, 11') is integrally fixed to the respective movable slider (15, 15') by means of fastening means (18, 18') to transmit a shifting motion to said movable slider.

5. An apparatus according to one of the claims from 2 to 4, wherein there is provided a protective plate (16, 17), interposed between a chock (3, 3') of at least one top bending cylinder (9), adapted to operate on a chock (3) of a top work roll (2), and with at least one bottom bending cylinder (9'), adapted to operate on a chock (3') of a bottom work roll (2'), and in that a bending piston (11') of said at least one bottom bending cylinder (9') is integrally fixed to a bottom movable slider (15') sliding on a second end portion of the balancing device (12), whereby the bending piston (11') can push through the bottom movable slider (15') onto the chock (3') of the bottom work roll (2').
one work roll (2, 2') and the bending device (8), and having size such as to prevent water and scale from depositing between the movable slider (15, 15') and the bending device (8).

6. An apparatus according to any one of the preceding claims, wherein there are provided two top bending cylinders (9) and two bottom bending cylinders (9').

7. An apparatus according to claim 6, wherein a first pair of cylinders, consisting of a top bending cylinder (9) and a bottom bending cylinder (9'), and a second pair of cylinders, consisting of the other top bending cylinder (9) and the other bottom bending cylinder (9'), are symmetrically arranged with respect to a middle plane of the balancing device (12).

8. A bending and balancing system for bending and balancing rolls of a rolling stand comprising four integrated bending and balancing apparatuses (10) according to any one of the preceding claims, adapted to be arranged in pairs at respective ends of the work rolls (2, 2') of the rolling stand.

9. A system according to claim 8, wherein axial shifting means are included to shift at least one of the work rolls (2, 2') along a respective longitudinal axis thereof, and are configured to operate in cooperation with the integrated bending and balancing apparatuses (10).

10. A rolling stand comprising:
   - a top back-up roll (4),
   - a top work roll (2),
   - a bottom work roll (2'),
   - a bottom back-up roll (4'),
   wherein a bending and balancing system according to claim 8 is included, the four integrated apparatuses (10) being arranged in pairs at respective ends of the work rolls (2, 2').

11. A rolling stand according to claim 10, wherein in each integrated apparatus (10), the balancing device (12) is configured so that a balancing piston (13) of the balancing cylinder (13) directly operates on the respective chock (5) of the top back-up roll (4).

12. A rolling stand according to claim 10 or 11, wherein said work rolls (2, 2') and said back-up rolls (4, 4') are arranged in a housing and each integrated apparatus (10) has the respective balancing device (12) fixed to said housing.

13. A rolling stand according to claim 12, wherein each integrated apparatus (10) is arranged at a respective upright (6) of the housing.

14. A rolling stand according to any one of the claims from 10 to 13, wherein axial shifting means are included to shift at least one of said top work roll (2) and said bottom work roll (2') along a respective longitudinal axis thereof.

Patentansprüche

1. Integrierte Biege- und Auswucht-Vorrichtung (10) zum Biegen und Auswuchten von Walzen eines Walzgerüsts, angepasst dafür, Arbeitswalzen (2, 2') zu biegen und eine obere Stützwalze (4) des Walzgerüsts auszuwuchten, sobald die Vorrichtung in dem Walzgerüst installiert wurde, wobei die Vorrichtung umfasst:
   - eine Biege-Vorrichtung (8), versehen mit wenigstens einem oberen Biege-Zylinder (9), angepasst dafür, auf einen Bremsschuh (3) einer oberen Arbeitswalze (2) einzuwirken, und mit wenigstens einem unteren Biege-Zylinder (9'), angepasst dafür, auf einen Bremsschuh (3') einer unteren Arbeitswalze (2') einzuwirken;
   - eine Auswucht-Vorrichtung (12), versehen mit wenigstens einem Auswucht-Zylinder (13), angepasst dafür, auf einen Bremsschuh (5) der oberen Stützwalze (4) einzuwirken, wobei die Auswucht-Vorrichtung (12) an der Biege-Vorrichtung (8) fixiert ist;
   - dadurch gekennzeichnet, dass ein Biege-Stempel (11) des wenigstens einen oberen Biege-Zylinders (9) integral an einem oberen bewegbaren Gleitelement (15) fixiert ist, das auf einem ersten End-Teil der Auswucht-Vorrichtung (12) gleitet, wodurch der Biege-Stempel (11) das obere bewegbare Gleitelement (15) auf den Bremsschuh (3) der oberen Arbeitswalze (2) drücken kann; und
   - dadurch, dass ein Biege-Stempel (11') des wenigstens einen unteren Biege-Zylinders (9') integral an einem unteren bewegbaren Gleitelement (15') fixiert ist, das auf einem zweiten End-Teil der Auswucht-Vorrichtung (12) gleitet, wodurch der Biege-Stempel (11') das untere bewegbare Gleitelement (15') auf den Bremsschuh (3') der unteren Arbeitswalze (2') drücken kann.

2. Vorrichtung nach Anspruch 1, wobei das obere bewegbare Gleitelement (15) und das untere bewegbare Gleitelement (15') wenigstens eine Fläche aufweisen, die der Auswucht-Vorrichtung (12) gegenüber liegt und ein Profil aufweist, das im Wesentlichen dem Profil der End-Teile der Auswucht-Vorrichtung (12) entspricht und diesem benachbart ist.

3. Vorrichtung nach Anspruch 2, wobei das obere be-
wegbare Gleitelement (15) und das untere bewegbare Gleitelement (15') einen C-förmigen Querschnitt entlang einer horizontalen Ebene aufweisen, so dass es in seiner Vertiefung ein Segment des ersten End-Teils bzw. des zweiten End-Teils unterbringt.

4. Vorrichtung nach Anspruch 2 oder 3, wobei jeder Biege-Stempel (11, 11') integral an dem jeweiligen bewegbaren Gleitelement (15, 15') mittels einer Befestigungseinrichtung (18, 18') fixiert ist und so eine Verschiebe-Bewegung auf das bewegbare Gleitelement überträgt.

5. Vorrichtung nach einem der Ansprüche von 2 bis 4, wobei eine Schutzplatte (16, 17) vorgesehen ist, die zwischen einem Bremsschuh (3, 3') wenigstens einer Arbeitswalze (2, 2') und der Biege-Vorrichtung (8) angeordnet ist und eine solche Größe aufweist, dass sie verhindert, dass sich Wasser und Zunder zwischen dem bewegbaren Gleitelement (15, 15') und der Biege-Vorrichtung (8) ablager.

6. Vorrichtung nach irgendeinem der vorangehenden Ansprüche, in der zwei obere Biege-Zylinder (9) und zwei untere Biege-Zylinder (9') vorgesehen sind.

7. Vorrichtung nach Anspruch 6, wobei ein erstes Paar Zylinder, bestehend aus einem oberen Biege-Zylinder (9) und einem unteren Biege-Zylinder (9'), und ein zweites Paar Zylinder, bestehend aus dem anderen oberen Biege-Zylinder (9) und dem anderen unteren Biege-Zylinder (9'), symmetrisch in Bezug auf eine Mittelebene der Auswucht-Vorrichtung (12) angeordnet sind.


9. System nach Anspruch 8, wobei Einrichtungen zum axialen Verschieben eingeschlossen sind, um wenigstens eine der Walzen obere Arbeitswalze (2) und untere Arbeitswalze (2') entlang einer jeweiligen Längsachse davon zu verschieben.

10. Walzgerüst, umfassend
- eine Stützwalze (4);
- eine obere Arbeitswalze (2);
- eine untere Arbeitswalze (2');
- eine untere Stützwalze (4');
- wobei ein Biege- und Auswucht-System gemäß Anspruch 8 eingeschlossen ist und wobei die vier integrierten Vorrichtungen (10) in Paaren an jeweiligen Enden der Arbeitswalzen (2, 2') angeordnet sind.

11. Walzgerüst nach Anspruch 10, wobei in jeder integrierten Vorrichtung (10) die Auswucht-Vorrichtung (12) so konfiguriert ist, dass ein Biege-Stempel (14) des Auswucht-Zylinders (13) direkt auf den jeweiligen Bremsschuh (5) der oberen Stützwalze (4) einwirkt.

12. Walzgerüst nach Anspruch 10 oder 11, wobei die Arbeitswalzen (2, 2') und die Stützwalzen (4, 4') in einem Gehäuse angeordnet sind und jede integrierte Vorrichtung (10) die jeweilige Auswucht-Vorrichtung (12) an dem Gehäuse fixiert aufweist.

13. Walzgerüst nach Anspruch 12, wobei jede integrierte Vorrichtung (10) an einem jeweiligen Ständer (6) des Gehäuses angeordnet ist.

14. Walzgerüst nach irgendeinem der Ansprüche von 10 bis 13, wobei Einrichtungen zum axialen Verschieben eingeschlossen sind, um wenigstens eine der Walzen obere Arbeitswalze (2) und untere Arbeitswalze (2') entlang einer jeweiligen Längsachse davon zu verschieben.

Revendications

1. Appareil de cintrage et d'équilibrage intégré (10) pour le cintrage et l'équilibrage de cylindres d'une cage de laminage, adapté à cintrer des cylindres de travail (2, 2') et à équilibrer un cylindre d'appui supérieur (4) de la cage de laminage une fois l'appareil installé dans la cage de laminage, l'appareil comprenant :
- un dispositif de cintrage (8), doté d’au moins un cylindre de cintrage supérieur (9), adapté à fonctionner sur une empoise (3) d’un cylindre de travail supérieur (2), et d’au moins un cylindre de cintrage inférieur (9'), adapté à fonctionner sur une empoise (3') d’un cylindre de travail inférieur (2'),
- et un dispositif d’équilibrage (12), doté d’au moins un cylindre d’équilibrage (13), adapté à fonctionner sur une empoise (5) du cylindre d’appui supérieur (4), ledit dispositif d’équilibrage (12) étant fixé au dispositif de cintrage (8),

 caractérisé en ce qu’un piston de cintrage (11) du dit au moins un cylindre de cintrage supérieur (9) est fixé d’une seule pièce à un coulisseau mobile supérieur (15) coulissant sur une première partie d’extré-
mité du dispositif d’équilibrage (12), moyennant quoi le piston de cintrage (11) peut enfoncer le coulisseau mobile supérieur (15) sur l’empoise (3) du cylindre de travail supérieur (2), et en ce qu’un piston de cintrage (11’) dudit au moins un cylindre de cintrage inférieur (9’) est fixé d’une seule pièce à un coulisseau mobile inférieur (15’) coulissant sur une seconde partie d’extrémité du dispositif d’équilibrage (12), moyennant quoi le piston de cintrage (11’) peut enfoncer le coulisseau mobile inférieur (15’) sur l’empoise (3’) du cylindre de travail inférieur (2’).

2. Appareil selon la revendication 1, dans lequel le coulisseau mobile supérieur (15) et le coulisseau mobile inférieur (15’) comprennent au moins une surface faisant face au dispositif d’équilibrage (12) et présentant un profil s’accouplant sensiblement et adjacent au profil desdites parties d’extrémité du dispositif d’équilibrage (12).

3. Appareil selon la revendication 2, dans lequel chaque piston de cintrage (11, 11’) au moyen de moyens de fixation (18, 18’) pour transmettre un mouvement de déplacement audit coulisseau mobile.

4. Appareil selon la revendication 2 ou 3, dans lequel une plaque de protection (16, 17) est fournie, placée entre une empoise (3, 3’) dans laquelle un système de cintrage et d’équilibrage selon la revendication 8 est inclus, les quatre appareils intégrés (10) étant agencés par paires au niveau d’extrémités respectives des cylindres de travail (2, 2’).

5. Appareil selon l’une quelconque des revendications précédentes, dans lequel sont fournis deux cylindres de cintrage supérieurs (9) et deux cylindres de cintrage inférieurs (9’).

6. Appareil selon la revendication 6, dans lequel une première paire de cylindres, composée d’un cylindre de cintrage supérieur (9) et d’un cylindre de cintrage inférieur (9’), et une seconde paire de cylindres, composée de l’autre cylindre de cintrage supérieur (9) et de l’autre cylindre de cintrage inférieur (9’), sont symétriquement agencées par rapport à un plan intermédiaire du dispositif d’équilibrage (12).

8. Système de cintrage et d’équilibrage pour le cintrage et l’équilibrage de cylindres d’une cage de laminage comprenant quatre appareils de cintrage et d’équilibre intègrents (10) selon l’une quelconque des revendications précédentes, adaptés à être agencés par paires au niveau d’extrémités respectives des cylindres de travail (2, 2’) de la cage de laminage.

9. Système selon la revendication 8, dans lequel des moyens de déplacement axial sont inclus pour déplacer au moins l’un des cylindres de travail (2, 2’) le long d’un axe longitudinal respectif de celui-ci, et sont configurés pour fonctionner en coopération avec les appareils de cintrage et d’équilibrage intégrés (10).

10. Cage de laminage comprenant : - un cylindre d’appui supérieur (4), - un cylindre de travail supérieur (2), - un cylindre de travail inférieur (2’), - un cylindre d’appui inférieur (4’), dans laquelle un système de cintrage et d’équilibrage selon la revendication 8 est inclus, les quatre appareils intégrés (10) étant agencés par paires au niveau d’extrémités respectives des cylindres de travail (2, 2’).

11. Cage de laminage selon la revendication 10, dans laquelle, dans chaque appareil intégré (10), le dispositif d’équilibrage (12) est configuré de sorte qu’un piston d’équilibrage (14) du cylindre d’équilibrage (13) fonctionne directement sur l’empoise respective (5) du cylindre d’appui supérieur (4).

12. Cage de laminage selon la revendication 10 ou 11, dans laquelle lesdits cylindres de travail (2, 2’) sont agencés dans un logement et chaque appareil intégré (10) comprend le dispositif d’équilibrage respectif (12) fixé audit logement.

13. Cage de laminage selon la revendication 12, dans laquelle chaque appareil intégré (10) est agencé au niveau d’un montant respectif (6) du logement.

14. Cage de laminage selon l’une quelconque des revendications 10 à 13, dans laquelle des moyens de déplacement axial sont inclus pour déplacer au moins l’un desdits cylindres de travail supérieur (2) et cylindre de travail inférieur (2’) le long d’un axe longitudinal respectif de celui-ci.
REFERENCES CITED IN THE DESCRIPTION

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