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(54) **SERVICING EQUIPMENT FOR A BLAST FURNACE AND DEVICE FOR REPLACING A BLAST FURNACE RUNNER**

VORRICHTUNG ZUM SERVICE EINES HOCHOFENS UND HANDHABUNGSVORRICHTUNG ZUM ERSATZ EINES LÄUFERS

DISPOSITIF DE SERVICE POUR HAUT-FOURNEAU ET DISPOSITIF DE MANIPULATION PERMETTANT DE REMPLACER UN CANAL DE COULEE

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Description

TECHNICAL FIELD

[0001] The present invention relates to a servicing equipment and handling device for replacing a runner, in particular the main iron runner of a blast furnace.

BACKGROUND ART

[0002] In a cast house of a blast furnace, pig iron and pig iron slag are separated in a main runner associated with a taphole of the blast furnace. Such a main runner is a trough provided with a refractory lining which has to be periodically refurbished. A complete refurbishment of the refractory lining of the main runner generally takes at least one week, during which the corresponding taphole is not productive. In order to reduce this non-productive time of a taphole, it has been suggested to simply replace the main runner with a reserve runner instead of refurbishing its refractory lining in situ. However, the dimensions of the main runner of a modern blast furnace are for example up to 20 m in length, 3 m in width and 2 m in height, and its weight is up to 400 t. It is obvious that the replacement of a main runner with a reserve runner causes serious handling problems.

[0003] For replacing the main runner it has been envisaged to use a crane that is generally available in the cast house. However, for hoisting a heavy main runner, the cast house crane and its support structure must be substantially reinforced, which is often very expensive and even impossible due to a chronic lack of space around the blast furnace. Furthermore, handling such bulky objects as the main runner of a big blast furnace with a crane under severe space constraints also involves substantial safety risks.

[0004] EP 0 279 165 discloses using a lifting device comprising vertical traction elements, which are flexible or rigid and are fixed to the tapping floor or alternatively to the runner, for lifting the main runner vertically between a lower service level and an upper tapping floor level. A similar approach is described in DE 36 24 266. According to this document, vertical lifting elements are arranged on the ground floor of the blast furnace plant.

[0005] Although prior art lifting devices as disclosed in EP 0 279 165 and DE 36 24 266 do allow replacement of the main runner, they require cumbersome and expensive vertical lifting means and entail moreover serious safety risks. This is in particular true if the main runner is very heavy and bulky.

OBJECT OF THE INVENTION

[0006] An object of the present invention is to propose an improved handling device for replacing a runner, which allows an easy, fast and safe transport of very heavy runners between a lower, service level and an upper, tapping floor level in a cast house.

GENERAL DESCRIPTION OF THE INVENTION

[0007] In accordance with the present invention according to claim 1 and 16, respectively, this object is achieved in that the servicing equipment, respectively the handling device, comprises an inclinable bridge capable of supporting the runner in an operational position in front of a taphole of the shaft furnace. This bridge can be inclined so as to form an inclined plane along which the runner can be raised or lowered. In other words, the runner can be brought from the upper tapping floor level to the lower service level and vice versa by moving it along an inclined plane. This allows an easy, fast and safe replacement of very heavy runners in a cast house. Sliding the runner along the inclined bridge involves indeed substantially smaller forces than vertically lifting it. Consequently, drive means required for moving a very heavy runner along the inclined plane may be simpler, less powerful and cumbersome and less expensive than lifting means required for a vertical lifting of the runner. Furthermore, moving a heavy mass along an inclined plane is obviously much safer than vertically lifting it. A further non-negligible advantage results from the fact that all major elements of the handling device in accordance with the present invention may be located below the level of the tapping floor. In other words, the handling device in accordance with the present invention forms no cumbersome obstacle on or above the tapping floor.

[0008] A particularly compact and simple handling device comprises a lower bridge portion and an upper bridge portion that can pivot separately and cooperate to form the inclined plane. Thus, the lower bridge portion can be brought into a horizontal position allowing, at the lower, service level, the replacement of a runner placed on this lower bridge portion. The upper bridge portion can be brought into a horizontal working position at the upper, tapping floor level, in which a runner placed on this upper bridge portion is operational in front of a taphole of the blast furnace.

[0009] In order to facilitate transport of the runner along the inclinable bridge, the runner is advantageously supported on a runner-supporting truck. Such a truck is for example a rail vehicle, wherein the inclinable bridge includes rails for guiding this rail vehicle.

[0010] To allow simple exchange of runner-supporting trucks on the lower bridge portion, two service areas are advantageously provided on either side of the lower bridge portion of the bridge. In order to easily move a runner-supporting truck from the lower bridge portion of the bridge in a lateral direction into one of these two service areas and vice versa, the runner-supporting truck advantageously has wheels that can pivot about a vertical axis.

[0011] Any kind of drive means capable of moving the truck along the inclinable bridge may be used. In a preferred embodiment this drive means comprises a hydraulic jack. However, the drive means may for example also comprise a winch or a rack-and-pinion system.

[0012] In a preferred embodiment the inclinable bridge comprises a lower bridge portion and an upper bridge portion that can pivot separately and that cooperate to form the inclined plane, and the hydraulic jack comprises a jack body incorporated into the lower bridge portion and a telescopic jack piston guided by guiding means, either in the lower bridge portion or in the upper bridge portion.

[0013] In a preferred embodiment the inclinable bridge is inclined by rotation about at least one approximately horizontal axis, preferably by means of at least one hydraulic jack. It advantageously includes at least one articulated prop used as a support in a non-inclined position and/or in the inclined position.

[0014] To further improve safety, the handling device includes a locking device for fixing the runner to the inclinable bridge. Such a locking device has two functions. Firstly, it allows to fix the runner, or the runner-supporting truck, in the operational position in front of the taphole. Secondly, it serves to fix the runner, or the runner-supporting truck, to the upper bridge portion of the inclinable bridge when the latter is in its inclined position. To prevent the runner from dropping back in an uncontrolled manner along the inclined plane, the locking device is advantageously conceived so as to unlocked only when the corresponding drive means, for example the hydraulic jack, has taken up the weight of the runner, or of the runner-supporting truck. In this preferred embodiment, the locking device comprises an associated safety mechanism, which allows release of said locking device only if the carrier head of the hydraulic piston has engaged the truck in operational position in front of the taphole.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Other features and advantageous of the invention will become apparent from the detailed description of a preferred embodiment described hereinafter, by way of illustration, with reference to the appended drawings. These drawings show:

Fig. 1: a sectional view of a handling device according to the invention, wherein this handling device supports a runner in an operational horizontal position in front of a taphole of a blast furnace;

Fig. 2: a sectional view of the handling device of Fig. 1, in a runner replacement configuration with the runner in a raised position;

Fig. 3: a sectional view of the handling device of Fig. 1, in a runner replacement configuration with the runner in a lowered position;

Fig. 4: a plan view of a runner exchange area of the handling device in Fig. 1 (see section line A-A in Fig. 1);

Fig. 5: a sectional view of the runner exchange area of the handling device in Fig. 1 (see section line B-B in Fig. 1);

Fig. 6: a vertical sectional view of a locking device for the runner; and

Fig. 7: a horizontal sectional view of the locking device of Fig. 6 (see section line C-C in Fig. 6).

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0016] Fig. 1 shows a section through a cast house of a blast furnace 10, with a taphole 12 and a main runner 14 associated with this taphole 12. Reference number 16 identifies a tapping floor in the cast house. The main runner 14 is shown at the level of a tapping floor 16, in a tapping position under the taphole 12. Iron runners and slag runners (not shown on the drawings) are arranged downstream and alongside the main runner 14 to divert the iron into iron ladles and the slag into slag pots or slag pits (not shown on the drawings).

[0017] A handling device in accordance with the present invention is globally identified with reference number 20. It comprises an inclinable bridge 26 consisting of an inclinable first bridge portion 24 and an inclinable second bridge portion 34. The first bridge portion 24 is mounted on the ground floor 44 of the cast house in front of the taphole 12. In Fig. 1, the inclinable first bridge portion 24 is shown in a horizontal configuration, in which it supports the runner 14 in a tapping position in front of the taphole 12. In Fig. 2 & 3, the inclinable first bridge portion 24 is shown in an inclined runner replacement configuration. The second bridge portion 34 is mounted in a servicing pit 42, below the ground floor 44 of the cast house in axial alignment with the first bridge portion 24. In Fig. 1, the inclinable second bridge portion 34 is shown in a non-inclined horizontal configuration at the same level than a service floor in a servicing pit 42. In Fig. 2 & 3 the inclinable second bridge portion 34 is shown in an inclined runner replacement configuration in which it cooperates with the inclined first bridge portion 24 to form an inclined plane along which the runner 14 can be raised or lowered.

[0018] Reference number 22 identifies a runner-supporting truck that supports the main runner 14. This runner-supporting truck 22 is conceived as a rail vehicle guided by rails 40 mounted on both bridge portions 24, 34. A locking device 28 allows to lock the a runner-supporting truck 22 to the front end of the first bridge portion 24. Reference number 32 identifies a second runner-supporting truck carrying a replacement main runner 36. In Fig. 1 this second runner-supporting truck 32 is parked on the service floor, in the servicing pit 42 laterally alongside the lowered second bridge portion 34.

[0019] The inclinable first bridge portion 24 will now be described in greater detail. It comprises a support track

46 for the runner-supporting truck 22. It will be noted that the support track 46 is substantially longer than the runner-supporting truck 22, whereby it is possible to arrange an extension runner (not shown) downstream of the main runner 14 when the latter is in the tapping position shown in Fig. 1. Reference number 58 identifies a thermal insulation 58 protecting the lower surface of the support track 46 against heat radiation in this tapping position. The end of the support track 46 that is closest to the taphole 12 rests on an articulated pillar 50. The latter comprises a first bracket 52 fixed to the support track 46 and a second bracket 54 mounted on a base on the cast house floor 44. The two brackets 52, 54 are linked by a substantially horizontal pivot shaft 56 so as to allow the support track 46 to pivot about the substantially horizontal pivot shaft 56. A linear actuator, such as a hydraulic jack 62, which is supported with one end in an articulated manner on the floor 44 and connected with its other end in an articulated manner to the support track 46, is used to pivot the support track 46 about the pivot shaft 56; thereby bringing the inclinable first bridge portion 24 either its horizontal tapping configuration or in its inclined runner replacement configuration. One or more pivotable props 64, bearing on pedestals 65 on the floor 44, form an additional support for the support track 46 in the horizontal position, so that the hydraulic jack 62 can be unloaded when the support track 46 is in its horizontal position. These props 64 can pivot about an articulation linked to the support track 46 and are pivoted by means of hydraulic jacks 66. Comparing Fig. 1 & 2 it becomes apparent how the inclined configuration of the first bridge portion 24 is achieved by pivoting away the first group of props 64 and by retracting the first actuator 62. It should be noted that in the inclined configuration of Fig. 2, the rear end of the support track 46 rests with the help of smaller props 88 on the same pedestals 65 on which the longer props 64 rest in the horizontal configuration.

[0020] The inclinable second bridge portion 34 comprises a support track 46' that cooperates in the replacement configuration of Fig. 2 & 3 with the support track 46 to form a continuous inclined track leading from the taphole 12 into the servicing pit 42. The end of the support track 46' that is farthest away from to the taphole 12 rests on an articulated support 70 in the servicing pit 42, so as to allow the support track 46' to pivot about a substantially horizontal axis. A linear actuator, such as a hydraulic jack 72, which is supported with one end in an articulated manner on the floor of the servicing pit 42 and connected with its other end in an articulated manner to the support track 46', is used to pivot the support track 46' about the articulated support 70; thereby bringing the inclinable second bridge portion 34 either its horizontal configuration shown in Fig. 1 or in its inclined runner replacement configuration shown in Fig. 2 or 3. Just as the first bridge portion 24, the second bridge portion 24 is additionally equipped with one or more props 90 that can be moved away. These props 90 support the support track 46' in the inclined position, so that it is possible to unload the second actuator 72 after having raised the support track 46' into its inclined position.

[0021] Reference number 80 identifies a telescopic jack 80 that is used for driving the runner-supporting truck 22 (or 32) along the inclined plane that is formed by both support tracks 46, 46' when the handling device 20 is in the runner replacement configuration shown in Fig. 2 or 3. In the non-inclined configuration of Fig. 1, the retracted telescopic jack 80 is arranged inside the support track 46'. It should be noted that the hydraulic jack 62 is preferably a double-action jack in order to be able to counteract the torque exerted by the telescopic jack 80 on the articulated pillar 50. In fact, a tensile force is thus exerted by the actuator 62 on the first portion 24 when the extended telescopic jack 80 pushes on the truck 22. This makes it possible to compensate for this torque and thus prevents damage to the replacing device 20. As is best shown in the enlarged detail Z in Fig. 2, the telescopic jack 80 includes a carrier head 82 which makes loose contact with a bracket 84 beneath the runner-supporting truck 22 so as to support this truck 22 on the inclined plane. The carrier head 82 and the telescopic piston of the jack 80 are equipped with guiding wheels which guide and support the piston and the carrier head 82 within guiding rails in of the support tracks 46, 46'. When the inclinable bridge 26 is in the runner replacement configuration shown in Fig. 2 and the locking device 28 has been released, the truck 22 supporting the runner 14 that is to be replaced can be lowered in a controlled manner by means of the telescopic jack 80.

[0022] Fig. 3 shows the situation after completion of the downward travel of the truck 22 on the inclined bridge 26. This situation is reached when the telescopic jack 80 is fully retracted. The truck 22 is then entirely supported on the lower bridge portion 34. When the props 90 are moved away, the second actuator 72 can pivot the lower bridge portion 34 into its horizontal position. The first truck 22 supporting the worn runner 14 can then be replaced with the second truck 32 supporting the refurbished runner 36. This operation is performed on the service floor in the pit 42.

[0023] Fig. 4 shows the plan of the rails in the pit 42. Two horizontal areas 100 and 102, for parking and for refurbishment, are provided laterally on either side of the lower bridge portion 34. Transverse rails 106 are placed transversally to the rails 40 of the portion 34, thereby allowing both the first truck 22 to be easily removed from the portion 34 and the second truck 32 to be easily placed thereon. To allow replacement by simple traction on one truck 22, 32, the two trucks 22 and 32 may be laterally hitched to each other. The reference numerals 108 identify winches intended for this lateral traction movement of the trucks. Lateral stops 110 are placed on some of the transverse rails 106 so as to limit the lateral travel of the trucks 22 resp. 32. End-of-travel stops 114 are placed in the extension of the rails 40 in the descending direction so as to limit the descending travel of the truck 22 resp. 32. Fig. 4 also shows vertical jacks 112 arranged along

the lower bridge portion 34 for lifting the truck 22 (resp. 32) from the rails 40 as described in the following paragraph.

[0024] Fig. 5 shows, in a cross section, the trucks 22 and 32 in the pit 42. The trucks 22, 32 are in the pit 42 during the exchange procedure. To allow lateral movement along the rails 106 shown in Fig. 4, running wheels 120, on which the trucks 22 and 32 can run, are each mounted on a bracket 122, which can rotate about a vertical axis. To change the orientation of the running wheels 120 from the longitudinal direction (cf. truck 22 in Fig. 5) into the lateral direction (cf. truck 32 in Fig. 5) and vice versa, the truck 22 resp. 32 is raised by the vertical jacks 112. When the truck 22 resp. 32 is raised, its running wheels 120 can be rotated through 90°, thereby making it possible to choose between the longitudinal or lateral movement. The truck 22 resp. 32 is then lowered onto its running wheels 120, which locks the bracket 122 in the chosen direction of movement. Fig. 5 also shows that the runners 14, 36 are mounted in the trucks 22, resp. 32, with a circumferential gap 124. In fact, the runners 14 resp. 36 are mounted on sliding plates or running rods (not shown) inside the trucks 22 resp. 32 and are fixed to the latter only at one particular point (not shown) along their length. This type of mounting allows thermal expansion of the runner 14 resp. 36 during operation in front of the taphole 12.

[0025] Fig. 5 also shows in sectional view the construction of the lower bridge portion 34. More precisely, the lower bridge portion 34 comprises two longitudinal parallel girders 130, for example two steel beams. The girders 130 are joined together along their length by a plurality of upper 132 and lower 134 cross members, welded to the inner walls 136 of the girders 130. A space is provided between the girders 130 and the upper 132 and lower 134 cross members for the extension of the telescopic jack 80. The support wheels 92 for the jack 80 are guided and supported in sections 138 fixed to the inside of the portions 24, 34. The rails 40 are welded to the girders 130 immediately above their outer walls 140 for stability reasons. The upper bridge portion 24 has a similar construction. It will be understood that such a construction makes it possible to obtain an inclined bridge 26 that is strong, reliable and compact.

[0026] When the truck 22 supporting the runner 14 that is to be replaced has been raised and substituted by the truck 32 supporting the refurbished runner 36 on the rails 40 of the lower bridge portion 34, the latter is again raised in order to form the inclined bridge 26. Before the truck 34 is raised, the configuration is identical to that in Fig. 3 (except for the replaced runner and replaced truck). After the truck 32 has been raised by the telescopic jack 80, the configuration shown in Fig. 2 applies with corresponding changes.

[0027] Returning the upper 22 and lower 34 bridge portions into the horizontal position is performed by the first 62 or alternatively the second 72 actuator, the props 90 being moved away beforehand and the props 64 being deployed thereafter. When the operation of replacing the main runner 14 with the refurbished main runner 36 has been completed, the configuration of the handling device 20 corresponds again to that shown in Fig. 1, except that the new refurbished runner 36 is then in the operational position in front of the taphole 12.

[0028] Returning to Figures 1 and 2, it should be noted that the locking device 28 provides an important function. In fact, it ensures both that the main runner 14 is secured in front of the taphole 12 in the operational position and that, in the runner replacement configuration of the inclined bridge 26, the runner-supporting truck 22 remains unable to move on the upper bridge portion 24, which is then inclined.

[0029] Fig. 6 shows a vertical section of a preferred embodiment of the locking device 28, which more precisely comprises a locking piston 200 that slides in a guide 202 with reinforced walls 204. In the locked position, as shown in Fig. 6, the locking piston 200 is engaged with a hollow clamping ring 206 provided on a lowered member 208 of the runner-supporting truck 22, resp. 32. The mechanism for the handling device 28 is housed in a box 210, which is firmly attached to the upper bridge portion 24, preferably near the taphole 12. This mechanism comprises a hydraulic actuating jack 212 used to withdraw or alternatively introduce the locking piston 200 relative to the clamping ring 206. The actuating jack 212 is mounted on a support arm 214 in the box 210.

[0030] Fig. 7 shows the locking device 28 of Fig. 6 in a horizontal section along the line C-C in Fig. 6. It can be seen that the handling device 28 comprises an additional internal safety mechanism 216. More precisely, this mechanism 216 comprises a safety yoke 218 that can pivot on a hinge 220. The safety yoke engages in a groove 222 of the locking piston 200 in order to secure it, that is to say to ensure that unintentional withdrawal of the locking piston 200 out of the clamping ring 206 cannot occur. A lever 224 normally holds the safety yoke 218 in position engaged in the groove 222, with elastic pre-stress provided by a spring 226. The safety yoke is disengaged by a cam 228 that acts on a pusher 230 provided on the safety yoke 218 on the side facing the portion 24. This cam 228 is placed on the carrier head 82 of the telescopic jack 80. Preferably, two devices 28 are placed symmetrically on either side of the upper bridge portion 24 (with their accessories on the truck 22, 32, the portion 24 and the carrier head 82). Thus, it will be understood that the locking piston 200 can release the truck 22, resp. 32, only when the carrier head 82 is present, that is to say when the telescopic jack 80 is able to support the truck 22, resp. 32.

[0031] Finally, it remains to be added that end-of-travel switches are provided as an additional safety measure, preferably for all the moving elements or motors of the handling device for replacing a runner 20. These elements are in particular, the bridge portions 24 and 34, the carrier head 82, the locking device 28, the props 64 and 90, the vertical jacks 112, the winches 108 and the

actuators 62, 72. In the case of the telescopic jack 80, end-of-travel switches are preferably provided for each of its members, which incidentally allow its rate of retraction/extension to be uniformly controlled.

Claims

1. Servicing equipment for a blast furnace comprising a blast furnace runner (14) and a device (20) for replacing said runner by transporting it between an upper tapping floor level (16) and a lower service level (42), said device (20) being **characterized by**:

   an inclinable bridge (26) for supporting said runner (14) in an operational position in front of a taphole (12) of the blast furnace (10), said bridge (26),
   when in an inclined position, forming an inclined plane;
   means for moving said runner (14) along said inclined plane between said upper tapping floor level (16) and said lower service level (42);
   a locking device (28) for fixing the runner to the inclinable bridge.

2. Equipment according to Claim 1, wherein said inclinable bridge (26) comprises a lower bridge portion (34) and an upper bridge portion (24) that can pivot separately between an inclined runner replacement configuration and a non-inclined configuration, said lower bridge portion (34) and said upper bridge portion (24) being aligned in their inclined runner replacement configuration so as to form said inclined plane along which said runner (14) can be moved.

3. Equipment according to Claim 2, wherein said lower bridge portion (34) is supported pivotable, about a substantially horizontal axis at its end away from said taphole (12), between its inclined runner replacement configuration and its non-inclined configuration, for supporting said runner (14) at said lower service level (42), which allows the replacement of a runner (14) placed on said lower bridge portion (34).

4. Equipment according to Claim 2 or 3, wherein said upper bridge portion (24) is supported pivotable, about a substantially horizontal axis at its end close to said taphole (12), between its inclined runner replacement configuration and its non-inclined configuration, for supporting said runner (14) at said upper tapping floor level (16), in which said runner (14) placed on said upper bridge portion (24) is operational in front of said taphole (12) of the blast furnace (10).

5. Equipment according to any one of Claims 1 to 4, further comprising a truck (22) capable of supporting said runner (14) and movable along said inclinable bridge (26).

6. Equipment according to Claim 5, wherein said truck (22) is a rail vehicle and said inclinable bridge (26) includes rails (40) for guiding the movement of said vehicle along said inclinable bridge (26).

7. Equipment according to Claim 5 or 6, wherein said truck (22) includes wheels (120) mounted on a bracket (122) that can pivot about a vertical axis to change the orientation of said wheels (120) from longitudinal direction into lateral direction for moving said truck (22) in a lateral direction in a service area (100, 102) provided on either side of said inclinable bridge (26) at said lower service level (42).

8. Equipment according to Claim 5, 6 or 7, further comprising a drive means capable of moving said truck (22) along said inclinable bridge (26).

9. Equipment according to Claim 8, wherein said drive means comprises a hydraulic jack (80).

10. Equipment according to Claim 9, wherein:

    said inclinable bridge (26) comprises a lower bridge portion (34) and an upper bridge portion (24) that can pivot separately and that cooperate to form said inclined plane, and
    said hydraulic jack (80) comprises a jack body incorporated into said lower bridge portion (34) and a telescopic jack piston guided by guiding means (92, 138) arranged in said lower bridge portion (34) and in said upper bridge portion (24).

11. Equipment according to according to any one of Claims 1 to 10, comprising at least one hydraulic jack (72) for inclining said inclinable bridge (26) by rotation about at least one approximately horizontal axis.

12. Equipment according to Claim 11, wherein said inclinable bridge (26) includes at least one articulated prop (64; 90) used as a support for said inclinable bridge (26) in a non-inclined position and/or in said inclined position.

13. Equipment according to any one of Claims 1 to 12, comprising:

    a truck (22) capable of supporting said runner (14) and movable along said inclinable bridge (26);
    a locking device (28) for fixing said truck (22) to said inclinable bridge (26) in said operational position in front of said taphole (12).

14. Equipment according to Claim 13, comprising:

a hydraulic jack (80) including a carrier head (82) capable of engaging said truck (22) for driving the latter along said inclinable bridge (26); and
a safety mechanism (216) comprising means for securing said locking device (28), said means allowing a release of said locking device (28) only if said carrier head (82) engages said truck (22) in said operational position in front of said taphole (12).

15. Use of the servicing equipment according to any one of Claims 1 to 14 for replacing the main runner of a blast furnace.

16. Device for replacing a blast furnace runner by transporting it between an upper tapping floor level (16) and a lower service level (42), **characterized by**:

an inclinable bridge (26) comprising an upper bridge portion (24) and a lower bridge portion (34);
said upper bridge portion (24) being supported pivotable, about a substantially horizontal axis at its end close to a taphole (12) of the blast furnace (10),
between a non-inclined configuration, for supporting said runner (14) in an operational position in front of said taphole (12) at said tapping floor level (16), and an inclined runner replacement configuration;
said lower bridge portion (34) being supported pivotable, about a substantially horizontal axis at its end away from said taphole (12), between a non-inclined configuration, for supporting said runner (14) at said service level (42), and an inclined runner replacement configuration;
said lower bridge portion (34) and said upper bridge portion (24) being aligned in their inclined runner replacement configuration so as to form a continuous inclined plane along which said runner (14) can be moved for transporting it between said upper tapping floor level (16) and said lower service level (42).

Patentansprüche

1. Vorrichtung zum Service eines Hochofens, aufweisend einen Hochofenläufer (14) und eine Vorrichtung (20) zum Ersetzen des Läufers durch dessen Beförderung zwischen einer oberen Abstichbodenebene (16) und einer unteren Serviceebene (42), wobei die Vorrichtung (20) **gekennzeichnet ist durch**:

eine neigbare Brücke (26) zum Tragen des Läufers (14) in einer Betriebsposition vor einem Abstichloch (12) des Hochofens (10), wobei die Brücke (26) in einer geneigten Position eine schiefe Ebene bildet;
Mittel zum Verschieben des Läufers (14) entlang der schiefen Ebene zwischen der oberen Abstichbodenebene (16) und der unteren Serviceebene (42);
eine Verriegelungsvorrichtung (28) zum Befestigen des Läufers an der neigbaren Brücke.

2. Vorrichtung nach Anspruch 1, wobei die neigbare Brücke (26) einen unteren Brückenabschnitt (34) und einen oberen Brückenabschnitt (24) aufweist, die getrennt zwischen einer geneigten Läuferersatzkonfiguration und einer nicht geneigten Konfiguration verschwenkbar sind, wobei der untere Brückenabschnitt (34) und der obere Brückenabschnitt (24) in ihrer geneigten Läuferersatzkonfiguration so ausgerichtet sind, dass sie die schiefe Ebene bilden, entlang welcher der Läufer (14) verschiebbar ist.

3. Vorrichtung nach Anspruch 2, wobei der untere Brückenabschnitt (34) um eine im Wesentlichen horizontale Achse an seinem dem Abstichloch (12) abgewandten Ende zwischen seiner geneigten Läuferersatzkonfiguration und seiner nicht geneigten Konfiguration verschwenkbar gelagert ist, um den Läufer (14) auf der unteren Serviceebene (42) zu tragen, wodurch der Ersatz eines auf dem unteren Brückenabschnitt (34) angeordneten Läufers (14) ermöglicht wird.

4. Vorrichtung nach Anspruch 2 oder 3, wobei der obere Brückenabschnitt (24) um eine im Wesentlichen horizontale Achse an seinem dem Abstichloch (12) nahen Ende zwischen seiner geneigten Läuferersatzkonfiguration und seiner nicht geneigten Konfiguration verschwenkbar gelagert ist, um den Läufer (14) auf der oberen Abstichbodenebene (16), in der der auf dem oberen Brückenabschnitt (24) angeordnete Läufer (14) vor dem Abstichloch (12) des Hochofens (10) betriebsbereit ist, zu tragen.

5. Vorrichtung nach einem der Ansprüche 1 bis 4, ferner aufweisend einen Förderwagen (22), der den Läufer (14) tragen kann und entlang der neigbaren Brücke (26) verschiebbar ist.

6. Vorrichtung nach Anspruch 5, wobei der Förderwagen (22) ein Schienenfahrzeug ist und die neigbare Brücke (26) Schienen (40) aufweist, um die Verschiebung des Fahrzeugs entlang der neigbaren Brücke (26) zu führen.

7. Vorrichtung nach Anspruch 5 oder 6, wobei der Förderwagen (22) Räder (120) umfasst, die an einer Halterung (122) angebracht sind, die um eine verti-

kale Achse verschwenkbar ist, um die Ausrichtung der Räder (120) von der Längsrichtung in eine seitliche Richtung zum Verschieben des Förderwagens (22) in seitlicher Richtung in einem Servicebereich (100, 102) zu verändern, der auf der unteren Serviceebene (42) beidseitig der neigbaren Brücke (26) vorgesehen ist.

8. Vorrichtung nach Anspruch 5, 6 oder 7, ferner aufweisend Antriebsmittel, die in der Lage sind, den Förderwagen (22) entlang der neigbaren Brücke (26) zu bewegen.

9. Vorrichtung nach Anspruch 8, wobei die Antriebsmittel eine hydraulische Winde (80) aufweisen.

10. Vorrichtung nach Anspruch 9, wobei:

die neigbare Brücke (26) einen unteren Brükkenabschnitt (34) und einen oberen Brückenabschnitt (24) aufweist, die getrennt verschwenkbar sind und zusammenwirken, um die schiefe Ebene zu bilden, und
die hydraulische Winde (80) einen Windenkörper, der in dem unteren Brückenabschnitt (34) eingebracht ist, und einen teleskopischen Windenkolben aufweist, der von Führungsmitteln (92, 138) geführt wird, die in dem unteren Brükkenabschnitt (34) und in dem oberen Brückenabschnitt (24) angeordnet sind.

11. Vorrichtung nach einem der Ansprüche 1 bis 10, aufweisend mindestens eine hydraulische Winde (72) zum Neigen der neigbaren Brücke (26) durch Drehung um mindestens eine in etwa horizontale Achse.

12. Vorrichtung nach Anspruch 11, wobei die neigbare Brücke (26) mindestens eine angelenkte Strebe (64; 90) umfasst, die als eine Stütze für die neigbare Brücke (26) in einer nicht geneigten Position und/oder in der geneigten Position dient.

13. Vorrichtung nach einem der Ansprüche 1 bis 12, aufweisend:

einen Förderwagen (22), der den Läufer (14) tragen kann und entlang der neigbaren Brücke (26) beweglich ist;
eine Verriegelungsvorrichtung (28) zum Befestigen des Förderwagens (22) an der neigbaren Brücke (26) in der Betriebsposition vor dem Abstichloch (12).

14. Vorrichtung nach Anspruch 13, aufweisend:

eine hydraulische Winde (80), umfassend einen Trägerkopf (82), der mit dem Förderwagen (22) in Eingriff kommen kann, um diesen entlang der neigbaren Brücke (26) anzutreiben; und
einen Sicherheitsmechanismus (216), aufweisend Mittel zum Sichern der Verriegelungsvorrichtung (28), wobei die Mittel ein Lösen der Verriegelungsvorrichtung (28) nur dann ermöglichen, wenn der Trägerkopf (82) mit dem Förderwagen (22) in der Betriebsposition vor dem Abstichloch (12) im Eingriff ist.

15. Verwendung der Vorrichtung zum Service nach einem der Ansprüche 1 bis 14 zum Ersetzen des Hauptläufers eines Hochofens.

16. Vorrichtung zum Ersetzen eines Hochofenläufers durch dessen Beförderung zwischen einer oberen Abstichbodenebene (16) und einer unteren Serviceebene (42), **gekennzeichnet durch**:

eine neigbare Brücke (26), aufweisend einen oberen Brückenabschnitt (24) und einen unteren Brükkenabschnitt (34);
wobei der obere Brückenabschnitt (24) um eine im Wesentlichen horizontale Achse an seinem einem Abstichloch (12) des Hochofens (10) nahen Ende zwischen einer nicht geneigten Konfiguration zum Tragen des Läufers (14) in einer Betriebsposition vor dem Abstichloch (12) auf der Abstichbodenebene (16) und einer geneigten Läuferersatzkonfiguration verschwenkbar gelagert ist;
wobei der untere Brückenabschnitt (34) um eine im Wesentlichen horizontale Achse an seinem dem Abstichloch (12) abgewandten Ende zwischen einer nicht geneigten Konfiguration, um den Läufer (14) auf der unteren Serviceebene (42) zu tragen, und einer geneigten Läuferersatzkonfiguration verschwenkbar gelagert ist;
wobei der untere Brückenabschnitt (34) und der obere Brückenabschnitt (24) in ihrer geneigten Läuferersatzkonfiguration so ausgerichtet sind, dass sie eine kontinuierliche schiefe Ebene bilden, entlang welcher der Läufer (14) zu dessen Beförderung zwischen der oberen Abstichbodenebene (16) und der unteren Serviceebene (42) beweglich ist.

Revendications

1. Équipement d'entretien pour un haut-fourneau comprenant un canal de coulée (14) de haut-fourneau et un dispositif (20) pour remplacer ledit canal de coulée en transportant celui-ci entre un niveau de sol supérieur de coulée (16) et un niveau inférieur d'entretien (42), ledit dispositif (20) étant **caractérisé par** :

un pont inclinable (26) pour supporter ledit canal

de coulée (14) dans une position opérationnelle devant un trou de coulée (12) du haut-fourneau (10), ledit pont (26), lorsqu'il est dans une position inclinée, formant un plan incliné ;
un moyen pour déplacer ledit canal de coulée (14) le long dudit plan incliné entre ledit niveau de sol supérieur de coulée (16) et ledit niveau inférieur d'entretien (42) ;
un dispositif de verrouillage (28) pour fixer le canal de coulée sur le pont inclinable.

2. Équipement selon la revendication 1, dans lequel ledit pont inclinable (26) comprend une partie inférieure de pont (34) et une partie supérieure de pont (24) qui peuvent pivoter séparément entre une configuration inclinée de remplacement de canal de coulée et une configuration non inclinée, ladite partie inférieure de pont (34) et ladite partie supérieure de pont (24) étant alignées dans leur configuration inclinée de remplacement de canal de coulée de façon à former ledit plan incliné le long duquel ledit canal de coulée (14) peut être déplacé.

3. Équipement selon la revendication 2, dans lequel ladite partie inférieure de pont (34) est supportée de manière pivotante, autour d'un axe sensiblement horizontal à son extrémité à l'écart dudit trou de coulée (12), entre sa configuration inclinée de remplacement de canal de coulée et sa configuration non inclinée, pour supporter ledit canal de coulée (14) audit niveau inférieur d'entretien (42), ce qui permet le remplacement d'un canal de coulée (14) placé sur ladite partie inférieure de pont (34).

4. Équipement selon la revendication 2 ou 3, dans lequel ladite partie supérieure de pont (24) est supportée de manière pivotante, autour d'un axe sensiblement horizontal à son extrémité à proximité dudit trou de coulée (12), entre sa configuration inclinée de remplacement de canal de coulée et sa configuration non inclinée, pour supporter ledit canal de coulée (14) audit niveau de sol supérieur de coulée (16), dans lequel ledit canal de coulée (14) placé sur ladite partie supérieure de pont (24) est opérationnel devant ledit trou de coulée (12) du haut-fourneau (10).

5. Équipement selon l'une quelconque des revendications 1 à 4, comprenant en outre un chariot (22) apte à supporter ledit canal de coulée (14) et mobile le long dudit pont inclinable (26).

6. Équipement selon la revendication 5, dans lequel ledit chariot (22) est un véhicule sur rails et ledit pont inclinable (26) inclut des rails (40) pour guider le mouvement dudit véhicule le long dudit pont inclinable (26).

7. Équipement selon la revendication 5 ou 6, dans lequel ledit chariot (22) inclut des roues (120) montées sur un support (122) qui peut pivoter autour d'un axe vertical pour changer l'orientation desdites roues (120) d'un sens longitudinal vers un sens latéral pour déplacer ledit chariot (22) dans un sens latéral dans une zone d'entretien (100, 102) prévue sur l'un ou l'autre côté dudit pont inclinable (26) au niveau dudit niveau inférieur d'entretien (42).

8. Équipement selon la revendication 5, 6 ou 7, comprenant en outre un moyen d'entraînement apte à déplacer ledit chariot (22) le long dudit pont inclinable (26).

9. Équipement selon la revendication 8, dans lequel ledit moyen d'entraînement comprend un vérin hydraulique (80).

10. Équipement selon la revendication 9, dans lequel :

ledit pont inclinable (26) comprend une partie inférieure de pont (34) et une partie supérieure de pont (24) qui peuvent pivoter séparément et qui coopèrent pour former ledit plan incliné, et
ledit vérin hydraulique (80) comprend un corps de vérin incorporé dans ladite partie inférieure de pont (34) et un piston télescopique de vérin guidé par un moyen de guidage (92, 138) agencé dans ladite partie inférieure de pont (34) et dans ladite partie supérieure de pont (24).

11. Équipement selon l'une quelconque des revendications 1 à 10, comprenant au moins un vérin hydraulique (72) pour incliner ledit pont inclinable (26) par rotation autour d'au moins un axe approximativement horizontal.

12. Équipement selon la revendication 11, dans lequel ledit pont inclinable (26) inclut au moins un montant articulé (64 ; 90) utilisé comme un support pour ledit pont inclinable (26) dans une position non inclinée et/ou dans ladite position inclinée.

13. Équipement selon l'une quelconque des revendications 1 à 12, comprenant :

un chariot (22) apte à supporter ledit canal de coulée (14) et mobile le long dudit pont inclinable (26) ;
un dispositif de verrouillage (28) pour fixer ledit chariot (22) sur ledit pont inclinable (26) dans ladite position opérationnelle devant ledit trou de coulée (12).

14. Équipement selon la revendication 13, comprenant :

un vérin hydraulique (80) incluant une tête de transport (82) apte à engager ledit chariot (22)

pour entraîner ce dernier le long dudit pont inclinable (26) ; et
un mécanisme de sécurité (216) comprenant un moyen pour fixer ledit dispositif de verrouillage (28), ledit moyen ne permettant une libération dudit dispositif de verrouillage (28) que si ladite tête de transport (82) engage ledit chariot (22) dans ladite position opérationnelle devant ledit trou de coulée (12).

15. Utilisation de l'équipement d'entretien selon l'une quelconque des revendications 1 à 14 pour remplacer le canal de coulée principal d'un haut-fourneau.

16. Dispositif de remplacement d'un canal de coulée de haut-fourneau en transportant celui-ci entre un niveau de sol supérieur de coulée (16) et un niveau inférieur d'entretien (42), **caractérisé par** :

un pont inclinable (26) comprenant une partie supérieure de pont (24) et une partie inférieure de pont (34) ;
ladite partie supérieure de pont (24) étant supportée de manière pivotante, autour d'un axe sensiblement horizontal à son extrémité à proximité d'un trou de coulée (12) du haut-fourneau (10), entre une configuration non inclinée, pour supporter ledit canal de coulée (14) dans une position opérationnelle devant ledit trou de coulée (12) au niveau dudit niveau de sol de coulée (16), et une configuration inclinée de remplacement de canal de coulée ;
ladite partie inférieure de pont (34) étant supportée de manière pivotante, autour d'un axe sensiblement horizontal à son extrémité à l'écart dudit trou de coulée (12), entre une configuration non inclinée, pour supporter ledit canal de coulée (14) au niveau dudit niveau d'entretien (42), et une configuration inclinée de remplacement de canal de coulée ,
ladite partie inférieure de pont (34) et ladite partie supérieure de pont (24) étant alignées dans leur configuration inclinée de remplacement de canal de coulée de façon à former un plan incliné continu le long duquel ledit canal de coulée (14) peut être déplacé pour transporter celui-ci entre ledit niveau de sol supérieur de coulée (16) et ledit niveau inférieur d'entretien (42).

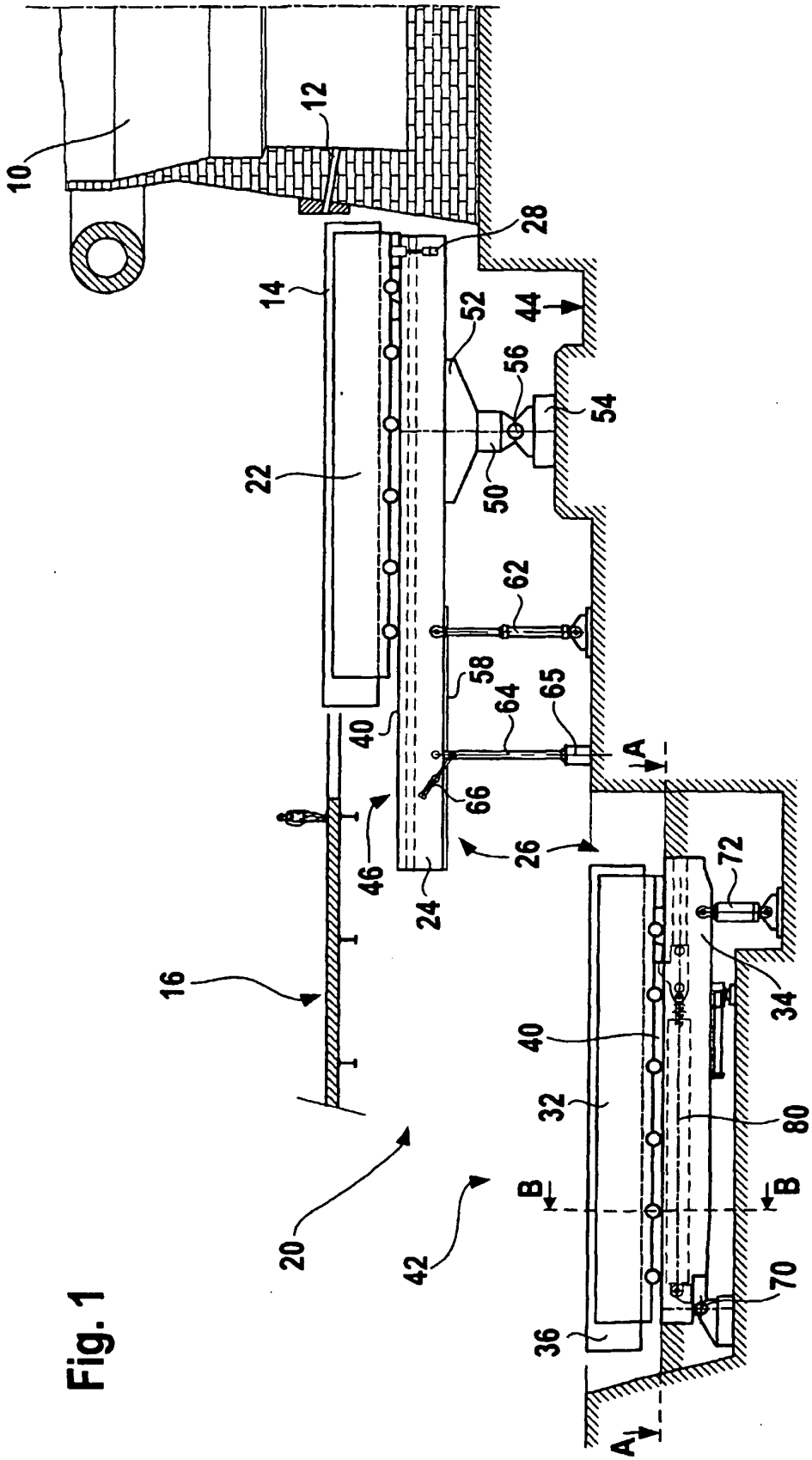
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Fig. 1

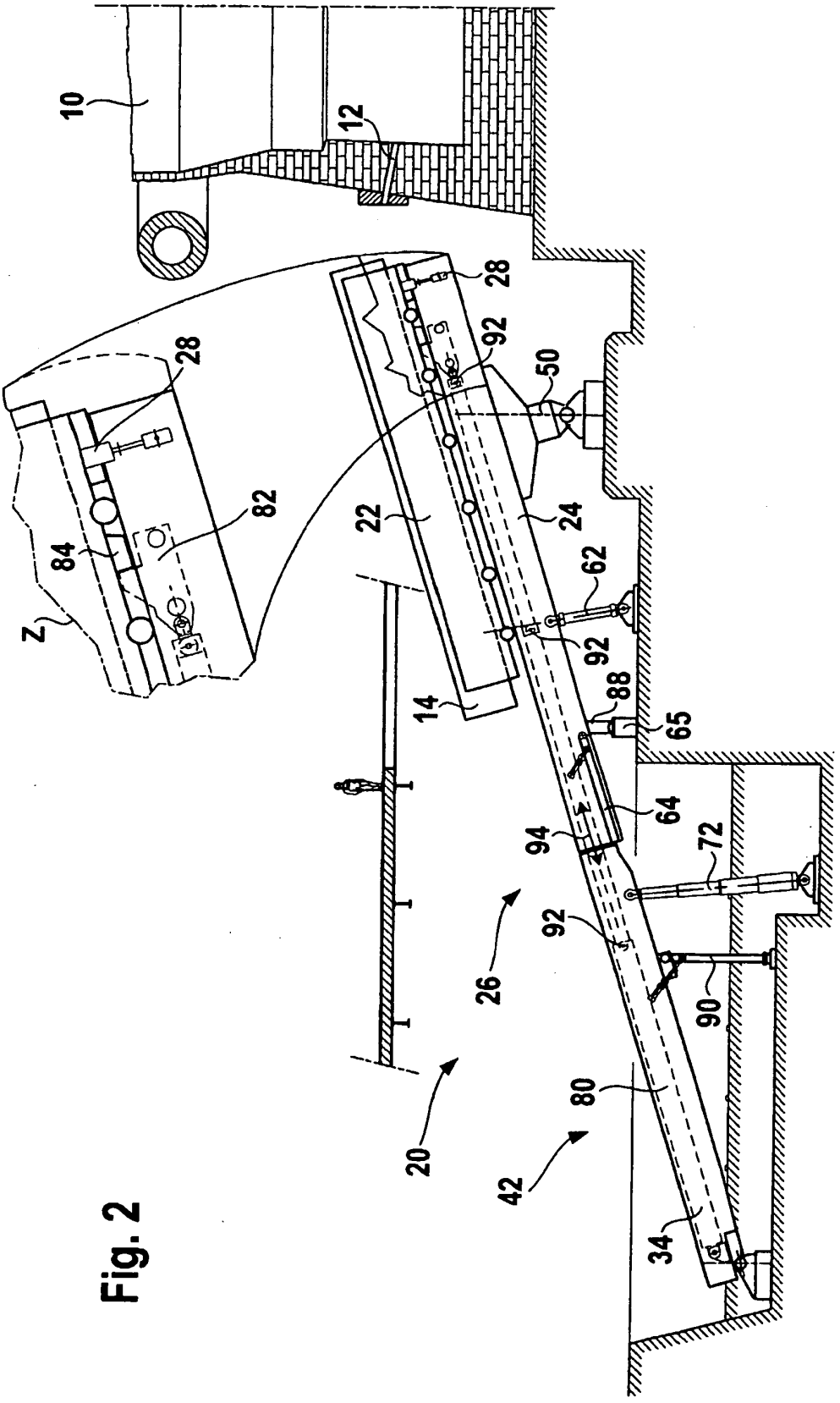
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Fig. 2

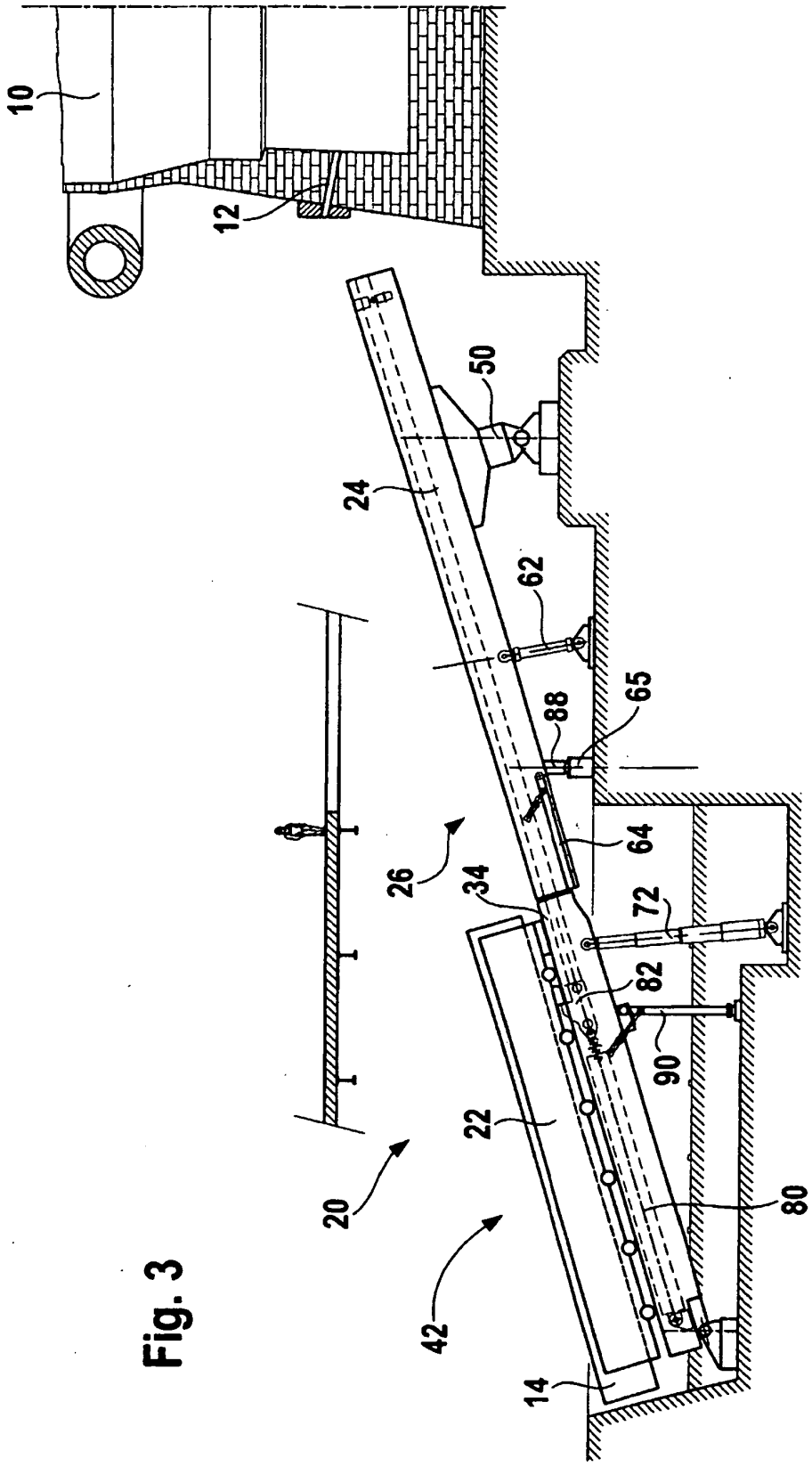
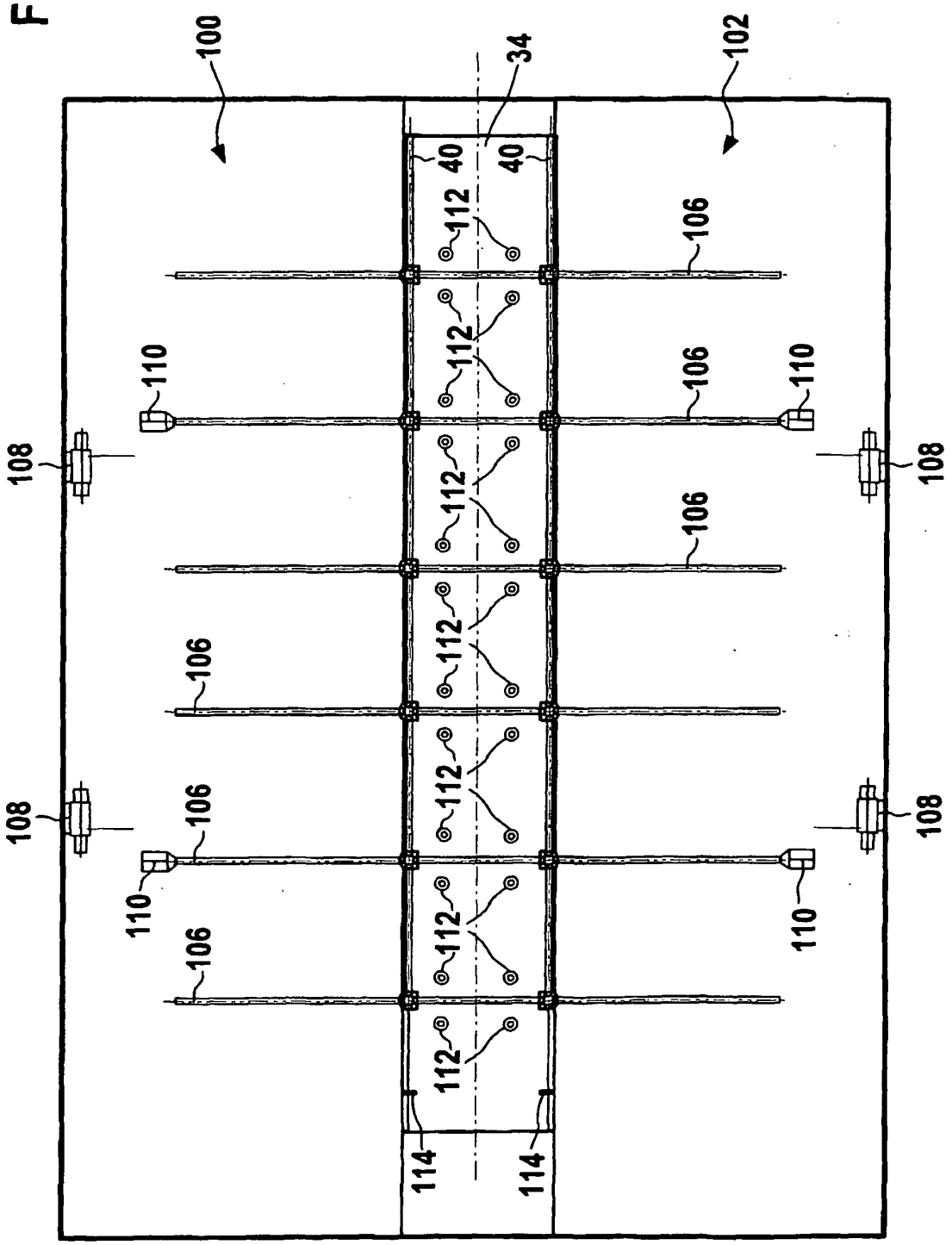


Fig. 3

Fig. 4



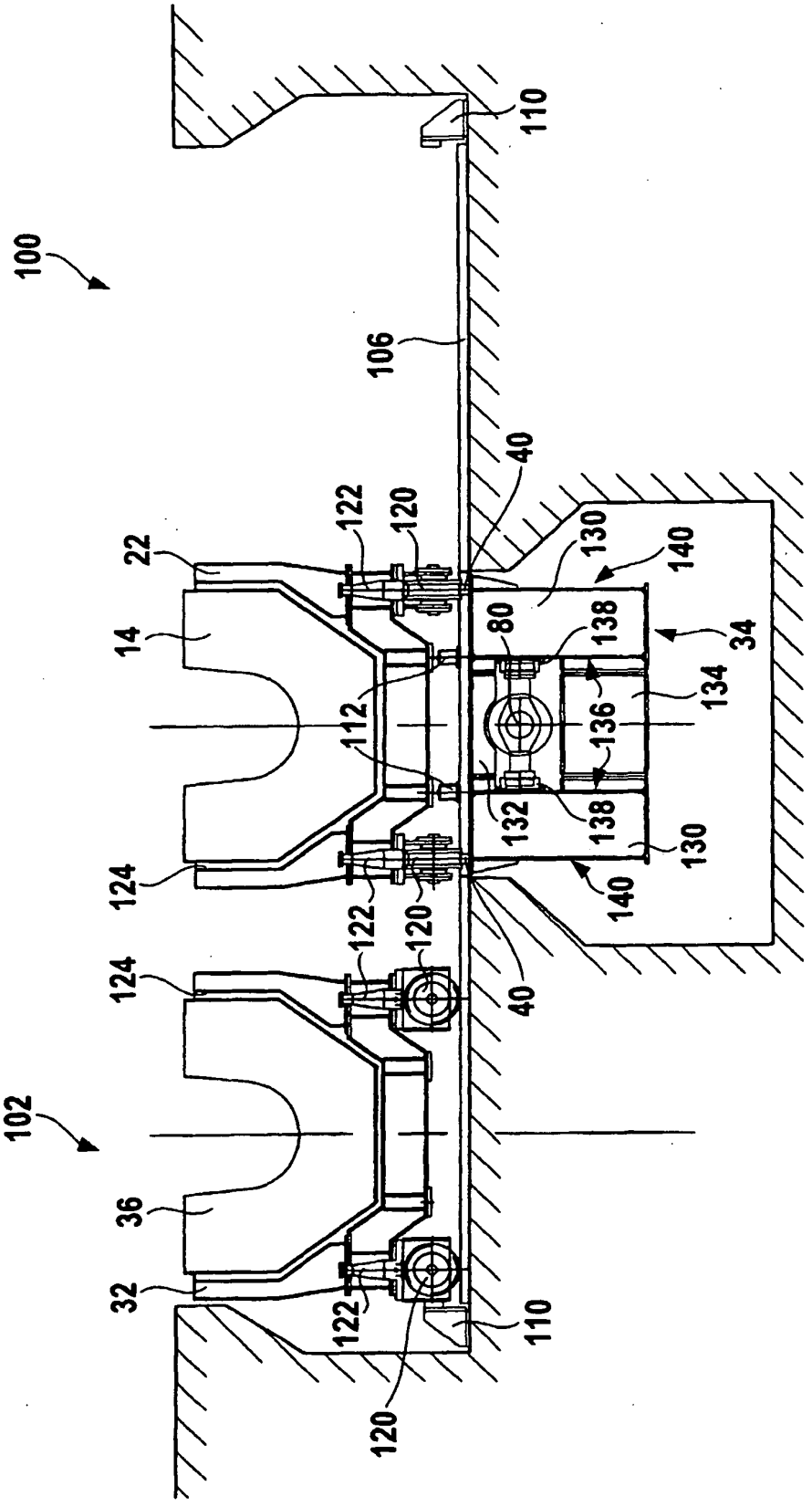

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Fig. 5

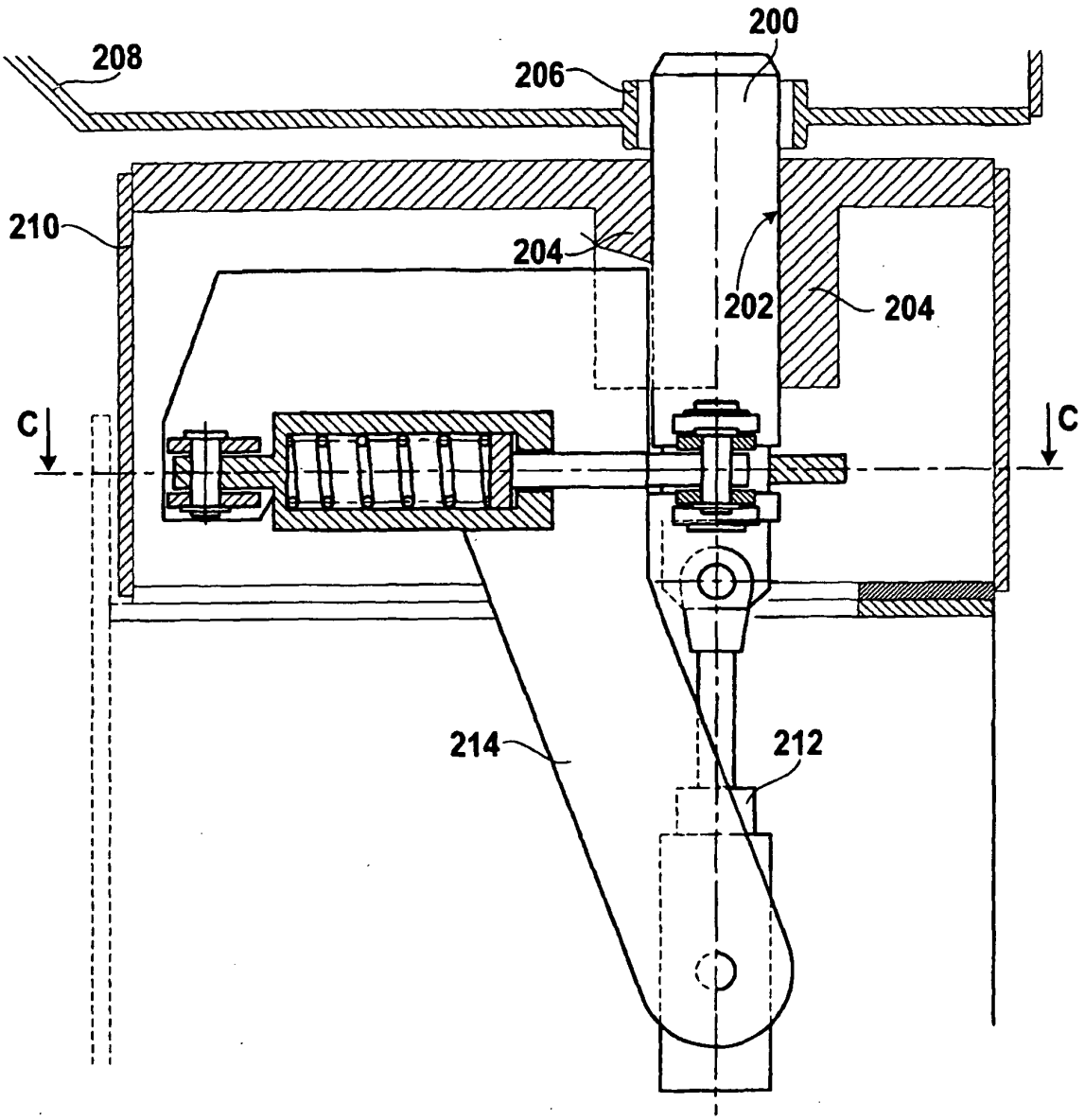

Fig. 6

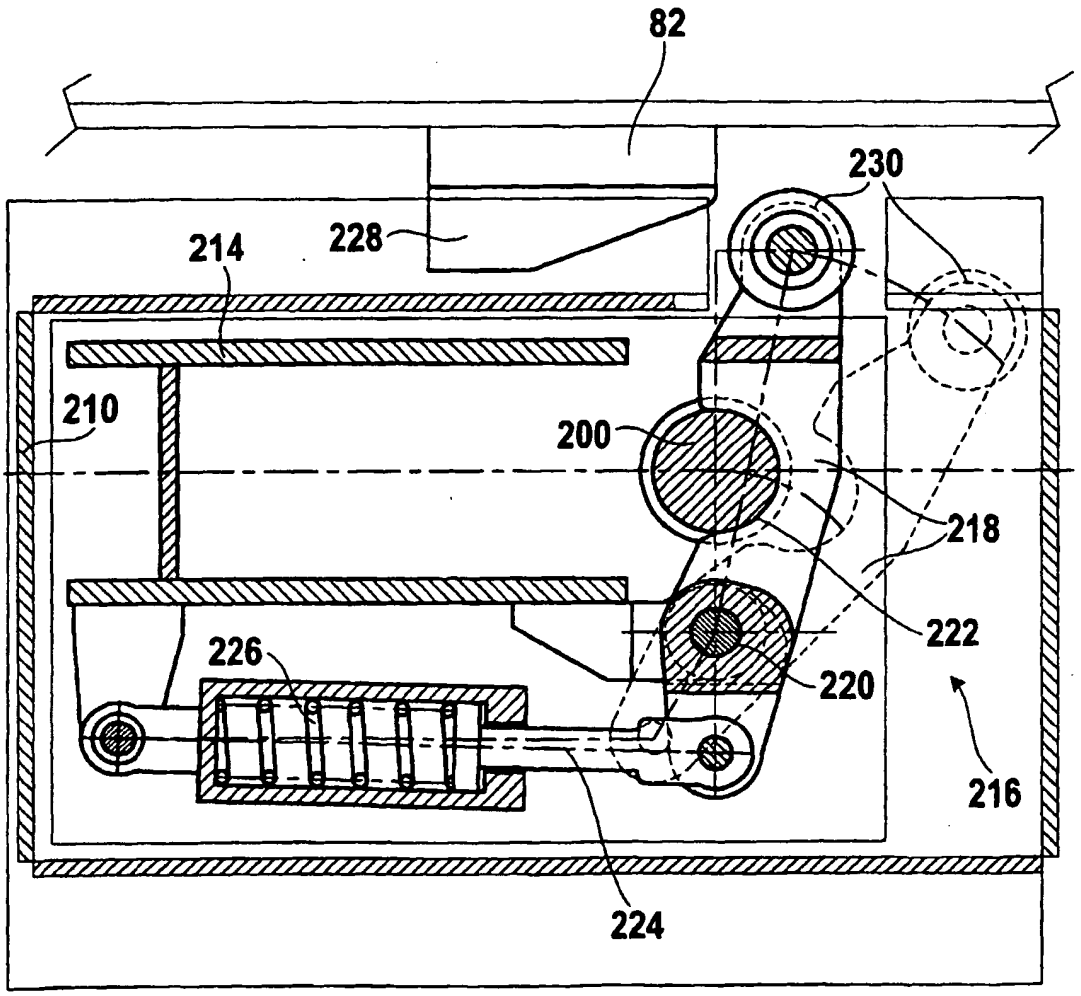

Fig. 7

REFERENCES CITED IN THE DESCRIPTION

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