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(54) **Operating unit for a roll forming machine**

Bedieneinheit für eine Rollumformmaschine

Unité de commande pour une machine de formage à rouleaux

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Description

[0001] The subject of the present invention is an operating unit for a roll forming machine.

[0002] A roll forming machine comprises substantially a series of cages, arranged in succession, each of which comprises at least two profiling rollers. These cages are configured for progressively bending a strip of steel around a longitudinal axis until they confer thereon a desired transverse section, which can even be tubular. The bending of the sheet is performed by passing the sheet itself between the rollers of various cages which, by contact, progressively deform it. The strip slides continuously through the cages, being progressively deformed.

[0003] The rollers of each cage are mounted on rotating shafts which are rotatably connected to uprights, also called shoulders, which, in turn, are fixed onto a base. This base is arranged on a fixed bed to which it is removably constrained.

[0004] Each section which it is desired to produce requires a series of profiled rollers whose characteristics are determined by the shape and dimensions of the section itself.

[0005] At each change of production it is necessary to carry out a partial or total replacement of the entire series of shaped rollers in the various cages. This operation, which must be carried out with the line stopped, requires a considerable time for its execution.

[0006] To allow an increase in the speed of operations of changing rollers, cages are currently available in which the rollers are connected to a support structure, also called a stack, which can be removed from and refitted to the cage as a unit. This essentially makes it possible to move all the rollers in a cage as a unit. **Examples of prior art devices are known from documents** EP 2520380**,** which forms the basis for the preamble of claim 1, **and** US 5887472**.**

[0007] These cages of known type require the stacks to be removed and repositioned with a movement which, at least in part, is in a vertical direction. In substance, the stacks must be lifted vertically to a certain height both to be removed, and to be refitted. In larger format production lines, the lifting height of the stack can reach considerable values. This implies that for performing stack changing operations, overhead cranes of considerable dimensions and load capacity are necessary, as well as very high sheds. Furthermore, operations performed by means of overhead cranes of their nature have a certain slowness.

[0008] An object of the present invention is to offer an operating unit for a roll forming machine which allows operations of changing the rollers to be speeded up.

[0009] One advantage of the operating unit according to the present invention is that it allows the rollers of each cage to be moved as a unit and on a substantially horizontal plane of movement, without requiring the rollers to be lifted above their own cage.

[0010] Another advantage of the operating unit according to the present invention is that it allows the distance between the rollers to be adjusted rapidly and precisely.

[0011] Another advantage of the operating unit according to the present invention is that it allows a roll-forming machine to be made in which the rollers can be moved easily along the processing line, without requiring the presence of an overhead crane for changing the equipment.

[0012] Further characteristics and advantages of the present invention will become clear from the following detailed description of an embodiment of the invention in question, illustrated by way of non-limiting example in the attached drawings, in which:

- figure 1 shows a schematic axonometric view of an operating unit according to the present invention, in a first operating configuration;
- figure 2 shows the operating unit of figure 1 in a second operating configuration;
- figure 3 shows a part of the operating unit according to the present invention, on an enlarged scale compared with figures 1 and 2;
- figure 4 shows another part of the operating unit according to the present invention, on an enlarged scale compared with figures 1 and 2;
- figure 5 shows a set of components of the operating unit according to the present invention;
- figure 6 shows a view in section, taken on a vertical plane containing the axes of rotation of rollers R1,R2;
- figure 7 shows a view of a part of the operating unit according to the present invention;
- figures 8 and 9 shows the set of components of figure 5, from a different angle;
- figure 10 shows a detail of the set of components of figure 9.

[0013] The operating unit comprises a cage (10), configured for being constrained to a base (B). Preferably the cage (10) comprises two pairs of uprights (11,12) connected together by a plurality of crosspieces.

[0014] The operating unit comprises furthermore a movable support structure, or stack, (G), comprising at least two rollers (R1,R2), rotatable around horizontal and parallel axes (X1,X2). The axes of rotation of the rollers (R1,R2) are arranged perpendicular to a direction of advancement (A) of the roll forming machine. The axes of rotation of the rollers (R1,R2) lie furthermore on a vertical plane perpendicular to the direction of advancement (A) of the roll forming machine.

[0015] The stack (G) comprises an upper support (21), configured for rotatably supporting a first roller (R1). The upper support (21) is connected to the ends of the first roller (R1) by rotating coupling means, preferably bearings. In a preferred embodiment, the upper support (21) comprises two supports (21), each connected to a respective end of the first roller (R1).

[0016] The stack (G) comprises furthermore a lower support (22), configured for rotatably supporting a second roller (R2). The upper support (22) is connected to

the ends of the first roller (R2) by rotating coupling means, preferably bearings. The second support (22), too, comprises preferably two supports (22) connected to the ends of the second roller (R2).

[0017] The stack (G) is furthermore provided with an intermediate support (23), interposed between the upper support (21) and the lower support (22). Preferably the intermediate support (23) comprises two supports (23) each of which is interposed between an upper support (21) and a lower support (22).

[0018] The upper supports (21), the lower supports (22) and the intermediate supports (23) are constrained to each other with the sole possibility of vertically translating with respect to each other, through a predetermined travel. The supports (21,22,23) are constrained to each other by slidable coupling means along a vertical direction. In particular, these coupling means comprise at least two prismatic bodies (31,32), each of which is oriented with a longitudinal axis thereof arranged vertically and is slidable in a vertical direction in its own housing (21s,22s,23s), distributed over the supports (21,22,23). In other words, each housing (21s,22s,23s) comprises a section integral with the upper support (21), a section integral with the intermediate support (23) and a section integral with the lower support (22).

[0019] A first prismatic body (31) connects together the intermediate support (23), the upper support (21) and the lower support (22) on one side of the rollers (R1,R2).

[0020] A second prismatic body (32) connects together the intermediate support (23), the upper support (21) and the lower support (22) on the opposite side of the rollers (R1,R2).

[0021] Each prismatic body (31,32) comprises at least one end stop (31a,32a), configured for limiting the movement of the lower support (22) in a downward direction. In the embodiment illustrated, the end stops (31a,32a) are in the form of nuts screwed onto a lower end of the prismatic bodies (31,32). Preferably, the prismatic bodies (31,32) are provided also with a second end stop (31b, 32b), configured for limiting the movement of the upper support (21) in an upward direction.

[0022] The coupling means (31,32) ensure that, during stack changing operations, the upper, lower and lateral support or supports (21,22,23) cannot perform reciprocal movements directed along a horizontal plane. This means that the stack can be moved on a horizontal plane and/or can be raised as a single unit, without forcing the operator to act on each individual support.

[0023] In a preferred embodiment, both the first prismatic body (31), and the second prismatic body (32) each comprise a pair of vertical cylindrical elements, to which are slidably coupled the upper supports (21), the lower supports (22) and the intermediate supports (23).

[0024] The upper support (21) and the lower support (22) are movable between a working position, in which they are spaced apart from the intermediate support (23), and a changing position, in which they are in contact with the intermediate support (23). In particular, in the changing position the upper support (21) rests on the intermediate support (23) which, in turn, rests on the lower support (22). In the changing position, the upper and lower supports (21,22), and with them the rollers (R1,R2) to which they are connected, can be moved as a single block on a horizontal plane. The prismatic bodies (31,32) in fact prevent relative movements between the supports (21,22,23) directed along a horizontal plane. In the event of lifting the stack, gripping can be effected at the upper support (21). The lower support (22) rests on its end stops (31a,32a) and is retained by them. The intermediate supports (23), in turn, rest on the lower support (22).

[0025] The possibility of moving the stack (G) as a single unit represents significant progress compared with the state of the art, since it makes it possible to drastically reduce the times necessary for effecting stack changes. This applies, obviously, in the case where each support (21,22,23) comprises two supports (21,22,23), as shown in the drawings.

[0026] Preferably the coupling means (31,32) comprise at least two centring elements (33,34), connected to the intermediate support (23). These centring elements face respectively towards the upper support and towards the lower support and are structural for customized insertion, i.e. with extremely limited clearance, in respective housings formed in the upper support and the lower support. This occurs in the position for changing the supports (21,22,23), so that, in this position, the supports (21,22,23) are perfectly aligned with each other on a horizontal plane and constrained together with respect to movements on a horizontal plane. The presence of coupling means (33,34) makes it possible to maintain greater clearance between the prismatic bodies (31,32) and their housings, to favour the movement of the supports (21,22,23) between the working and changing configurations.

[0027] The upper support or supports (21) are movable between the working position and the changing position by means of actuating means (M1), comprising for example jacks and/or hydraulic or electric cylinders. In particular, each upper support (21) is connected to an actuating means (M1) which, in turn, is constrained to the cage (10), precisely at an upper crosspiece of the cage (10) itself. The actuating means (M1), therefore, are configured for raising or lowering the upper supports (21) with respect to the cage (10). Preferably the actuating means (M1) are connected to a section (P) arranged horizontally and perpendicularly to the direction of advancement (A). Each upper support (21) is connected to the section (P) with only the freedom of sliding along a direction horizontal and perpendicular to the direction of advancement (A). In other words, each upper support (21) is constrained to the section (P) with respect to movements in a vertical direction. This entails that, in the working position, the upper supports are supported by the section (P) and by the actuating means (M1) which are integral with the cage (10).

[0028] In the same way the lower support or supports

(22) are movable between the working position and the changing position by means of actuating means (M2), which also in this case comprise for example jacks and/or hydraulic or electric cylinders. In particular, each lower support (22) is connected to an actuating means (M2) which, in turn, is constrained to the cage (10), precisely at a lower crosspiece of the cage (10) itself. The actuating means (M2), therefore, are configured for raising or lowering the lower supports (22) with respect to the cage (10).

[0029] The intermediate support (23) is structured so as to be able to slide in a transverse direction (Y), perpendicular to the direction of advancement (A) of the roll forming machine. In particular, the intermediate support or supports (23) each have at least one coupling body (23a) designed to be slidably inserted into a guide (24) integral with the cage (10) and located horizontally along the transverse direction (Y). Between each coupling body (23a) and its guide (24) there is clearance which allows a limited vertical movement of the intermediate support (23). In the working position, the intermediate supports (23) are thus supported by the guides (24) which are integral with the cage (10). Preferably each guide (24) is formed along a profile (13) which is integral with the uprights (11,12).

[0030] The operating unit according to the present invention is furthermore equipped with a guide device (40), configured for guiding the stack (G) along the transverse direction (Y) between an inner or working position and an outer position which allows the operator to operate on the stack. In the inner position, the stack (G) is arranged substantially inside the cage and is aligned with the direction of advancement (A) of the roll forming machine. In the outer position, the stack (G) is arranged beside the cage (10), at a certain distance therefrom, in a position in which it is accessible to the operator in substantially complete manner. In the outer position the stack (G) can furthermore be distanced from the cage (10) itself, for maintenance operations or to be replaced.

[0031] In a preferred embodiment, the guide device comprises a track (40), arranged below the lower supports (22). This track (40) is structured to support the weight of the stack (G) at the lower supports (22). To this end, the lower supports (22) are provided underneath with sliding means (22a), in the form for example of rollers or skids. Preferably the track (40) comprises a pair of rails, along which the stack (G) can translate.

[0032] The track (40) is vertically movable between a lower position and an upper position. The track (40) is kept in its lower position during the stages of producing and processing the section bar. The track (40) moves to its upper position during the stages of changing the stack (G). In the upper position, the track (40) supports the stack (G) at the lower supports (22).

[0033] Starting from an initial working configuration, in which the upper and lower supports (21,22) are in their working position and the stack (G) is in the inner position, removal of the stack (G) is performed through the following stages.

[0034] Initially the upper supports (21) and the lower supports (22) move from the working position to the changing position when operated by their actuating means (M1,M2). In particular, the upper supports (21) are lowered, supported during the movement by their actuators (M1), while the lower supports (22) are raised until they come into contact with the intermediate supports (23). The lower supports (22) slightly lift the intermediate supports (23) with respect to the guides (24), as far as is permitted by the clearance between the guides (24) and the coupling bodies (23a). As already mentioned, at the end of the movements the upper supports (21) and the intermediate supports (23) rest on the lower supports (22). The movement of the upper and lower supports takes place preferably simultaneously, although the two movements could take place in sequence.

[0035] Once the upper and lower supports (21,22) have reached the changing position, the track (40) lifts from the lower position to the upper position, coming into contact with the lower supports (22). The weight of the entire stack (G), in these conditions, is supported by the track (40), so that it can be translated from the inner position to the outer position. The relocation of the stack (G) in the inner position can be effected through a sequence of movements and operations which are the reverse of those described.

[0036] It should be noted that the height of the guides (24), and therefore of the transverse direction (Y) of movement of the stack (G) between the inner and outer position, remains constant. In the event of changing the stack (G) with a stack equipped with rollers (R1,R2) of larger diameter, the larger overall dimensions in height of the rollers (R1,R2) themselves can be compensated for by lowering the position of the lower support (22) and raising the position of the upper support (21). Vice versa, in the case of a stack fitted with rollers of smaller diameter, the smaller overall dimensions in height of the rollers (R1,R2) can be compensated for by raising the position of the lower support (22) and lowering the position of the upper support (21).

[0037] The translation of the stack (G) along the track (40) is performed by the use of a motor means (41), in the form for example of a hydraulic or electrical cylinder, or by means of a kinematism of another sort.

[0038] To facilitate the movement of the stack (G) when it is in its outer position, the upper position of the track (40) is defined so that the stack (G) is above the plane of travel of the section bar. This makes it possible to have at the outer position of the stack (G) a trolley or other transport means (V), onto which the stack (G) can be moved to be loaded directly and to be taken elsewhere. This trolley or vehicle (V) can in turn be movable along a path with rails (W), a solution which is particularly advantageous given the considerable weight which the stack (G) can reach. The rails can be located alongside the section bar, so that each stack (G) can, if necessary, be transferred on a trolley (V) to be taken where required.

[0039] The operating unit can also be provided with two further rollers (R3,R4) rotating around vertical and parallel axes of rotation. These two further rollers (R3,R4) are connected to the intermediate support (23). Preferably each of said vertical rollers is connected to an intermediate support (23). In this way rollers (R3,R4) with vertical axis can be moved integrally with the stack (G). In particular, each vertical roller (R3,R4) is connected with a respective support or tray (S3,S4). The supports or trays (S3,S4) are, in turn, integral with the intermediate supports (23) with respect to vertical movements, while they can slide with respect to them along the transverse direction (Y).

[0040] Attachment means are provided for making the trays (S3,S4) and the intermediate supports (23) integral with respect to translation along the transverse direction (Y). In particular, these attachment means are configured for assuming, on command, an attachment configuration in which they constrain together each tray (S3,S4) with an intermediate support (23), and a release configuration, in which the trays (S3,S4) can slide along the transverse direction (Y) with respect to the intermediate supports (23).

[0041] The attachment means, in a preferred solution, comprise two hooks (243,244) each connected to an intermediate support (23). Each hook is equipped with a shaped end, configured for engaging in a housing (53,54) integral with a respective tray (S3,S4). Preferably each hook is oscillating between a hooking position, in which it engages its own end to the respective intermediate support, and an unhooking position, in which it is not engaged to the respective intermediate support (23). In the solution represented, each hook is oscillating on a vertical plane, but this is not strictly necessary. Elastic means thrust each hook towards the hooking position.

[0042] The oscillation of each hook (243,244) can be achieved, for example, by means of a respective cam (C3,C4), designed to come into contact with an end of the hook itself. In the solution represented in figure 6, the activation of the hooks is achieved by bringing about a relative sliding movement between each hook and its cam. The hooks are represented in the release position, since the stack (G) is in the inner position and the trays (S3,S4) are kept in position by the coupling with its own actuating means (T3,T4).

[0043] Actuating means (T3,T4), connected to the cage (10), are configured for bringing about the sliding of the trays (S3,S4) with respect to the intermediate supports (23). This makes it possible to adjust the distance between the vertical rollers (R3,R4) to obtain profiles of different dimensions and/or shape. The actuating means (T3,T4) comprise for example hydraulic or electric jacks.

[0044] As can be seen in the drawing, the actuating means (T3) connected with a first tray (S3) are located alongside the stack (G), along the trajectory of the movement from the inner position to the outer position of the stack (G) itself. The actuating means (T3) are thus vertically movable between a lower position, in which they are substantially aligned with the first tray (S3), and an upper position, in which they are above the intermediate supports (23). When they are in the upper position, the actuating means (T3) allow the stack (G) to move from the inner position to the outer position. The actuating means (T3) connected to the first vertical roller (R3) are contained in a casing (81) which is slidably connected to a guide structure (82) along a vertical sliding direction. Motor means (not illustrated in detail) are configured for sliding the actuating means (T3) along the vertical sliding direction. Before the stack (G) is moved into the outer position, the actuating means (T3) are required to be raised into the upper position.

[0045] Between the actuating means (T3) and the first tray (S3), axial coupling means are interposed which enable the actuating means themselves to be disengaged from the first tray (S3). In a preferred embodiment, these coupling means comprise at least one shaped housing (6), integral with the first tray (S3) and configured for receiving the free end (61) of a sliding shaft of the actuating means (T3) integrally with respect to a translation parallel to the transverse direction (Y). The shaped housing (6) is open at the top to allow the disengagement of the free end (61) during the lifting of the actuating means (T3). To favour the disengagement of the free end (61), a certain clearance is required between it and the shaped housing (6). This clearance brings about a slight relative movement between the free end (61) and the shaped housing (6) during the inversion of the sliding movement of the shaft. Preferably, the actuating means (T3) comprise two shafts, each equipped with a free end (61) engageable in a respective shaped housing (6) as described above.

[0046] Between the actuating means (T4) and the second tray (S4), coupling means are interposed which enable the actuating means themselves to be disengaged from the second tray (S4). These coupling means, in a preferred embodiment, comprise at least one engagement body (7), integral with the second tray (S4) and equipped with a shaped housing for receiving the free end (71) of a shaft of the actuating means (T4) integrally with respect to a translation parallel to the transverse direction (Y).

[0047] The engagement body (7) is rotatable between an engagement position, in which it receives the free end (71) of the shaft, and a disengagement position, in which the free end (71) does not interact with the engagement body (7) and the second tray (S4) can slide along the transverse direction (Y) with respect to the actuating means (T4).

[0048] In a preferred solution, shown in the drawing, two engagement bodies (7) are provided, arranged symmetrically with each other and each configured for interacting with the free end (71) of a shaft, which are made to rotate by a cylinder (7a) which, at its ends, is constrained to the two engagement bodies (7) themselves in an eccentric position with respect to the axes of rotation of the engagement bodies (7). The cylinder (7a) then

enables the simultaneous actuation of the two engagement bodies (7).

[0049] To rotate the first and second roller (R1,R2), the operating unit comprises at least one motor (E1) kinematically coupled at least to the first roller (R1). The second roller (R2) can be kinematically coupled to the first roller (R1). Preferably the operating unit comprises a first and a second motor (E1,E2), respectively coupled to the first and the second roller (R1,R2),

[0050] Between each motor and the respective roller, a transmission device is provided which makes it possible to misalign the axes of rotation of the motor and the roller. In a preferred embodiment, this transmission device is in the form of a cardan shaft (C1,C2). Between each shaft (C1,C2) and the respective roller (R1,R2) a transmission shaft is arranged suitable to allow decoupling between the two parts following the horizontal translation of the rollers (R1,R2) together with the stack (G) in the movement of the latter from the inner position to the outer position, and to allow coupling between the two parts in the reverse movement of the stack (G).

Claims

1. An operating unit for a roll forming machine, comprising a cage (2), configured for being connected to a base (B), and a stack (G), comprising:

at least two rollers (R1,R2), rotating around axes (X1,X2) which are horizontal and perpendicular to a direction of advancement (A) of the roll forming machine; an upper support (21), which supports a first roller (R1);
a lower support (22), which supports a second roller (R2); an intermediate support (23), interposed between the upper support (21) and the lower support (22); coupling means (31,32), structured for constraining to each other the upper support (21), the lower support (22) and the intermediate support (23) with the sole possibility of vertically translating one with respect to the other; the upper support (21) and the lower support (22) are movable between a working position, in which they are spaced apart from the intermediate support (23), and a changing position, in which the upper support rests on the intermediate support (23) which, in its turn, rests on the lower support (22);
characterised in that:

the coupling means (31,32) comprise at least two prismatic bodies (31,32), each of which is oriented with a longitudinal axis thereof arranged vertically and is slidable in a vertical direction in its own housing (21s,22s,23s), distributed over the supports (21,22,23);
each prismatic body (31,32) comprises at least one end stop (31a,32a), configured for limiting the movement of the lower support (22) in a downward direction.

2. The operating unit according to claim 1, wherein both the first prismatic body (31), and the second prismatic body (32) each comprise a pair of vertical cylindrical elements, to which the upper support (21), the lower support (22) and the intermediate support (23) are slidably coupled.

3. The operating unit according to claim 1, wherein the coupling means (31,32) comprise at least two centring elements (33,34), integral with the intermediate support (23), at least with respect to vertical translation, which face respectively towards the upper support (21) and towards the lower support (22) and are structured so as to be custom fit in respective housings formed respectively in the upper support (21) and the lower support (22).

4. The operating unit according to claim 1, comprising actuating means (M1), integral with the cage (10), configured for translating the upper support (21) in a vertical direction.

5. The operating unit according to claim 4, comprising a section bar (P), connected to the actuating means (M1), to which is connected the upper support (21) with the freedom only to slide in a horizontal direction perpendicular to the direction of advancement (A).

6. The operating unit according to claim 1, comprising actuating means (M2), integral with the cage (10), configured for translating the lower support (22) in a vertical direction.

7. The operating unit according to claim 1, wherein the intermediate support (23) is structured so as to be able to slide in a transverse direction (Y), perpendicular to the direction of advancement (A) of the roll forming machine.

8. The operating unit according to claim 7, wherein the intermediate support (23) has at least one coupling body (23a) designed to be slidably inserted into a guide (24) integral with the cage (10) and located along the transverse direction (Y).

9. The operating unit according to claim 7, comprising a guide device (40), configured for guiding the stack (G) in translation in the transverse direction (Y) between an internal or working position, in which the stack (G) is located substantially inside the cage (10) and is aligned with the direction of advancement (A) of the roll forming machine, and an external position, in which the stack (G) is located alongside the cage

(10), at a certain distance therefrom.

10. The operating unit according to claim 9, wherein the guide device (40) comprises a track (40), arranged below the lower support (22) and structured so as to bear the weight of the stack at the lower support (22).

11. The operating unit according to claim 10, wherein the track (40) is vertically movable between a lower position, in which it is not in contact with the stack (G), and an upper position, in which it supports the stack (G) at the lower support (22).

12. The operating unit according to claim 1, wherein the stack (G) comprises a first and a second vertical roller (R3,R4), each of which is connected to a support or tray (S3,S4) integral with the intermediate support (23) with respect to vertical movements.

13. The operating unit according to claim 12, wherein the supports (S3,S4) of the vertical rollers (R3,R4) are movable in a horizontal direction perpendicular to the direction of advancement (A) with respect to the intermediate support (23).

14. The operating unit according to claim 13, comprising attachment means (243,244) predisposed for making the trays (S3,S4) and the intermediate support (23) integral with respect to translation along the transverse direction (Y); said attachment means are predisposed for assuming, on command, an attached configuration, wherein they constrain each of the trays (S3,S4) to each other with the intermediate support (23), and a detached configuration, in which the trays (S3,S4) can slide along the transverse direction (Y) with respect to the intermediate support (23).

15. The operating unit according to claim 13, comprising actuating means (T3,T4) configured for sliding the supports (S3,S4) of the vertical rollers (R3,R4); the actuating means (T3) connected to the support (S3) of a first vertical roller (R3) are movable in a vertical direction between a lower position, in which they are substantially aligned to the support (S3) of the first vertical roller (R3), and an upper position, in which they are above the intermediate supports (23).

16. The operating unit according to claim 15, comprising coupling means (6,61,7,71) configured for removably constraining the actuating means (T3,T4) to the supports (S3,S4) with respect to translation in the transverse direction (Y).

17. The operating unit according to claim 16, wherein said coupling means comprise at least one shaped housing (6), integral with a first tray (S3) and configured for receiving the free end (61) of a sliding shaft of the actuating means (T3) integrally with respect to a translation parallel to the transverse direction (Y); said shaped housing (6) is open at the top to allow the disengagement of the free end (61) during the lifting of the actuating means (T3).

18. The operating unit according to claim 16, wherein said coupling means comprise at least one engagement body (7), integral with the second tray (S4) and equipped with a housing shaped to receive the free end (71) of a shaft of the actuating means (T4) integrally with respect to translation parallel to the transverse direction (Y); the engagement body (7) is rotatable between an engagement position, in which it houses the free end (71) of the shaft, and a disengagement position, in which the free end (71) does not interact with the engagement body (7) and the second tray (S4) can slide in the transverse direction (Y) with respect to the actuating means (T4).

19. A roll forming line, comprising: one or more operating units according to claim 9, aligned along the direction of advancement (A); a track (W), located alongside the line of advancement (A); at least one trolley (V), movable along said track (W); the track (W) is located so that said trolley (V) can be situated below the stack (G) when it is in its external position.

Patentansprüche

1. Bedieneinheit für eine Rollumformmaschine, umfassend einen Käfig (2), der zum Verbinden mit einer Basis (B) konfiguriert ist, und einen Stapel (G), umfassend: mindestens zwei Rollen (R1, R2), die sich um Achsen (X1, X2), die horizontal und senkrecht zu einer Vorschubrichtung (A) der Rollumformmaschine sind, drehen; eine obere Halterung (21), die eine erste Rolle (R1) abstützt; eine untere Halterung (22), die eine zweite Rolle (R2) abstützt; eine Zwischenhalterung (23), die zwischen der oberen Halterung (21) und der unteren Halterung (22) angeordnet ist; Kopplungsmittel (31, 32), die so strukturiert sind, dass sie die obere Halterung (21), die untere Halterung (22) und die Zwischenhalterung (23) untereinander festspannen, mit der einzigen Möglichkeit, eine in Bezug auf die andere vertikal zu verschieben; wobei die obere Halterung (21) und die untere Halterung (22) zwischen einer Arbeitsposition, in der sie von der Zwischenhalterung (23) beabstandet sind, und einer Wechselposition, in der die obere Halterung auf der Zwischenhalterung (23) ruht, die wiederum auf der unteren Halterung (22) ruht, beweglich sind;
dadurch gekennzeichnet, dass
die Kopplungsmittel (31, 32) mindestens zwei prismatische Körper (31, 32) umfassen, von denen ein jeder mit dessen vertikal angeordneten Längsachse

ausgerichtet ist und in vertikaler Richtung in einem eigenen Gehäuse (21s, 22s, 23s) verschiebbar ist, das über die Halterungen (21, 22, 23) verteilt ist;
ein jeder prismatische Körper (31, 32) mindestens einen Endanschlag (31a, 32a) umfasst, der zum Begrenzen der Bewegung der unteren Halterung (22) nach unten konfiguriert ist.

2. Bedieneinheit nach Anspruch 1, wobei sowohl der erste prismatische Körper (31) als auch der zweite prismatische Körper (32) jeweils ein Paar vertikaler zylindrischer Elemente umfassen, zu denen die obere Halterung (21), die untere Halterung (22) und die Zwischenhalterung (23) verschiebbar gekoppelt sind.

3. Bedieneinheit nach Anspruch 1, wobei die Kopplungsmittel (31, 32) mindestens zwei Zentrierelemente (33, 34) umfassen, die mit der Zwischenhalterung (23) einstückig sind, zumindest in Bezug auf die vertikale Verschiebung, die jeweils in Richtung der oberen Halterung (21) und in Richtung der unteren Halterung (22) zugewandt sind und so strukturiert sind, dass sie in die jeweils in der oberen Halterung (21) und der unteren Halterung (22) ausgebildeten Gehäuse nach Maß passen.

4. Bedieneinheit nach Anspruch 1, umfassend Betätigungsmittel (M1), die mit dem Käfig (10) einstückig sind und zum Verschieben der oberen Halterung (21) in eine vertikale Richtung konfiguriert sind.

5. Bedieneinheit nach Anspruch 4, umfassend eine mit den Betätigungsmitteln (M1) verbundene Querschnittsstange (P), mit der die obere Halterung (21) verbunden ist, mit der Freiheit, nur in einer horizontalen Richtung senkrecht zur Vorschubrichtung (A) zu gleiten.

6. Bedieneinheit nach Anspruch 1, umfassend Betätigungsmittel (M2), die mit dem Käfig (10) einstückig sind und zum Verschieben der unteren Halterung (22) in eine vertikale Richtung konfiguriert sind.

7. Bedieneinheit nach Anspruch 1, wobei die Zwischenhalterung (23) so strukturiert ist, dass sie in einer Querrichtung (Y) senkrecht zur Vorschubrichtung (A) der Rollumformmaschine gleiten kann.

8. Bedieneinheit nach Anspruch 7, wobei die Zwischenhalterung (23) mindestens einen Kupplungskörper (23a) aufweist, der so ausgelegt ist, dass er verschiebbar in eine Führung (24) eingeführt werden kann, die mit dem Käfig (10) einstückig ist und sich entlang der Querrichtung (Y) befindet.

9. Bedieneinheit nach Anspruch 7, umfassend eine Führungsvorrichtung (40), konfiguriert zum Leiten des Stapels (G) in der Verschiebung in die Querrichtung (Y) zwischen einer Innen- oder Arbeitsposition, in der sich der Stapel (G) im Wesentlichen innerhalb des Käfigs (10) befindet und mit der Vorschubrichtung (A) der Rollumformmaschine ausgerichtet ist und einer äußeren Position, in der sich der Stapel (G) neben dem Käfig (10) in einem bestimmten Abstand davon befindet.

10. Bedieneinheit nach Anspruch 9, wobei die Führungsvorrichtung (40) eine Bahn (40) umfasst, die unterhalb der unteren Halterung (22) angeordnet und so strukturiert ist, dass sie das Gewicht des Stapels an der unteren Halterung (22) trägt.

11. Bedieneinheit nach Anspruch 10, wobei die Bahn (40) vertikal zwischen einer unteren Position, in der sie nicht mit dem Stapel (G) in Kontakt steht, und einer oberen Position, in der sie den Stapel (G) an der unteren Halterung (22) abstützt, beweglich ist.

12. Bedieneinheit nach Anspruch 1, wobei der Stapel (G) eine erste und eine zweite vertikale Rolle (R3, R4) umfasst, von denen eine jede mit einer Halterung oder einem Tablett (S3, S4) verbunden ist, das mit der Zwischenhalterung (23) in Bezug auf vertikale Bewegungen einstückig ist.

13. Bedieneinheit nach Anspruch 12, wobei die Halterungen (S3, S4) der vertikalen Rollen (R3, R4) in einer horizontalen Richtung senkrecht zur Vorschubrichtung (A) in Bezug auf die Zwischenhalterung (23) beweglich sind.

14. Bedieneinheit nach Anspruch 13, umfassend Anbringungsmittel (243, 244), die dazu eingerichtet sind, um die Tabletts (S3, S4) und die Zwischenhalterung (23) in Bezug auf die Verschiebung entlang der Querrichtung (Y) einstückig zu machen; wobei die Anbringungsmittel dazu eingerichtet sind, um auf Befehl eine angebrachte Konfiguration, wobei sie ein jedes der Tabletts (S3, S4) mit der Zwischenhalterung (23) festspannen und eine abgetrennte Konfiguration, in der die Tabletts (S3, S4) in Querrichtung (Y) in Bezug auf die Zwischenhalterung (23) gleiten können, einzunehmen.

15. Bedieneinheit nach Anspruch 13, umfassend Betätigungsmittel (T3, T4), die zum Gleiten der Halterungen (S3, S4) der vertikalen Rollen (R3, R4) konfiguriert sind; die mit der Halterung (S3) einer ersten vertikalen Rolle (R3) verbundenen Betätigungsmittel (T3) sind in vertikaler Richtung zwischen einer unteren Position, in der sie im Wesentlichen mit der Halterung (S3) der ersten vertikalen Rolle (R3) ausgerichtet sind und einer oberen Position, in der sie sich über den Zwischenhalterungen (23) befinden, beweglich sind.

16. Bedieneinheit nach Anspruch 15, umfassend Kopplungsmittel (6, 61, 7, 71), die konfiguriert sind, um die Betätigungsmittel (T3, T4) in Bezug auf die Verschiebung in der Querrichtung (Y) auf die Halterungen (S3, S4) entfernbar festzuspannen.

17. Bedieneinheit nach Anspruch 16, wobei die Kopplungsmittel mindestens ein ausgeformtes Gehäuse (6) umfassen, das mit einem ersten Tablett (S3) einstückig ist und zum Aufnehmen des freien Endes (61) einer Gleitwelle der Betätigungsmittel (T3) einstückig in Bezug auf eine Verschiebung parallel zur Querrichtung (Y) konfiguriert ist; das ausgeformte Gehäuse (6) ist oben offen, um das Lösen des freien Endes (61) während des Anhebens der Betätigungsmittel (T3) zu ermöglichen.

18. Bedieneinheit nach Anspruch 16, wobei die Kopplungsmittel mindestens einen Eingriffskörper (7) umfassen, der mit dem zweiten Tablett (S4) einstückig ist und mit einem Gehäuse ausgestattet ist, das so ausgeformt ist, dass es das freie Ende (71) einer Welle der Betätigungsmittel (T4) einstückig in Bezug auf die Verschiebung parallel zur Querrichtung (Y) aufnimmt; der Eingriffskörper (7) ist drehbar zwischen einer Eingriffsposition, in der er das freie Ende (71) der Welle unterbringt, und einer Löseposition, in der das freie Ende (71) mit dem Eingriffskörper (7) nicht zusammenwirkt und das zweite Tablett (S4) in Bezug auf die Betätigungsmittel (T4) in der Querrichtung (Y) gleiten kann.

19. Rollumformlinie, umfassend: eine oder mehrere Bedieneinheiten nach Anspruch 9, ausgerichtet entlang der Vorschubrichtung (A); eine Bahn (W), die entlang der Vorschublinie (A) liegt; mindestens einen Wagen (V), der entlang der Bahn (W) beweglich ist; die Bahn (W) ist so angeordnet, dass sich der Wagen (V) unter dem Stapel (G) befinden kann, wenn er sich in seiner äußeren Position befindet.

Revendications

1. Unité de commande pour une machine de formage à rouleaux, comprenant une cage (2), configurée pour être reliée à une base (B), et une pile (G), comprenant: au moins deux rouleaux (R1, R2), tournant autour d'axes (X1, X2) étant horizontaux et perpendiculaires à une direction d'avancement (A) de la machine de formage à rouleaux; un support supérieur (21) supportant un premier rouleau (R1); un support inférieur (22) supportant un deuxième rouleau (R2); un support intermédiaire (23) interposé entre le support supérieur (21) et le support inférieur (22); des moyens d'accouplement (31, 32) structurés pour mettre en prise les uns aux autres le support supérieur (21), le support inférieur (22) et le support intermédiaire (23) avec la seule possibilité de translation verticale de l'un par rapport à l'autre; le support supérieur (21) et le support inférieur (22) sont mobiles entre une position de travail, dans laquelle ils sont espacés du support intermédiaire (23), et une position de changement, dans laquelle le support supérieur repose sur le support intermédiaire (23) qui, à son tour, repose sur le support inférieur (22); **caractérisée en ce que**:

   les moyens d'accouplement (31, 32) comprennent au moins deux corps prismatiques (31, 32), dont chacun est orienté avec un axe longitudinal de celui-ci disposé verticalement et peut coulisser dans une direction verticale dans son propre logement (21s, 22s, 23s) réparti sur les supports (21, 22, 23);
   chaque corps prismatique (31, 32) comprend au moins une butée d'extrémité (31a, 32a), configurée pour limiter le mouvement du support inférieur (22) dans une direction vers le bas.

2. Unité de commande selon la revendication 1, dans laquelle le premier corps prismatique (31) et le deuxième corps prismatique (32) comprennent chacun une paire d'éléments cylindriques verticaux auxquels le support supérieur (21), le support inférieur (22) et le support intermédiaire (23) sont couplés de manière coulissante.

3. Unité de commande selon la revendication 1, dans laquelle les moyens d'accouplement (31, 32) comprennent au moins deux éléments de centrage (33, 34), solidaires du support intermédiaire (23), au moins par rapport à la translation verticale, faisant face respectivement vers le support supérieur (21) et vers le support inférieur (22) et sont structurés de manière à être adaptés sur mesure dans des logements respectifs formés respectivement dans le support supérieur (21) et le support inférieur (22).

4. Unité de commande selon la revendication 1, comprenant des moyens d'actionnement (M1), solidaires de la cage (10), configurés pour la translation du support supérieur (21) dans une direction verticale.

5. Unité de commande selon la revendication 4, comprenant un profilé (P), relié aux moyens d'actionnement (M1), auquel est relié le support supérieur (21) avec la seule liberté de coulisser dans une direction horizontale perpendiculaire à la direction d'avancement (A).

6. Unité de commande selon la revendication 1, comprenant des moyens d'actionnement (M2), solidaires de la cage (10), configurés pour translater le support inférieur (22) dans une direction verticale.

7. Unité de commande selon la revendication 1, dans laquelle le support intermédiaire (23) est structuré de manière à pouvoir coulisser dans une direction transversale (Y) perpendiculaire à la direction d'avancement (A) de la machine de formage à rouleaux.

8. Unité de commande selon la revendication 7, dans laquelle le support intermédiaire (23) comporte au moins un corps d'accouplement (23a) conçu pour être introduit de manière coulissante dans un guide (24) solidaire de la cage (10) et situé le long de la direction transversale (Y).

9. Unité de commande selon la revendication 7, comprenant un dispositif de guidage (40) configuré pour guider la pile (G) en translation dans la direction transversale (Y) entre une position interne ou de travail, dans laquelle la pile (G) est située substantiellement à l'intérieur de la cage (10) et est alignée avec la direction d'avancement (A) de la machine de formage à rouleaux, et une position externe, dans laquelle la pile (G) est située le long de la cage (10), à une certaine distance de celle-ci.

10. Unité de commande selon la revendication 9, dans laquelle le dispositif de guidage (40) comprend une piste (40) disposée sous le support inférieur (22) et structurée de manière à supporter le poids de la pile en correspondance du support inférieur (22).

11. Unité de commande selon la revendication 10, dans laquelle la piste (40) est mobile verticalement entre une position inférieure, dans laquelle elle n'est pas en contact avec la pile (G), et une position supérieure, dans laquelle elle soutient la pile (G) en correspondance du support inférieur (22).

12. Unité de commande selon la revendication 1, dans laquelle la pile (G) comprend un premier et un deuxième rouleau vertical (R3, R4), chacun d'entre eux étant relié à un support ou plateau (S3, S4) solidaire du support intermédiaire (23) par rapport aux mouvements verticaux.

13. Unité de commande selon la revendication 12, dans laquelle les supports (S3, S4) des rouleaux verticaux (R3, R4) sont mobiles dans une direction horizontale perpendiculaire à la direction d'avancement (A) par rapport au support intermédiaire (23).

14. Unité de commande selon la revendication 13, comprenant des moyens de fixation (243, 244) prédisposés pour rendre les plateaux (S3, S4) et le support intermédiaire (23) solidaires par rapport à la translation le long de la direction transversale (Y); lesdits moyens de fixation sont prédisposés pour adopter, sur commande, une configuration fixée, dans laquelle ils mettent en prise chacun des plateaux (S3, S4) l'un à l'autre avec le support intermédiaire (23), et une configuration détachée, dans laquelle les plateaux (S3, S4) peuvent coulisser le long de la direction transversale (Y) par rapport au support intermédiaire (23).

15. Unité de commande selon la revendication 13, comprenant des moyens d'actionnement (T3, T4) configurés pour faire coulisser les supports (S3, S4) des rouleaux verticaux (R3, R4); les moyens d'actionnement (T3), reliés au support (S3) d'un premier rouleau vertical (R3), sont mobiles dans une direction verticale entre une position inférieure, dans laquelle ils sont substantiellement alignés avec le support (S3) du premier rouleau vertical (R3), et une position supérieure, dans laquelle ils se trouvent au-dessus des supports intermédiaires (23).

16. Unité de commande selon la revendication 15, comprenant des moyens d'accouplement (6, 61, 7, 71) configurés pour mettre en prise, de manière amovible, les moyens d'actionnement (T3, T4) aux supports (S3, S4) par rapport à une translation dans la direction transversale (Y).

17. Unité de commande selon la revendication 16, dans laquelle lesdits moyens d'accouplement comprennent au moins un logement façonné (6), solidaire d'un premier plateau (S3), et configuré pour recevoir l'extrémité libre (61) d'un arbre coulissant des moyens d'actionnement (T3) solidairement par rapport à une translation parallèle à la direction transversale (Y); ledit logement façonné (6) est ouvert sur le dessus pour permettre le désengagement de l'extrémité libre (61) pendant le levage des moyens d'actionnement (T3).

18. Unité de commande selon la revendication 16, dans laquelle lesdits moyens d'accouplement comprennent au moins un corps d'engagement (7) solidaire du second plateau (S4) et équipé d'un logement ayant une forme pour recevoir l'extrémité libre (71) d'un arbre des moyens d'actionnement (T4) de manière solidaire par rapport à une translation parallèle à la direction transversale (Y); le corps d'engagement (7) est rotatif entre une position d'engagement, dans laquelle il loge l'extrémité libre (71) de l'arbre, et une position de désengagement, dans laquelle l'extrémité libre (71) n'interagit pas avec le corps d'engagement (7) et le second plateau (S4) peut coulisser dans la direction transversale (Y) par rapport aux moyens d'actionnement (T4).

19. Ligne de formage à rouleaux, comprenant: une ou plusieurs unités d'actionnement selon la revendication 9, alignées le long de la direction d'avancement (A); une piste (W) située le long de la ligne d'avan-

cement (A); au moins un chariot (V) mobile le long de ladite piste (W); la piste (W) est située de telle sorte que ledit chariot (V) puisse être situé sous la pile (G) lorsqu'elle est dans sa position externe.

Fig.1

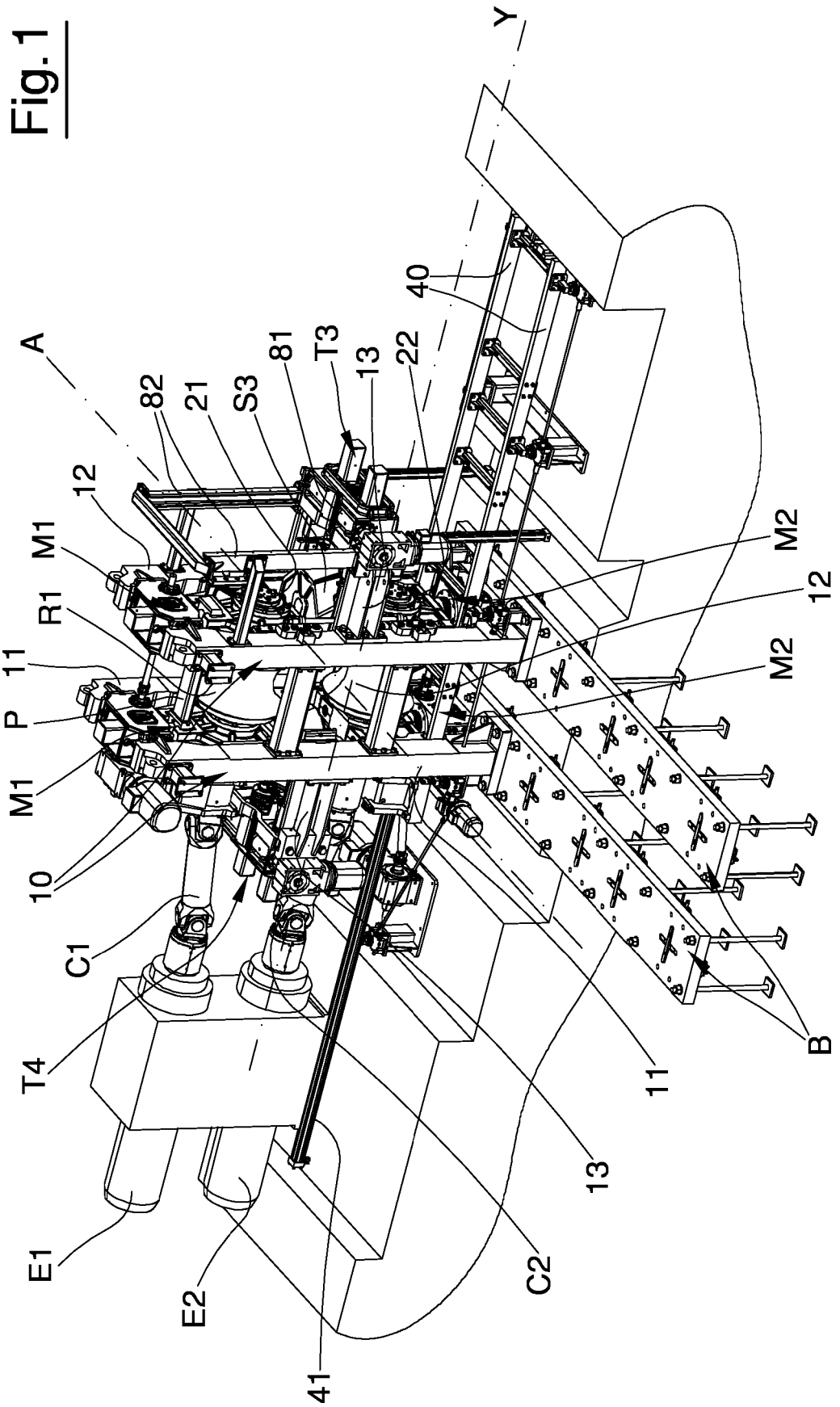

Y
40
A
82
21
S3
81
T3
13
22
12
M1
R1
11
P
M1
10
C1
T4
E1
E2
41
C2
13
11
M2
12
M2
B

Fig. 2

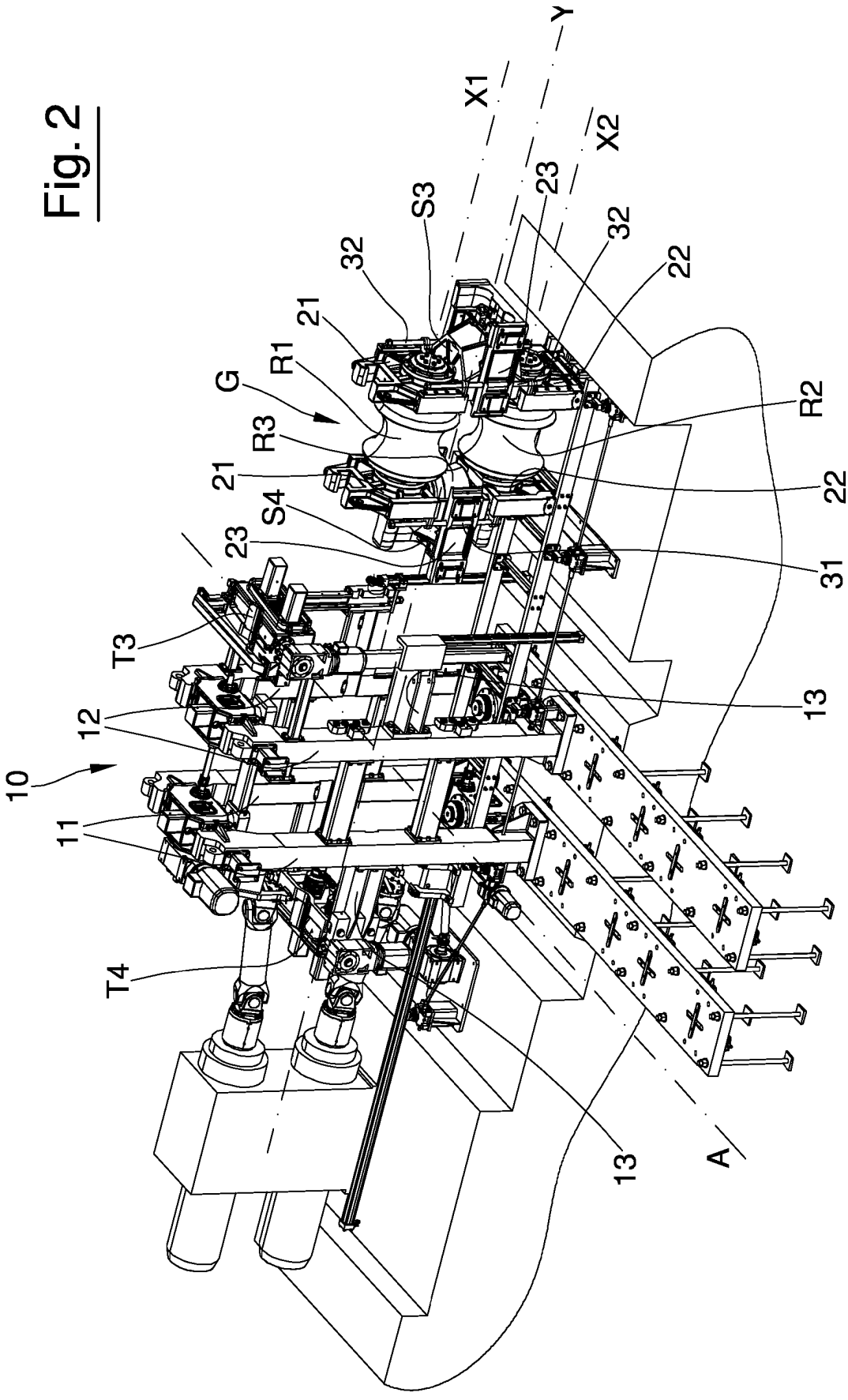


Fig. 3

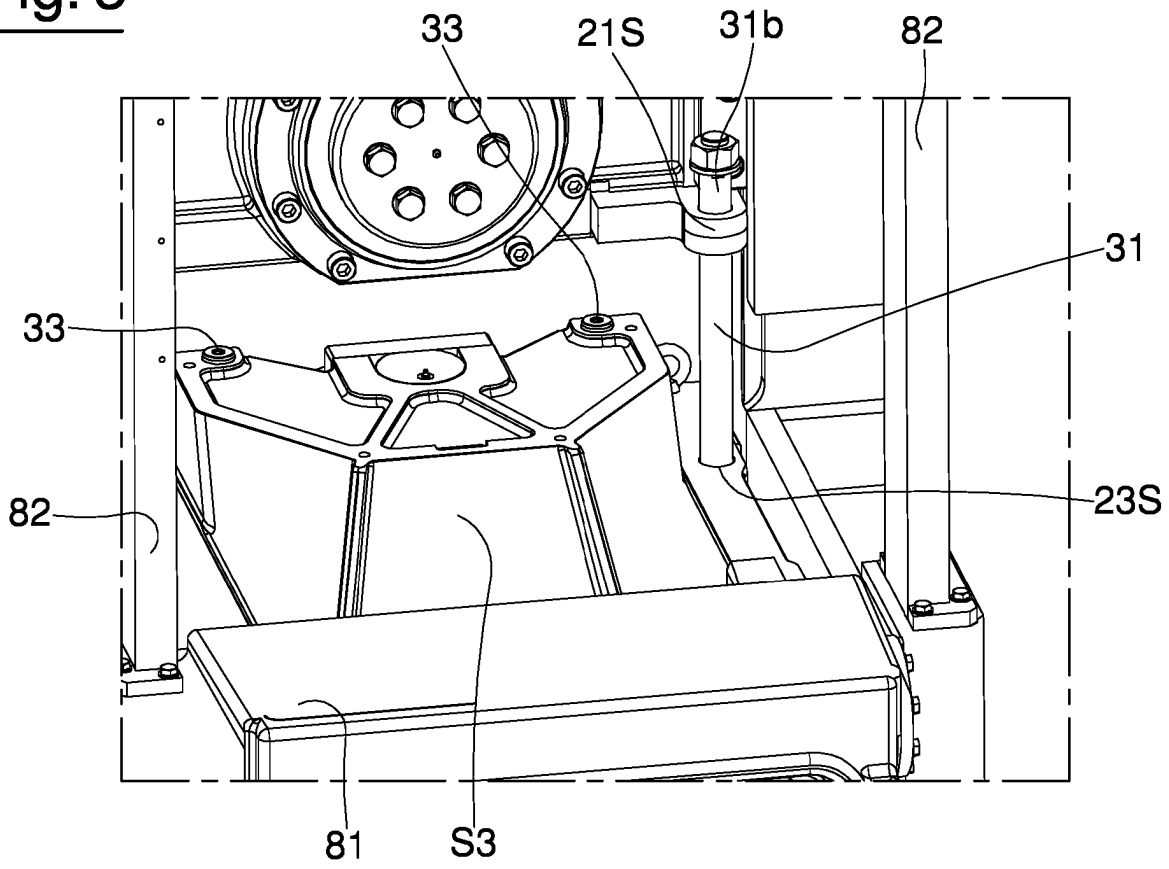
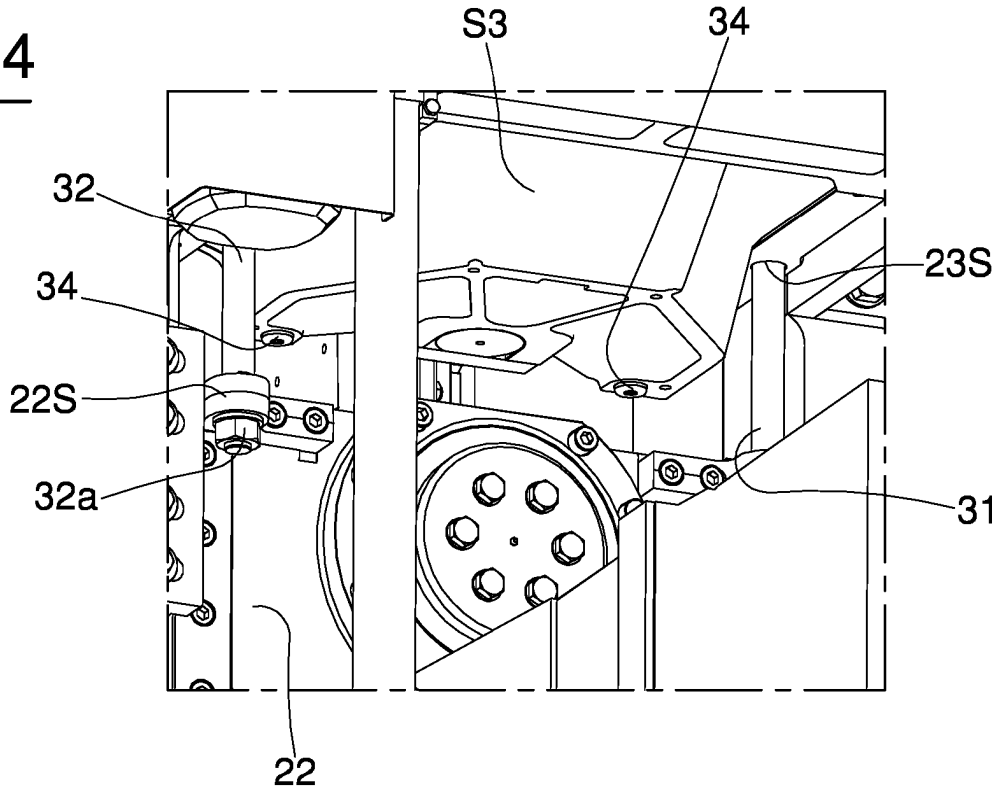


Fig. 4



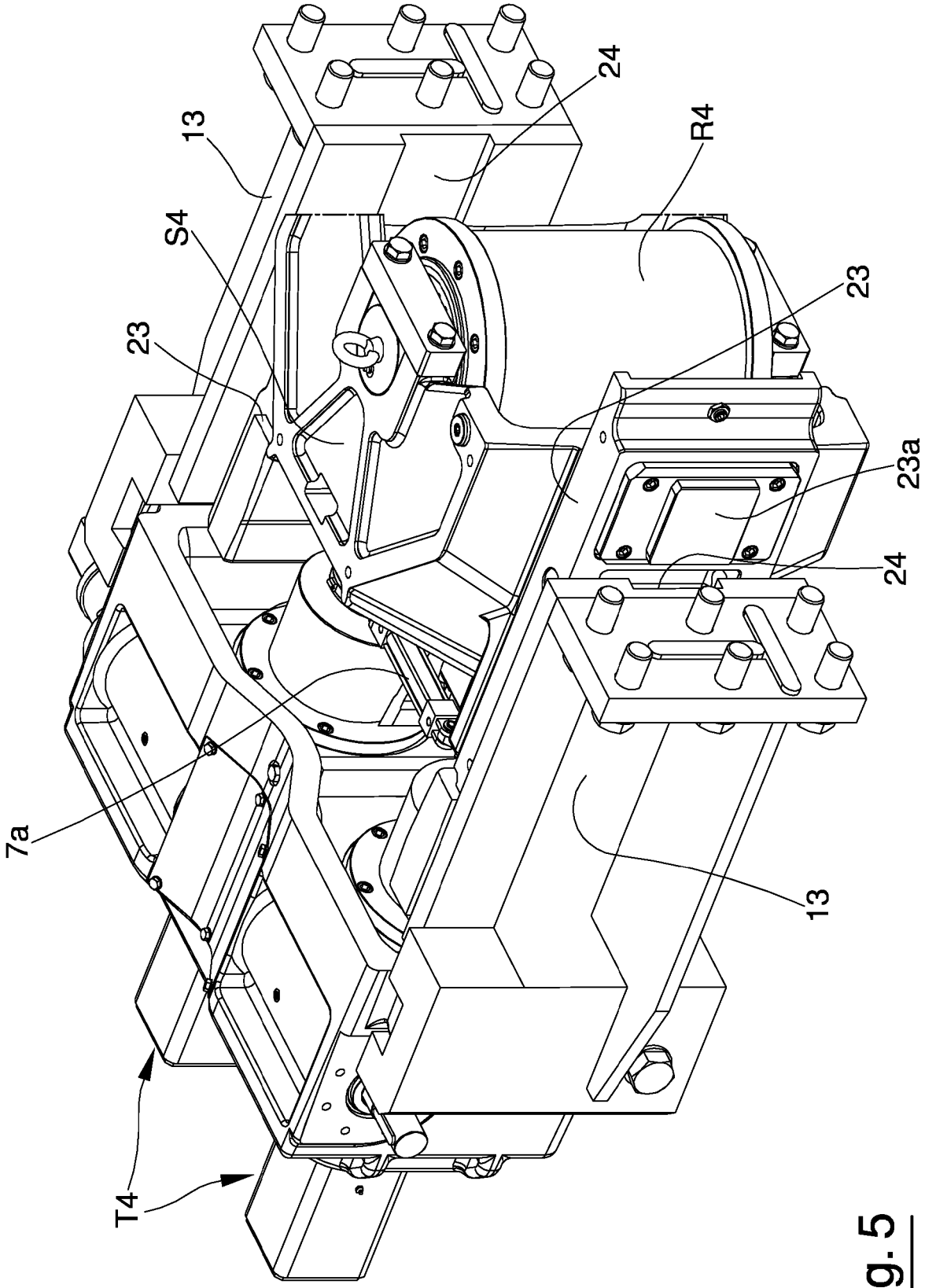


Fig. 5

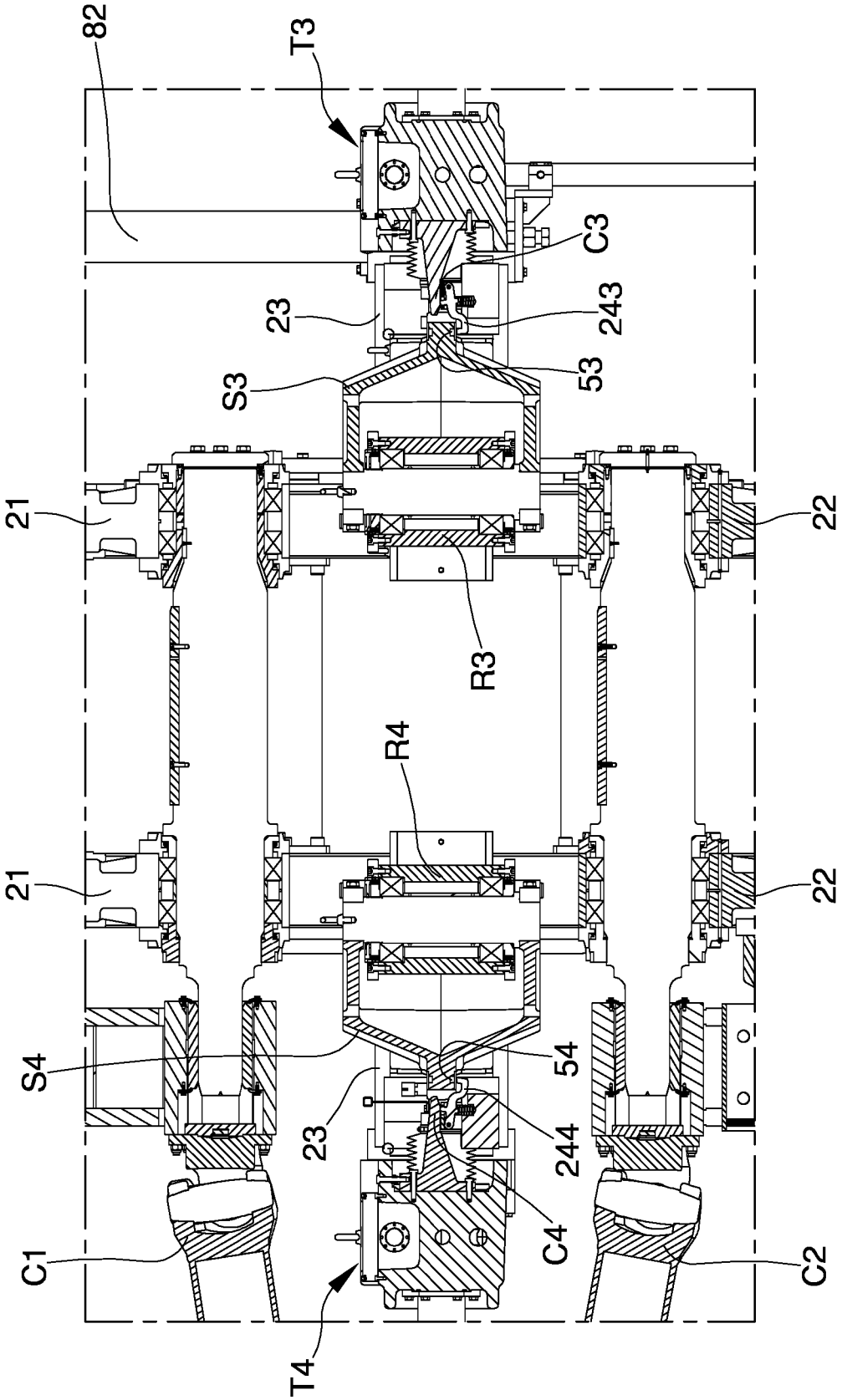


Fig. 6

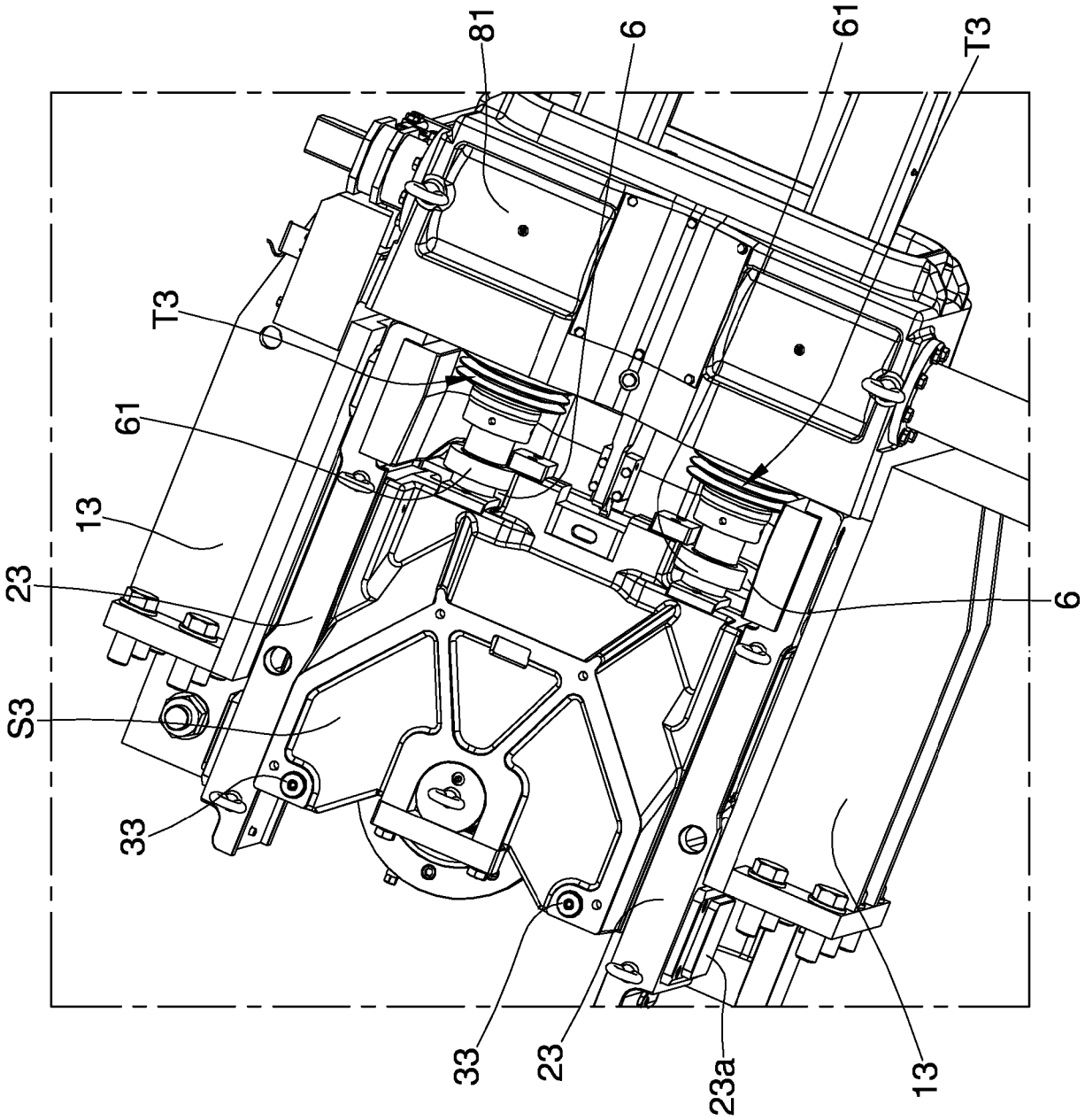


Fig. 7

Fig. 8

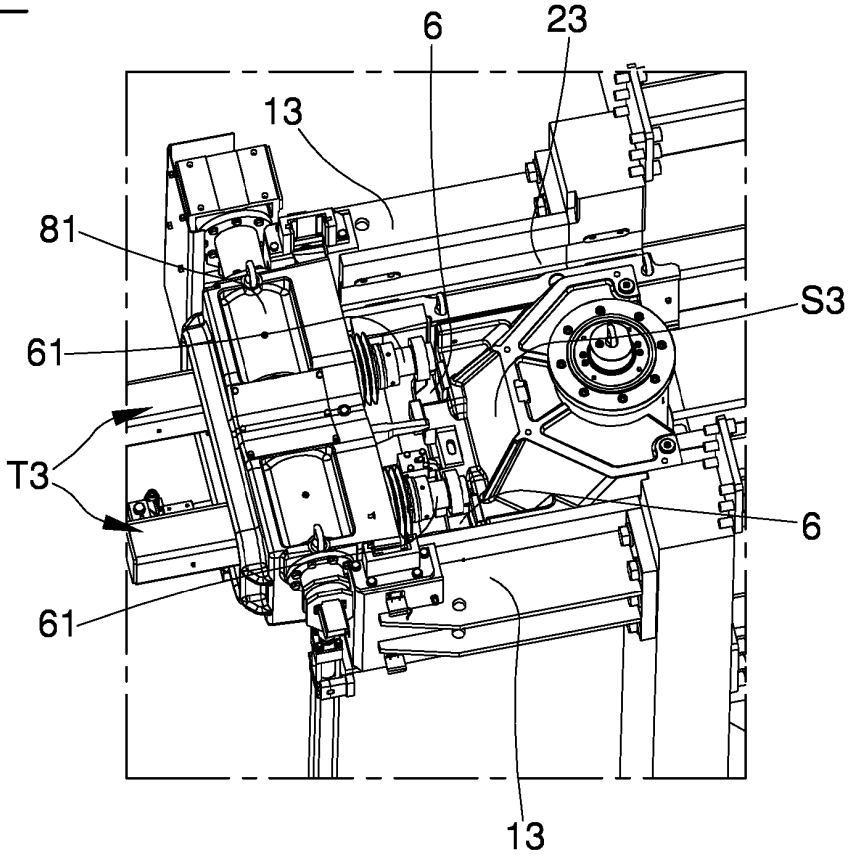
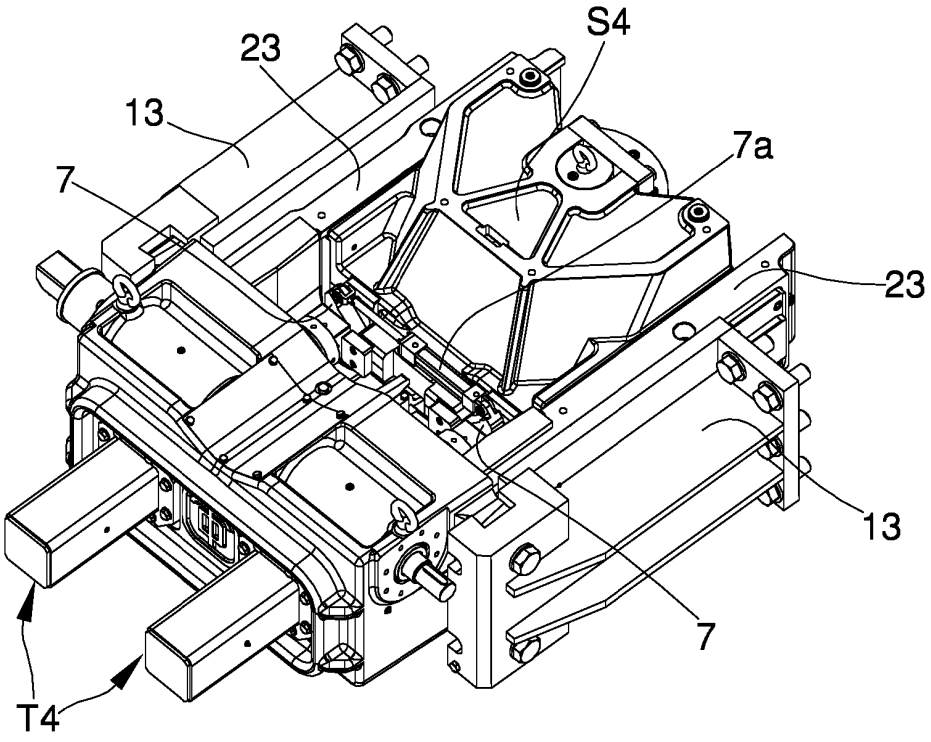


Fig. 9



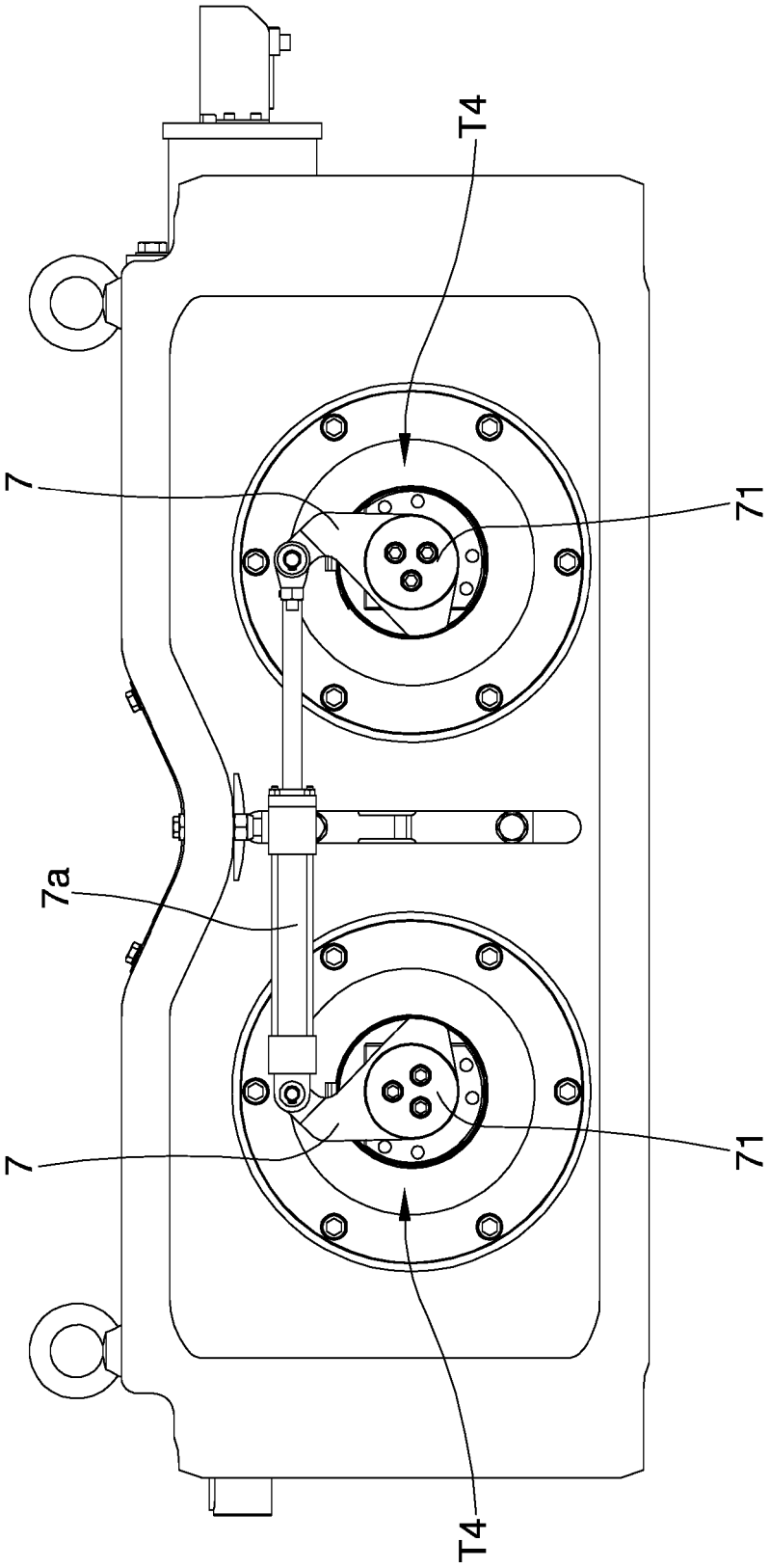


Fig. 10

REFERENCES CITED IN THE DESCRIPTION

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