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(54) **A ROLLER CAGE FOR A PROFILING LINE**

(57) A roller cage for a profiling line, comprising:
a support frame (F1);
a first motor equipped with a first substantially horizontal spindle (12) that projects in a cantilever fashion externally to a shoulder (S1) of the support frame (F1) into an operating space of the line;
a transverse roller (13), assembled directly on the first spindle (12);
a movable frame (F2), with which an upright first roller (33) is associated, rotating about a first shaft (32) which projects in a cantilever fashion from the movable frame (F2);
the movable frame (F2) is movable between an operating position, in which the first shaft (32) assumes a substantially vertical position, and a non-operating position, in which the first shaft (32) assumes a substantially horizontal position and is facing the same way as the first spindle (12), towards the operating space of the line.

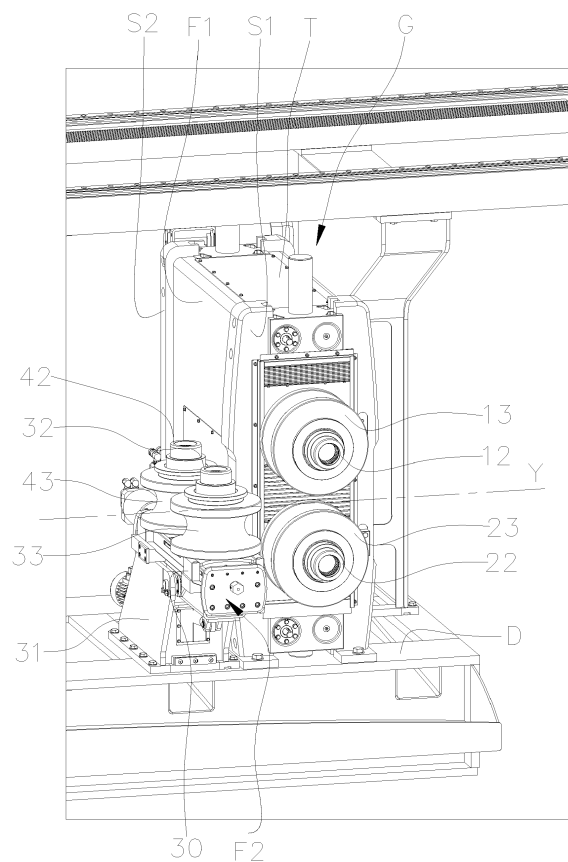


Fig.1

Description

[0001] The present invention relates to a roller cage for a profiling line.

[0002] A profiling 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 cross section, which may for example be square, rectangular or another shape. 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 connected to uprights, also known as shoulders, which, in turn, are fixed onto a base. This base is arranged on a fixed bed to which it is removably constrained and/or transversally adjustable.

[0004] Each profile to be produced requires a series of transverse rollers whose characteristics are determined by the shape and dimensions of the profile itself.

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

[0006] Roller cages according to current technology have two uprights or shoulders, with which the cage rollers are associated. The cage rollers are substantially positioned in the space comprised between the two shoulders. On one side of the cage, i.e. next to one of the two shoulders, the motor unit of the cage is positioned, comprising one or more motors, one or two reducers and one or two Cardan joints, for the activation in rotation of at least two cage rollers. The shoulder on the motor unit side is normally fixed. The other shoulder of the cage, positioned on the opposite side of the motor unit, is removable, for allowing access to the rollers and to the other components of the cage and also for allowing changes, either in case of maintenance, or in case of changing the format of the product to be produced. To change the tools of the cage, it is necessary to remove the movable shoulder, take out the tools to be replaced and mount those intended for the new production. Over time quick change methods have been developed that envisage the off-line replacement of whole plates equipped with cages. In this way, the equipment can be changed off line during production downtime.

[0007] The currently available roller cages have several drawbacks.

[0008] First of all, it is necessary to double the supply of cages, so as to always have one available in line and one off line. This implies a clear cost burden.

[0009] It is also necessary to provide very large spaces for positioning the cages off line and performing the equipment change.

[0010] A further drawback is represented by the dangerousness of moving the mounted cages which can reach the weight of 15-20 tonnes, with the use of bridge cranes.

[0011] Consider also that the technology currently available on the market envisages, for every cage, in the simplest case, a power transmission to the motor rollers through flanges, Cardan joints, a distributor per cage, a gearbox and an electric motor. For example, a section of the line for the calibration of the profile, provided with four cages, requires an electric motor, a reducer, a gearbox, four distributors (for distributing power to the four cages) and eight Cardan joints (two per cage) with the related coupling flanges.

[0012] Alternatively, more evolved solutions envisage an electric motor per cage, a distributor with a gearbox per cage, two Cardan joints with the related coupling flanges per cage.

[0013] Both solutions therefore require a lot of space on the motor unit side, and therefore have very low performance levels. Much of the energy developed by the electric motors is in fact consumed just for rotationally driving the transmission, with consequent losses due to the effect of the couplings between the gears of the reducers, for the rolling of the bearings, due to the movement of oil, etc.

[0014] The aim of the present invention is to provide a roller cage for a profiling line which allows the drawbacks of the currently available machines to be obviated.

[0015] An advantage of the roller cage according to the present invention is that of being much more compact than the cages currently available.

[0016] Another advantage of the roller cage according to the present invention is that it notably facilitates access to the transverse rollers, as well as all the maintenance and/or replacement operations.

[0017] A further advantage of the roller cage according to the present invention is that it does not require the use of reducers or other transmission members, allowing a remarkable saving on costs and a consistent reduction of power dispersions.

[0018] Further characteristics and advantages of the present invention will become more apparent in the following detailed description of an embodiment of the present invention, illustrated by way of non-limiting example in the attached figures, in which:

- figure 1 shows a view of a cage according to the present invention, in a first operating configuration;
- figure 2 shows a view of a cage according to the present invention, in a second operating configuration;
- figures 3 to 7 show different operating steps of a sequence of operations for the automatic change of two transverse rollers (33,43).

[0019] A profiling line (figures 3-7) comprises a plurality of roller cages (G), arranged in succession along a lon-

gitudinal direction (Y) which is also the advancement direction of the profile being processed. As is known, roller cages are configured and suitably sized for progressively bending the starting steel strip around the longitudinal axis (Y), until a tubular conformation is conferred thereto. The bending of the starting strip takes place through the passage of the strip itself between the rollers of the various cages which, by contact, progressively produce the deformation thereof. In other words, the strip slides continuously through the roller cages, being progressively deformed. Downstream of the roller cages (G) a welding device is normally provided (not illustrated) which joins the longitudinally neared edges of the starting strip.

[0020] As shown in figures 1 and 2, the roller cage according to the present invention comprises a support frame (F1) placed in a non-operating space external to the line, i.e. a space inside which the profile does not transit and no processing is performed on the profile. The support frame (F1) comprises, for example, two shoulders (S1, S2), i.e. two load-bearing structures that extend substantially on a vertical plane. These shoulders (S1, S2) are associated inferiorly with a base (D) and superiorly with a transverse structure (T). The position of the frame (F1), in its entirety, can be regulated transversally to the longitudinal direction (Y).

[0021] The cage comprises a motor (not shown) associated with the frame (F1) and a spindle (12) that projects externally to the non-operating space. In a preferred, but not exclusive, embodiment, the spindle (12) projects in a cantilever fashion from the motor (11), i.e. it is sustained by the motor (11) alone and has a free end that is not sustained by other structural parts. In this preferred solution, the motor is preferably a torque type motor, as will be better explained in the following description. In a possible solution, the spindle (12) is associated with the motor through a transmission of the known type, which comprises, for example, a reducer and one or more Cardan joints and one or more transmission shafts.

[0022] A transverse roller (13) is assembled directly on the spindle (12) and arranged inside an operating space of the line, i.e. the space within which the profile transits for undergoing the processing by the transverse roller (13). The operating space is substantially arranged next to the frame (F1), externally to a shoulder (S1) of the frame (F1) itself. In substance, the transverse roller (13) is not arranged between the shoulders (S1, S2) of the frame (F1), but on the external side of a shoulder (S1), on the opposite side with respect to the other shoulder (S2), projecting externally to the frame (F1).

[0023] Thanks to the structure of the cage according to the present invention, the transverse roller (13) is cantilevered or projecting externally to the support frame (F1). The transverse roller (13) faces outwards, in the operator's view, without obstacles or other front parts. The remarkable ease with which it is possible to access the transverse roller (13) if necessary is therefore absolutely clear, for example, for maintenance operations or disassembly and replacement operations.

[0024] Furthermore, the direct mounting of the transverse roller (13) on the spindle (12) allows to avoid the use of reducers and other transmission members. This implies a remarkable reduction in system costs and energy losses, as well as a considerable reduction in the space required.

[0025] Advantageously, the cage according to the invention may be provided with a second motor (not shown) associated with a spindle (22) that projects externally to the operating space. Also in this case, in a preferred, but not exclusive, embodiment, the second spindle (22) projects in a cantilever fashion from the second motor (21), i.e. it is sustained by the motor (21) alone and has a free end that is not sustained by other structural parts. In this preferred solution, the motor is preferably a torque type motor, as will be better explained in the following description. It would be possible, however, to associate the spindle (12) with the motor through a transmission of the known type, which comprises, for example, a reducer and one or more Cardan joints and one or more transmission shafts.

[0026] A second transverse roller (23) may be mounted directly on the spindle (22) of the second motor (21). The second transverse roller (23) is also arranged in the operating space of the line, next to the frame (F1), externally to a shoulder (S1) of the frame (F1) itself. The second transverse roller (23) is also not arranged between the shoulders (S1, S2) of the frame (F1), but on the external side of a shoulder (S1), on the opposite side with respect to the other shoulder (S2), projecting externally to the frame (F1), and is therefore easily accessible as the first roller (13) is.

[0027] The direct coupling between each transverse roller and the respective spindle allows to avoid the use of reducers, joints and other transmissions which, as well as increasing the costs of the cage, produce a significant reduction in the mechanical performance of the cage itself.

[0028] The two transverse rollers (12,23) may be arranged in a vertically opposing position, as shown in figure 1, or could be offset from one another. Preferably, they are arranged one above and the other below the profile being processed. For the second transverse roller (23) the same advantages already described for the first transverse roller (13) are valid, in terms of direct accessibility and ease of maintenance or replacement.

[0029] The direct coupling of the second transverse roller (23) to its spindle (22) allows to avoid the use of a reducer and other transmission members, with the advantages already described above, without increasing the overall space occupied by the cage.

[0030] In the embodiment represented, the spindles (12,22) of the two motors (11,21) are substantially parallel to one another. Furthermore, the axes of rotation of the two spindles (12,22) lie on the same vertical plane. The motors (11,21) are substantially parallel to one another, to allow the overall dimensions required by the two motors to be reduced. This does not exclude the possi-

bility that, for particular construction or positioning requirements, the two motors and the two spindles could be arranged differently from what is illustrated in figure 1.

[0031] The cage according to the present invention comprises a movable frame (F2), with which a first upright roller (33) is associated, rotating about a first shaft (32). Such first shaft (32) projects in a cantilever fashion from the movable frame (F2).

[0032] The movable frame (F2) is movable between an operating position (figure 1), in which the first shaft (32) assumes a substantially vertical position, and a non-operating position (figure 2), in which the first shaft (32) assumes a substantially horizontal position and is facing the same way as the first spindle (12) and the second spindle (22), towards the operating space of the line.

[0033] In the operating position of the movable frame (F2) the upright roller (33) is arranged with a substantially vertical axis of rotation, or an axis of rotation slightly inclined with respect to the vertical direction, so as to come into contact with a side of the profile being processed. Preferably, but not necessarily, the shaft (32) projects upwards towards the top of the movable frame (F2). In a possible alternative embodiment, the shaft (32) could project downwards from the movable frame (F2). In that case, the movable frame (F2) would be arranged in a higher position with respect to the one shown.

[0034] In the non-operating position of the movable frame (F2), the shaft (32) projects in a cantilever fashion from the movable frame (F2) and is arranged in a substantially perpendicular position to the previous one, therefore being substantially horizontal, or slightly inclined with respect to the horizontal direction. The shaft (32) is also facing the same side as the spindles (12,22), towards the operating space of the line, with the movable frame (F2) instead facing towards the non-operating space of the line, on the same side as the shoulder (S1) of the load-bearing frame (F1). In the non-operating position of the movable frame (F2), the upright roller (33) is therefore accessible on the same side as the transverse rollers (13,23), without any front obstacles, since it is connected in a cantilever fashion to the movable frame (F2).

[0035] Preferably, a second upright roller (43) is associated, with the possibility to rotate, with a second shaft (42), substantially parallel to the first shaft (32) and projecting in a cantilever fashion from the movable frame (F2). The second upright roller (43) is placed next to the first upright roller (33) so as to be able to be arranged, in the operating position of the frame (F2), in contact with an opposite side of the profile being processed. In the non-operating position of the movable frame (F2), the second upright roller (43) is arranged in exactly the same way as the first upright roller (33), and is equally accessible on the same side as the transverse rollers (13,23), without any front obstacles, since it is connected in a cantilever fashion to the movable frame (F2).

[0036] In the embodiment represented, the movable frame (F2) comprises a cross member (30) which can

rotate about an axis between the operating position (figure 1) and the non-operating position (figure 2). The first shaft (32) and the second shaft (42) are connected in a cantilever fashion to the cross member (30), projecting upwards from the latter, in the operating position. The cross member (30) is connected to a base (31), in turn connected to the base of the profiling line. In a known way not illustrated in the figures, the position of the base (31) can be adjusted transversally to the longitudinal direction (Y) on the base of the profiling line. The cross member (30) may rotate with respect to the base (31) about a horizontal axis that is substantially parallel to the longitudinal direction (Y). Preferably the shafts (32,42) are slidable on the cross member (30) along a perpendicular direction with respect to the axis of rotation of the cross member (30). This allows the position of the upright rollers (33,43) to be adjusted, particularly in the operating position of the movable frame (F2), for adapting to any changes of the profile being processed.

[0037] The movable frame (F2) is placed next to the load-bearing frame (F1).

[0038] Preferably, the position of each motor associated with the spindles (12,22) is adjustable along a vertical direction. The vertical adjustment allows the position of the transverse rollers to be adapted to the thickness of the sheet and/or to the dimensions or conformation of the profile. The vertical adjustment of each motor may be obtained through guides and actuators, known to a person skilled in the art, interposed for example between each motor and the load-bearing frame (F1).

[0039] Preferably, the position of the transverse rollers (13,23) is adjustable along a horizontal direction. In particular, the horizontal adjustment direction of each roller is perpendicular to the longitudinal direction (Y) of the profiling line, for example it coincides with or is parallel to the axis of rotation of the roller itself. The adjustment of each transverse roller along the horizontal direction may be obtained, for example, by adjusting the position of the respective motor, or by arranging an adjustable coupling in the axial direction between each transverse roller (13,23) and the related spindle (12,22). The horizontal adjustment of each motor may be obtained through guides and actuators, known to a person skilled in the art, interposed for example between each motor and the load-bearing frame (F1). Further, the position of the transverse rollers (13, 23) is adjustable in the vertical direction (in a known way not illustrated in the figure).

[0040] The horizontal adjustment of each transverse roller (13, 23) allows the position of the transverse rollers to be adapted to the thickness of the sheet and/or to the dimensions or conformation of the profile. Further, the horizontal adjustment of each transverse roller (13, 23) allows the various cages arranged in succession along the profiling line, to be aligned along a longitudinal direction of the profiling line. In a possible configuration, the lower transverse roller (23) is fixed, while the upper transverse roller (13) is movable horizontally for adapting to the profile of the lower transverse roller.

[0041] To facilitate the longitudinal alignment of the various cages arranged along the profiling line, the load-bearing frames (F1) of each cage can be equipped with a horizontal adjustment means, that allows the position of each load-bearing frame to be adjusted along a horizontal and perpendicular direction to the longitudinal direction (Y) of the profiling line.

[0042] Such horizontal adjustment means may, for example, comprise a guide interposed between the base (D) of each frame (F1) and an actuator device for controlling the sliding of the load-bearing frame along the guide. The adjustment means is known to a person skilled in the art, therefore will not be described in further detail.

[0043] The profiling line comprising a plurality of roller cages (G) according to the present invention may be equipped with an automatic alignment device for aligning the transverse rollers (13,23) with respect to the longitudinal direction (Y). In substance, the device is configured to adjust the position of each transverse roller (13, 23) along a horizontal direction perpendicular to the longitudinal direction (Y) and along a vertical direction. Such regulation could be performed for example through the horizontal and/or vertical movement of each motor, in the ways already described previously, or in combination with the horizontal movement of the support frames (F1). The alignment device may acquire the effective position of each transverse roller (13,23) through an optical detector, for example through a laser detector.

[0044] Furthermore, each roller cage (G) may be equipped with a dimensional detector (not shown), configured to detect and measure determined geometrical parameters of the profile at the outlet of the cage (G) itself, for example a radius of curvature, the height or width of the profile with respect to a horizontal frame and the dimensions of the profile. Each dimensional detector may be connected to the automatic alignment device which adjusts the position of each transverse roller according to the signal received.

[0045] In a preferred embodiment, each motor is a brushless motor with permanent magnets. In particular, each motor is a torque motor. As is known, the torque motor is particularly suitable for direct coupling with the member to be rotationally driven, in this case a transverse roller.

[0046] The cantilevered arrangement of the transverse rollers (13, 23), and the possibility to rotate the upright rollers (33, 43) in the operating position, in which they are turned parallel to the transverse rollers (13, 23), notably facilitates all maintenance, disassembly and replacement operations on the rollers themselves, since the rollers are facing towards the operator without obstacles or other front parts. In particular, the cantilevered arrangement of the rollers (13, 23, 33, 43) allows the use of a changing device (50), configured for replacing each roller (13,23,33,43) of the cages (G) with another roller.

[0047] The changing device (50) comprises an operating head (51), movable in the space so as to be able to reach each roller (13,23,33,43) of the cages (G). As

can be easily inferred from the figures, the operating head (51) has free access to all the rollers (13, 23, 33, 43) of the various cages (G), i.e. thanks to the cantilevered arrangement of the transverse rollers (13, 23) and to the non-operating position of the upright rollers (33, 43), in which the latter are disposed in a cantilever fashion from the movable frame (F2) substantially parallel to the transverse rollers (13, 23).

[0048] In order to be able to reach all the cages (G) and the related rollers, the operating head (51) is associated with a support structure that comprises a first guide (55), parallel to the longitudinal direction (Y). The first guide (55) is preferably positioned above the cages (G) and is supported by the pillars solidly constrained to the base (D) of the line. A cross member (56) is slidable along a first guide (55) in a direction parallel to the longitudinal direction (Y). Such cross member (56) is associated with an upright (57) with which the operating head (51) is associated. The upright (57) is slidable along the cross member (56) according to a horizontal transverse direction (X) perpendicular to the advancement direction (Y).

[0049] The operating head (51) is associated with the upright (57) with the possibility to slide along a vertical direction. Preferably, but not necessarily, the operating head (51) comprises a rotary actuator (58), configured to determine the rotation of the operating head (51) about a vertical axis.

[0050] As can be seen in the figures, the combination of movements of the cross member (56), the upright (57) and the operating head (51) itself along the upright (57), including the rotation about a vertical axis, allows the operating head to reach all the rollers of the various cages (G).

[0051] The operating head (51) is equipped with an actuator means (52) for the disassembly and reassembly of a roller (13, 23, 33, 43) on the respective spindle or shaft. Preferably the actuator means (52) comprises a pair of actuators substantially parallel to one another, able to act simultaneously on two rollers. As can be seen in figures 5 and 6, thanks to its own movements, the head (51) may bring each actuator means (52) into an aligned position with one or both of the spindles (12,22) or with one or both of the shafts (32, 42) of a cage (G). In that position, shown in figure 5, the head (51) brings the actuator means (52) into contact with one or both transverse rollers (13, 23) or one or both upright rollers (33, 43). In such configuration, the actuator means (52) remove the rollers from their supports (spindle or shaft), as shown in figure 6. With a sequence of inverse movements, the head (51) is obviously able to position a roller on a spindle (12,22) or on a shaft (32, 42).

[0052] Advantageously, the profiling line may be provided with a magazine (60) for a plurality of rollers (R) interchangeable with the rollers (13, 23, 33, 43) of the cages (G). The magazine (60) is located in a position that can be reached by the head (51). Preferably, but not necessarily, the magazine (60) rotates on command about a vertical axis. This allows each roller (R) to be facing a

desired position, for facilitating the operations of the head (51). As shown in figure 7, the head (51), through its movements, is able to reach the magazine (60) for taking a roller (R) or releasing a roller (13,23,33,43) taken from one of the cages (G).

[0053] In the embodiment represented, the magazine (60) comprises a plurality of support pins (61) for supporting the rollers (G). Such pins (61) project transversally from a central support (62), rotating about a vertical axis.

[0054] Advantageously, but not necessarily, the magazine (60) may have the possibility to slide vertically between an upper position, in which it is reachable by the head (51), and a lower position, in which it is located below ground level. In substance, in the lower position the magazine (60) is located in an underground position with respect to the profiling line, without projecting from the ground. In that position, the magazine (60) does not encumber the resting surface of the profiling line. The magazine (60) could also be at a distance from the profiling line, to allow, for example, the removal or replacement of the rollers (R).

Claims

1. A roller cage for a profiling line, **characterised in that** it comprises:

- a support frame (F1);
- a first motor associated with a first substantially horizontal spindle (12) that projects in a cantilever fashion externally to a shoulder (S1) of the support frame (F1) into an operating space of the line;
- a first transverse roller (13), assembled directly on the first spindle (12);
- a movable frame (F2), with which an upright first roller (33) is associated, rotating about a first shaft (32) which projects in a cantilever fashion from the movable frame (F2);
- the movable frame (F2) is movable between an operating position, in which the first shaft (32) assumes a substantially vertical position, and a non-operating position, in which the first shaft (32) assumes a substantially horizontal position and is facing the same way as the first spindle (12), towards the operating space of the line.

2. The cage according to claim 1, comprising a second upright roller (43), rotatably associated with a second shaft (42), substantially parallel to the first shaft (32) and projecting in a cantilever fashion from the movable frame (F2).
3. The cage according to claim 1, wherein the movable frame (F2) comprises a cross member (30) which can rotate about an axis between the operating po-

sition and the non-operating position, and wherein the first shaft (32) is connected in a cantilever fashion to the cross member (30).

4. The cage according to claim 1, wherein the movable frame (F2) comprises a cross member (30) which can rotate about an axis between the operating position and the non-operating position, and wherein the first shaft (32) and the second shaft (42) are connected in a cantilever fashion to the cross member (30).
5. The cage according to claim 1, wherein the movable frame (F2) is placed next to the load-bearing frame (F1).
6. The cage according to claim 1, comprising a second motor associated with a second spindle (22) that projects in a cantilever fashion externally to the shoulder (S1) of the support frame (F1); a second transverse roller (23) mounted directly on the second spindle (22).
7. The cage according to the preceding claims, wherein the support frame (F1) comprises two shoulders (S1, S2) between which a non-operating space is defined, and wherein the first roller (13) and, if present, the second roller (23), are located externally to the frame (F1), i.e. they are on the side of the shoulder (S1) that is not facing towards the other shoulder (S2).
8. The cage according to one of the preceding claims, wherein the position of each motor is adjustable along a vertical direction and/or along a horizontal direction.
9. The cage according to one of the preceding claims, wherein each motor is a permanent magnet motor, preferably of the torque type.
10. A profiling line, comprising a plurality of roller cages (G) according to one of the preceding claims, aligned along a longitudinal direction (Y).
11. The profiling line according to claim 10, comprising a changing device (50), configured for replacing each roller (13,23,33,43) of the cages (G) with another roller.
12. The profiling line according to claim 11, wherein the changing device (50) comprises an operating head (51), movable in the space so as to be able to reach each roller (13,23,33,43) of the cages (G).
13. The profiling line according to claim 12, wherein the operating head (51) is equipped with a means for disassembling and reassembling a roller (13,23,33,43) on the respective spindle or shaft.

14. The profiling line according to claim 11, comprising a magazine (60) for a plurality of rollers (R) interchangeable with the rollers (13,23,33,43) of the cages (G).

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15. The profiling line according to claim 14, wherein the magazine (60) rotates about a vertical and/or movable axis along a vertical axis.

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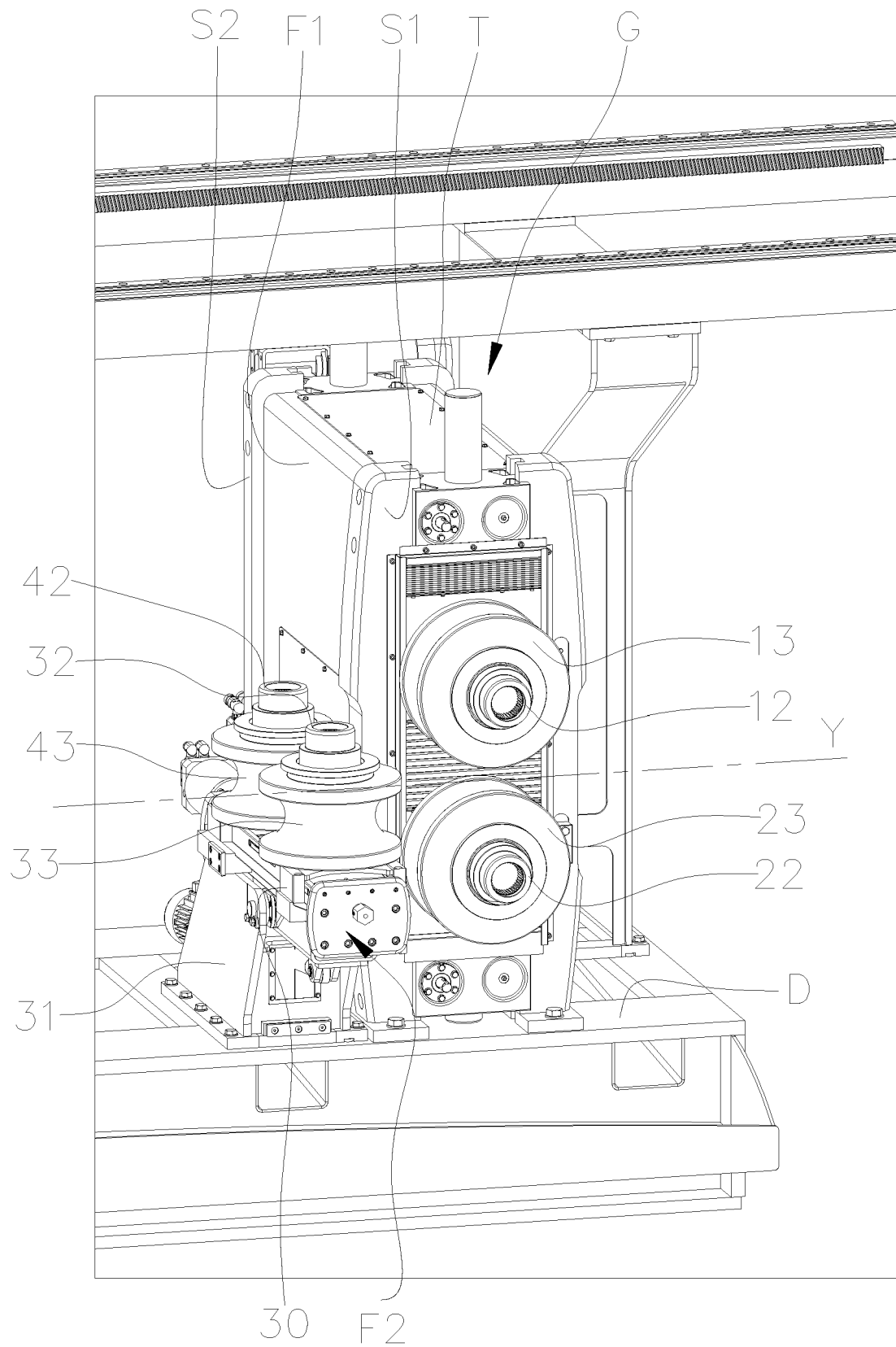


Fig.1

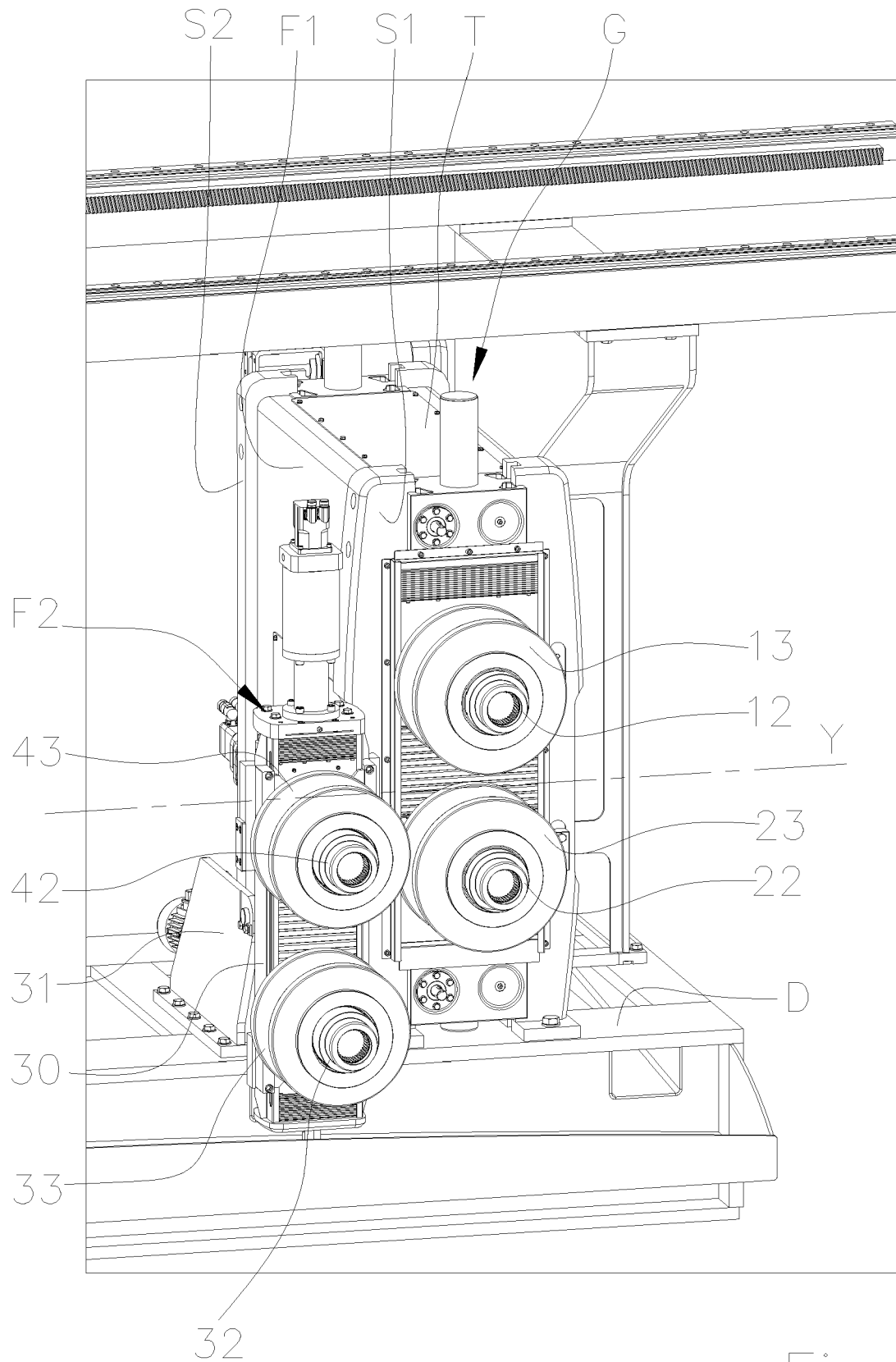
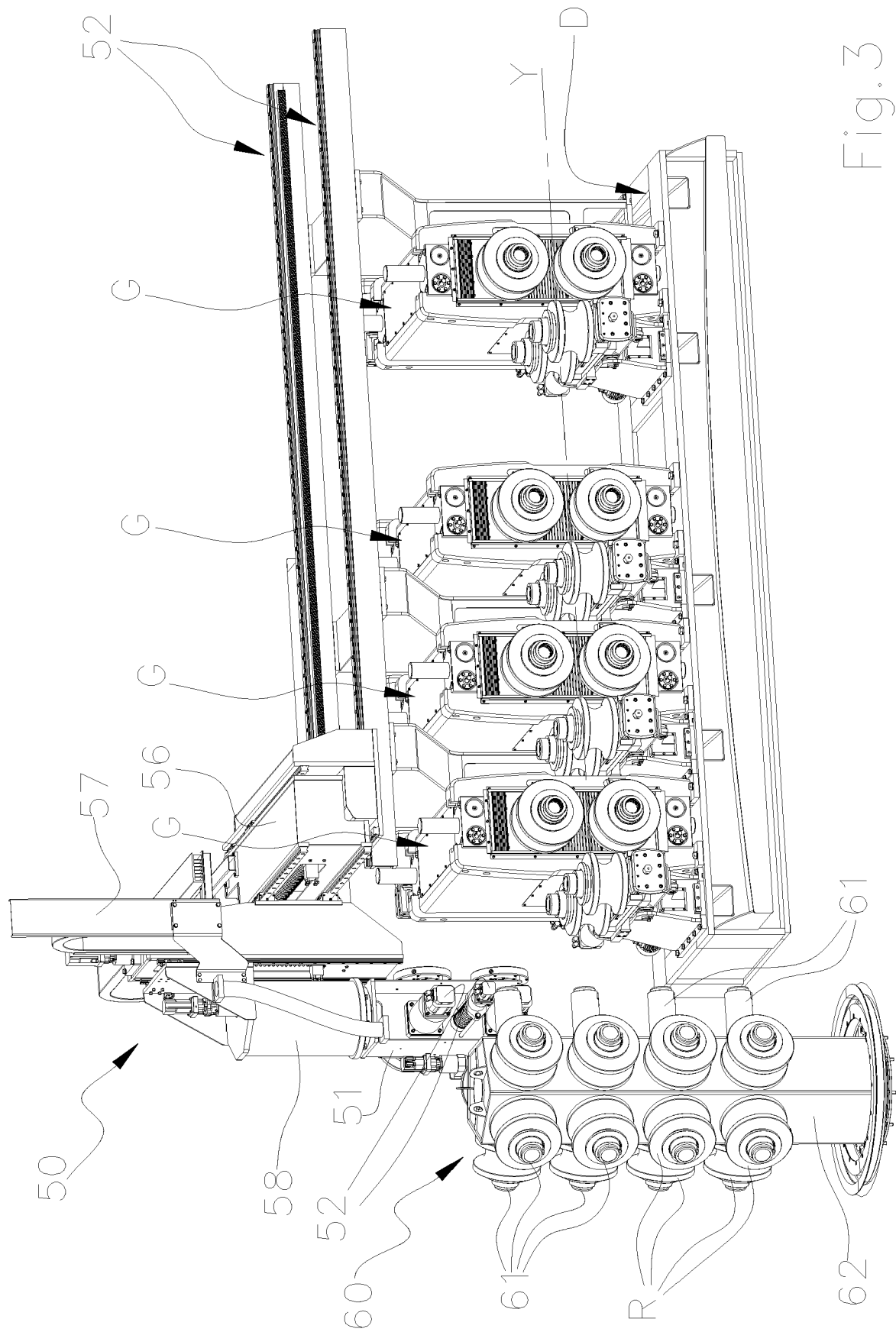


Fig.2



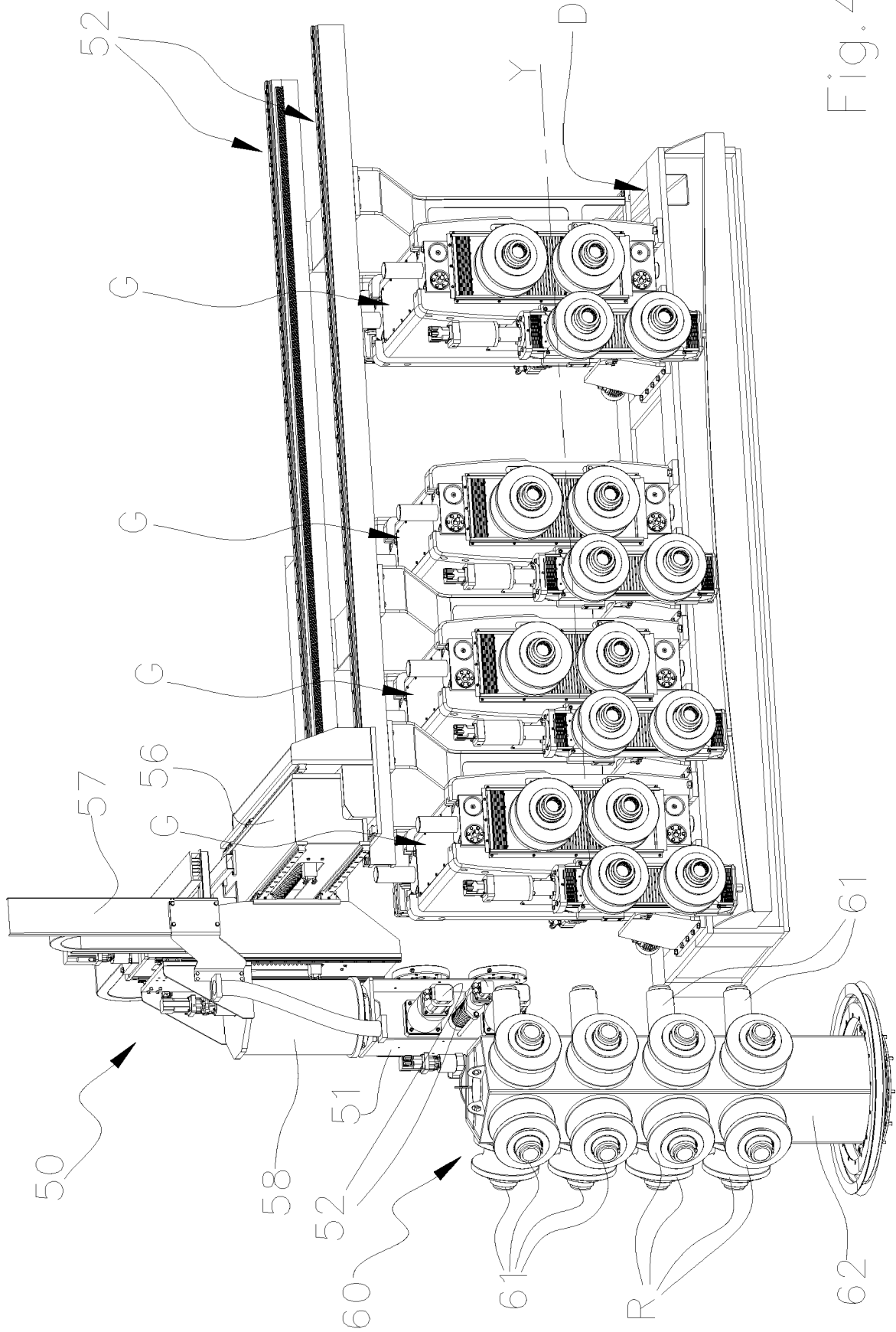


Fig. 4

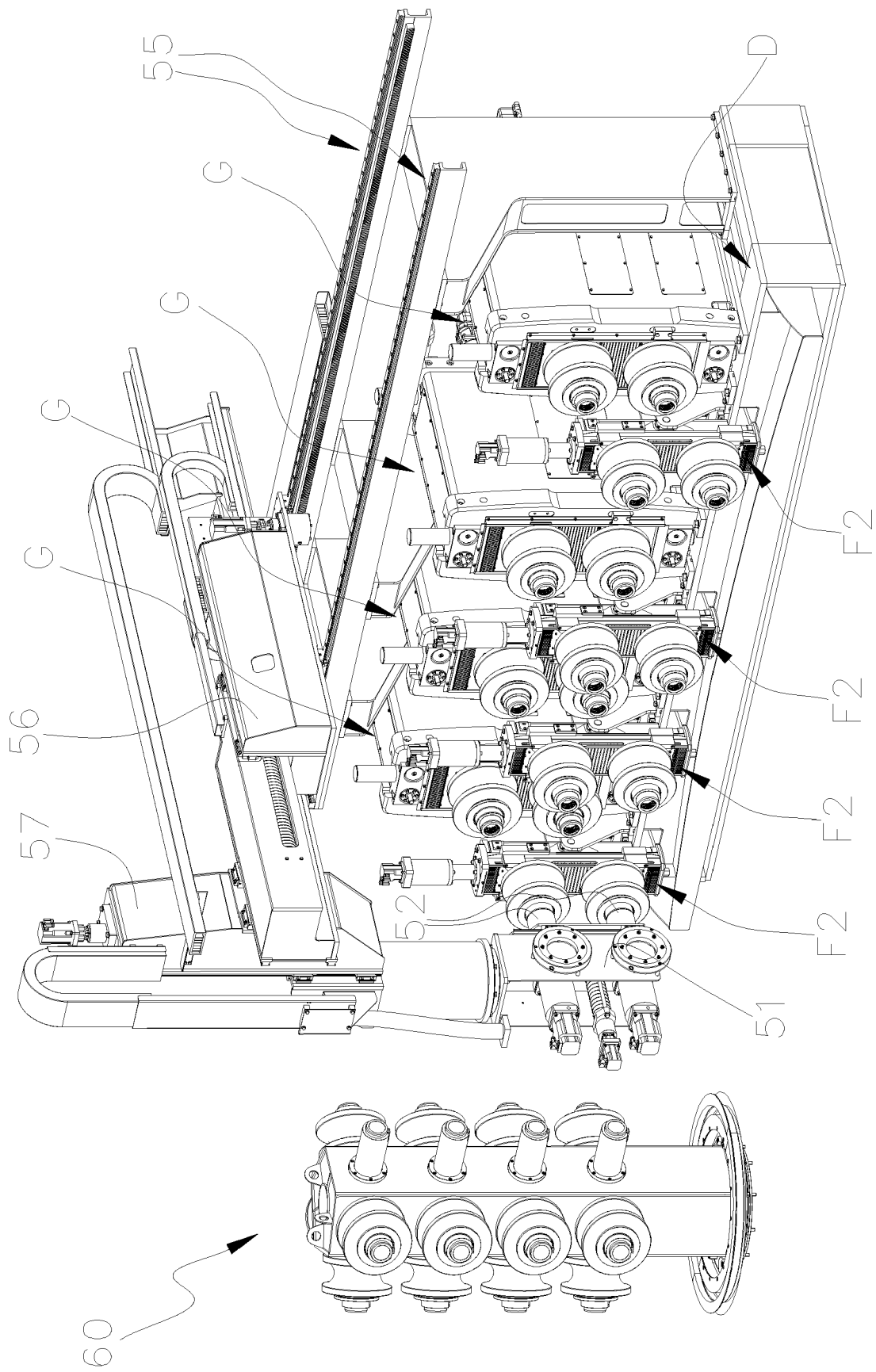


Fig. 5

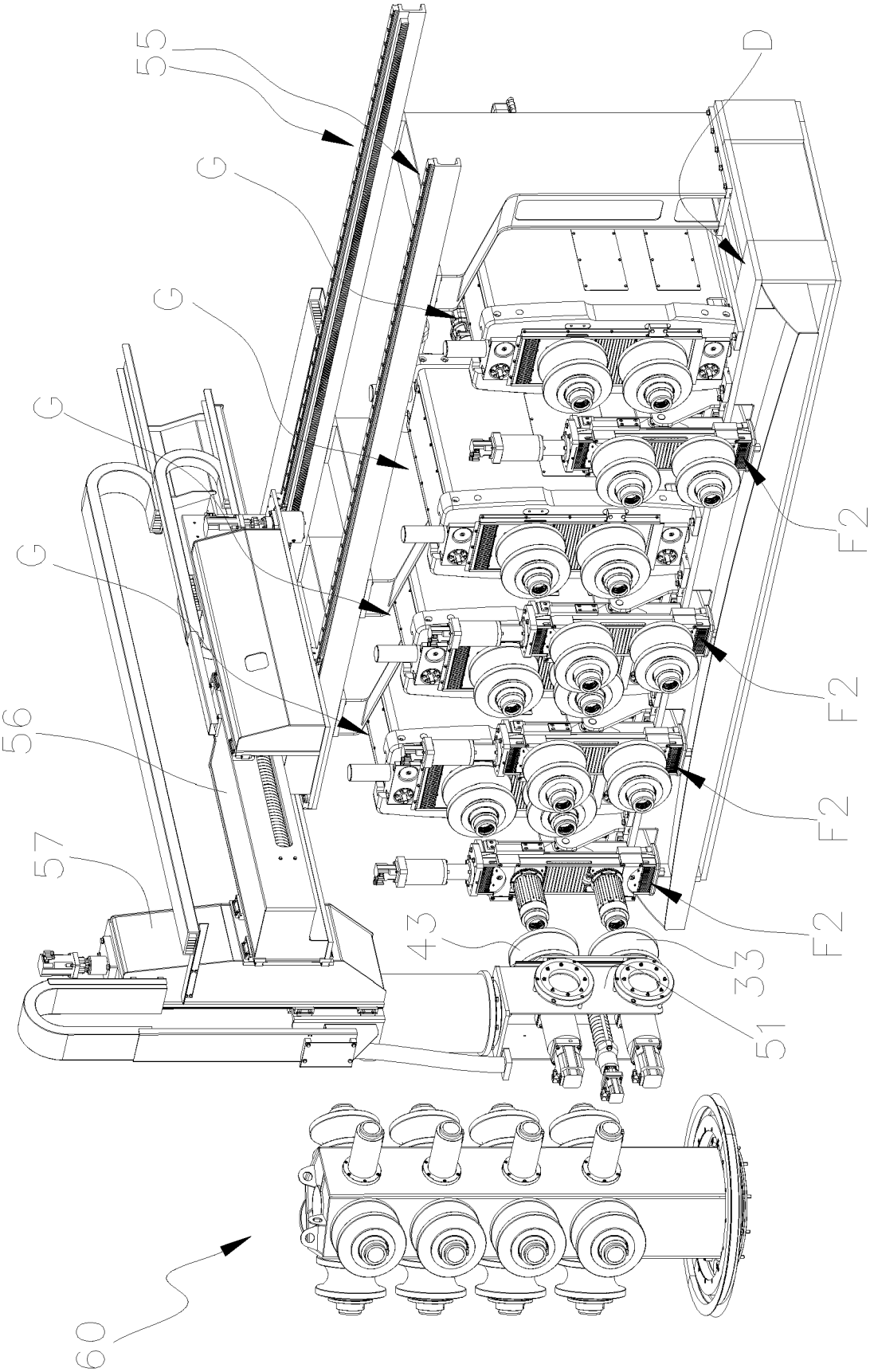
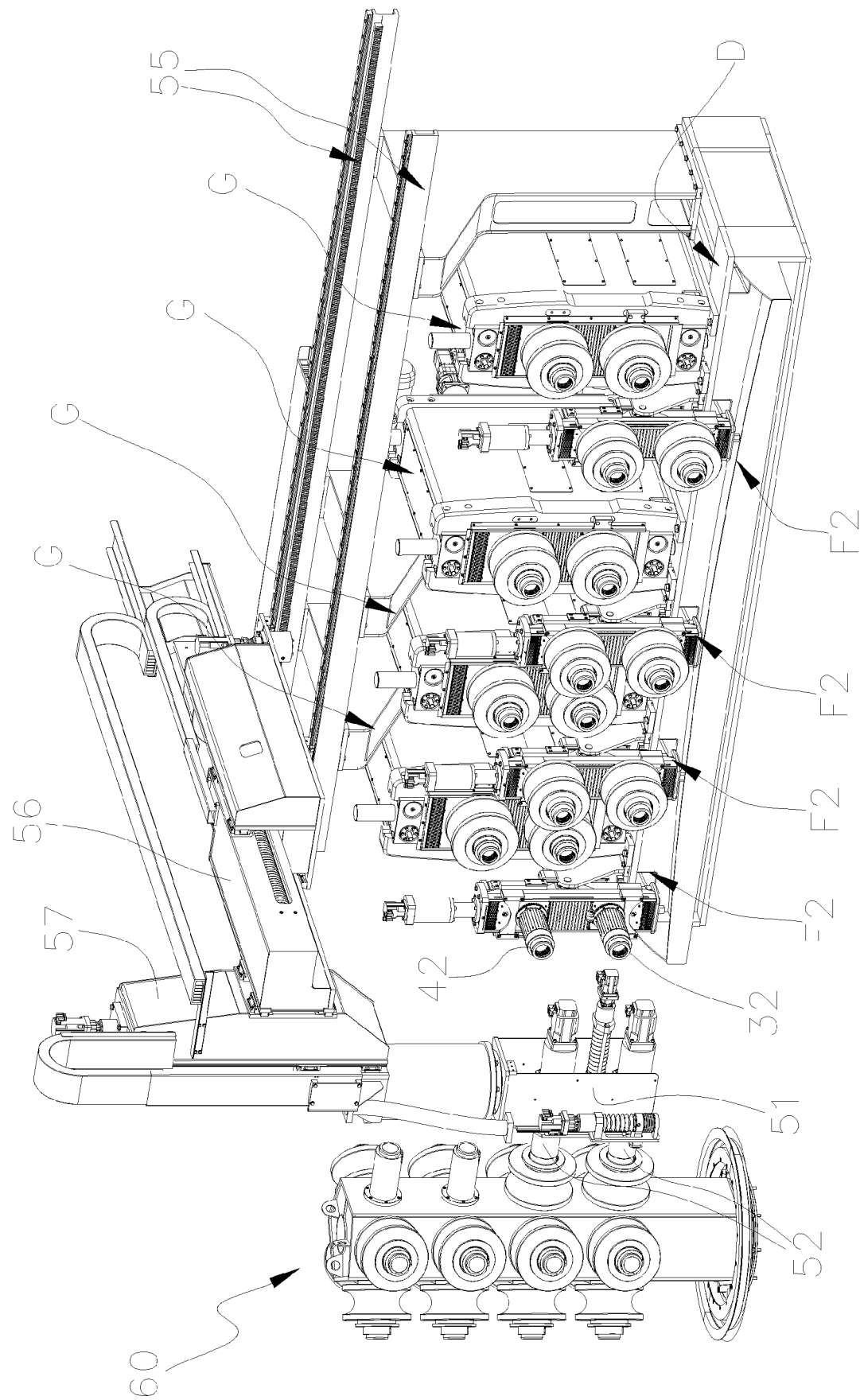


Fig. 6



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EUROPEAN SEARCH REPORT

 Application Number
 EP 17 16 8657

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 985 387 A1 (DREISTERN GMBH & CO KG [DE]) 29 October 2008 (2008-10-29) * paragraph [0023] - paragraph [0024]; figures 1,2 *	1-15	INV. B21B31/08 B21B31/02 B21D5/08 B21D5/12
A	US 3 507 136 A (SALZMAN DAVID) 21 April 1970 (1970-04-21) * column 1, line 59 - column 5, line 18; figures 1,2 *	1-15	
A	EP 2 883 628 A1 (FIVES OTO S P A [IT]) 17 June 2015 (2015-06-17) * figures 1,2 *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			B21B B21D
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 October 2017	Examiner Vinci, Vincenzo
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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 EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 16 8657

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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06-10-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1985387 A1	29-10-2008	NONE	
US 3507136 A	21-04-1970	NONE	
EP 2883628 A1	17-06-2015	EP 2883628 A1	17-06-2015
		JP 2015112646 A	22-06-2015

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82