



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.08.2019 Bulletin 2019/34

(51) Int Cl.:
D06B 17/06 (2006.01) **D06B 19/00 (2006.01)**
F26B 13/10 (2006.01)

(21) Application number: **19163342.9**

(22) Date of filing: **21.05.2015**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **21.05.2014 IT MI20150937**
21.05.2014 IT MI20140938

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
15732389.0 / 3 146 102

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Remarks:

This application was filed on 18.03.2019 as a divisional application to the application mentioned under INID code 62.

(54) **A MACHINE FOR TREATING FOLDED PRINTED FABRICS**

(57) A machine for treating folded printed fabrics, comprising: a frame (200), delimiting at least one fabric (40) treatment chamber (1), the latter being equipped with an inlet (6) and an outlet (7) for the fabric (40); a conveyor (T) for advancing the fabric within said chamber (1), comprising: a pair of endless chains (10, 11), each chain (10, 11) having an active or advance branch (16) extending between said inlet (6) and said outlet (7); a motion structure (M3, 12, 13, 14, 15) for promoting the advance of said chains (10, 11). The machine further comprises a plurality of fabric supporting rods (20), each rod (20) having its ends supported by said chains (10, 11), said rods (20) being associated with said chains (10, 11) such that they can be moved from a first position in which they are hung to said chains (10, 11) to a second position above said chains (10, 11); an overturning structure (300), configured for selectively moving said rods (20) from said first position to said second position.

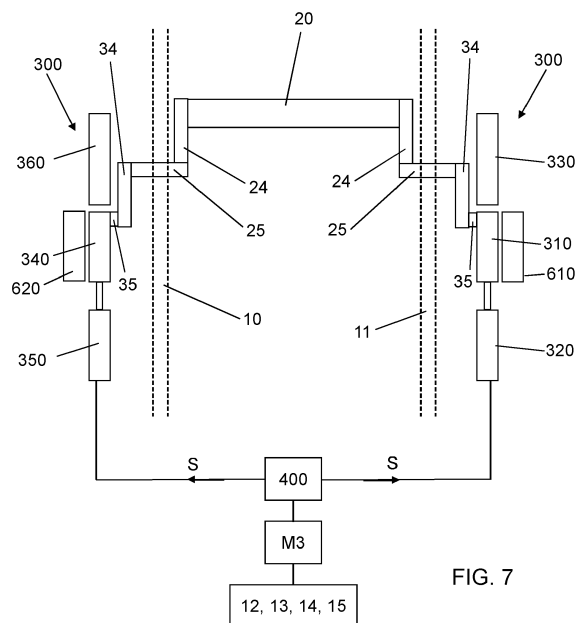


FIG. 7

Description

[TECHNICAL FIELD]

[0001] The present invention relates to a machine for treating folded printed fabrics.

[0002] In particular, though not exclusively, the invention is advantageously applicable to machines or apparatuses for steaming printed fabrics.

[PRIOR ART]

[0003] As is known, the steaming operation is used for stably fixing dyes to the fibre of a fabric by exploiting the action of condensed humidity, combined with the action of environmental heat, in order to cause the dye and all recipe products on the material surface to spread from the surface layer towards the inside of the fibre, thus being fixed thereto.

[0004] A machine of this kind for treating (e.g. preparing, steaming, dyeing, finishing, ennobling and the like) folded fabrics generally comprises a treatment chamber, in which an endless (continuous) conveyor is supported for transferring the fabric to be treated from an inlet side of said chamber, where a roller supports and feeds the fabric, to an outlet side of the treatment chamber.

[0005] Said conveyor comprises a pair of endless chains, which are supported and moved in proximity to the longitudinal walls of the chamber, and the advance and return branches of which extend, respectively, in proximity to the ceiling and bottom of the chamber. The fabric is supported in folds inside the treatment chamber by a plurality of rollers, referred to as rods in the art and in this description, the ends of which are connected to opposite links of the above-mentioned chains.

[0006] Generally, a conveyor of this type is made to advance continuously in order to promote, near the inlet side, the formation of successive folds of fabric on successive rods, and for the time necessary for forming the folded fabric in the treatment chamber.

[0007] International patent application WO 2004/074567 in the name of the present Applicant describes a system for moving rods and forming respective folds, wherein each rod is connected to respective chain links through a pair of arms, each one having a first end constrained to a link of one chain and a second end constrained to a corresponding end of the rod.

[0008] This system uses shaped plates on which the arms that carry the rods can slide. As the fabric advances, the arms are overturned, thus raising the rods and moving them from a condition in which they are hung to the transportation chains in the ascending tract to a condition in which they rest on rails arranged above the active advance branches of the chains.

[0009] The Applicant has noticed that such a machine, as well as other similar machines wherein feeding is effected by means of chains of rods supporting folded fabric, may suffer problems when used for treating ink-jet

printed fabrics or, more in general, fabrics that have been previously subjected to a digital printing process.

[0010] More precisely, the Applicant has verified that digitally printed fabrics not yet subjected to treatments such as, for example, steaming, may transfer the applied dye to other fabrics or to other portions of the same fabric, even upon very slight contact.

[0011] The Applicant has also noticed that folds that are too narrow may promote accidental contact between contiguous portions of the same fold, due to which the dye may be transferred from one fold surface to the surface facing it (i.e. the other inner surface belonging to the same fold), thus giving rise to problems of undesired duplicates on some fabric portions.

[OBJECTS AND SUMMARY OF THE INVENTION]

[0012] It is therefore the object of the present invention to prevent the formation of undesired duplicates after digital printing processes, while still adopting a reliable rod overturning technique that uses little room.

[0013] This and other objects are substantially achieved through a machine for treating folded printed fabrics as set out in the appended claims.

[0014] Further features and advantages will become more apparent from the following detailed description of one preferred and non-limiting embodiment of the invention.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0015] This description will refer to the annexed drawings, also provided merely as explanatory and non-limiting examples, wherein:

Figure 1 schematically shows a longitudinal section of a known machine for treating folded printed fabrics, to which the invention is applicable;

Figure 2 schematically shows a cross-section of the machine of Fig. 1;

Figure 3 shows an enlarged sectional view of a detail of the machine of Fig. 2, which is used also in the present invention;

Figures 4-6 show enlarged views of a part of the machine of Figure 1 during successive steps of its operation;

Figure 7 shows a simplified block diagram of some elements of the machine according to the invention;

Figure 8-9 show some enlarged details of elements belonging to the machine according to the invention;

Figure 10 shows the details of Figures 8-9 in a side view from the inside of the machine;

Figure 11 schematically shows a part of the machine according to the invention, with some elements removed in order to make other elements more visible;

Figures 12 and 13a-13c schematically show the operation of the machine according to the invention;

Figures 14a-14b and 15a-15b schematically show

some operating steps of the machine according to the invention;

Figures 16a-16b schematically show some details of the machine according to the invention;

Figure 17 shows a simplified block diagram of some elements of a second embodiment of the machine according to the invention;

Figure 18 shows an enlarged detail of an element belonging to the machine according the second embodiment of the invention;

Figures 18a-18b and 19a-19b schematically show some operating steps of the machine according to the second embodiment of the invention;

Figures 19c and 20a-20i schematically show the motion of some elements of the machine according to the second embodiment of the invention;

Figures 21a-21b and 22a-22b schematically show a perspective view of details of a variant of the machine according to the invention;

Figures 23a-23f and 24a-24f schematically show some steps of the functioning of said variant of the machine according to the invention;

Figures 25a-25b, 26a-26b schematically show plant views of some elements of said variant of the machine according to the invention;

Figures 27-28 schematically show partial perspective views of said variant of the machine according to the invention;

Figures 29-30 show rear views of said variant of the machine according to the invention, wherein some parts have been removed in order to make other parts more visible.

[DETAILED DESCRIPTION OF THE INVENTION]

[0016] With reference to the annexed drawings, a machine for treating folded printed fabrics, in particular for subjecting printed fabrics to a steaming treatment, is designated as a whole by reference numeral 100.

[0017] Figure 1 shows a known machine 100 to which the present invention is applicable.

[0018] The features of the machine 100 can therefore be a part of the invention.

[0019] The machine 100 (Figure 1) comprises a parallelepiped chamber 1 with longitudinal or side walls 2, 3, a ceiling 4 and a bottom 5.

[0020] At the front, the chamber 1 has an opening 6 for letting in the fabric to be treated; at the rear, it has an opening 7 for letting out the treated fabric.

[0021] Preferably, both openings are located in the upper part of the chamber 1.

[0022] The chamber 1 is delimited by a frame 200, which may comprise the above-mentioned side walls 2, 3, ceiling 4 and bottom 5.

[0023] A fabric supporting and feeding roller 8 is supported in the chamber 1 at the opening 6, while the idle roller 9 that supports the fabric is located in proximity to the outlet opening 7.

[0024] Both rollers 8, 9 preferably have their horizontal axes perpendicular to the walls 2, 3.

[0025] A conveyor T is also supported in the chamber 1, which comprises a pair of endless chains 10, 11.

[0026] The chains 10, 11 may be of the conventional type normally employed in the industry.

[0027] The chain 10 is supported and dragged, near the longitudinal wall 2, by respective chain-type toothed wheels 12, 13, 14, 15, all of which have an horizontal axis perpendicular to the wall 2. The wheel 12, which is supported in proximity to the outlet opening 7, is preferably a drive wheel directly controlled by a drive M3.

[0028] The drive M3 and the toothed wheels 12, 13, 14, 15 form a motion structure adapted to promote the advance of the chain 10.

[0029] The active or advance upper branch 16 of the chain 10 extends horizontally between the fabric inlet and outlet openings 6, 7, whereas the return lower branch 17 of the chain 10 is located underneath and extends horizontally near the bottom 5 of the chamber 1.

[0030] Reference numeral 18 designates the ascending front branch of the chain 10; the ascending branch 18 extends vertically near the fabric feeding roller 8.

[0031] Reference numeral 19 designates the vertically descending rear branch of the same chain 10.

[0032] The chain 11 is substantially identical to the chain 10, and is supported in the same manner near the longitudinal wall 3 of the chamber 1. In particular, the chain 11 is supported by a set of toothed wheels, e.g. four toothed wheels, including a drive wheel. Preferably, the above-mentioned motion structure comprises also all those elements which are useful for promoting the advance of the chain 11. For simplicity, all parts related to the chain 11 have the same reference numerals as those related to the chain 10.

[0033] In the following description, the terms "upstream" and "downstream" should be understood with reference to the direction of motion of the chain 10, 11.

[0034] Within the chamber 1, in proximity to the ceiling 4 thereof, a plurality of horizontal rods 20 are arranged for supporting the folded fabric. The ends of each rod 20 are connected to opposite links of the chains 10, 11. In particular (see Figures 2 and 3), each rod 20 is supported at its ends by pins 21.

[0035] Each pin 21 is freely mounted to a corresponding end 23 of an arm 24. The opposite end of said arm 24 is freely pivoted, through a pin 25, into a respective link of the chain 10 or 11.

[0036] In normal conditions, each rod 20 is therefore rotatably constrained to the chains 10, 11, with the possibility of rotating in both directions about the axis defined by the pins 25.

[0037] Each rod is kept substantially horizontal, perpendicular to the walls 2, 3.

[0038] The arms 24 are pivoted to the opposite links of the chains 10, 11 via the pins 25; on the opposite side of said links, they carry a control lever 34 with a crank 35.

[0039] In other words, the chain link is interposed be-

tween the arm 24 and the control lever 34.

[0040] The crank 35 may be, for example, of the cylindrical type.

[0041] This structure is such that, as the control lever 34 is rotated about the pin 25, a corresponding rotation of the arm 24 will be generated about the same pin 25. The rod 20, which is pivoted to the opposite end of the arm 24, will thus undergo a rotational movement.

[0042] During the steaming treatment, the printed fabric being fed into the chamber 1 by the support roller 8 is supported in folds F by the rods 20 running along the upper branch 16 of the continuously advancing chains 10, 11.

[0043] The steaming process is carried out in a per se known manner, and will not therefore be described in detail herein.

[0044] At the end of the upper branch 16, the fabric is picked up in a conventional manner and unloaded from the steaming chamber through the opening 7. Along the next branches 19 and 17 of the chains 10, 11, the rods 20 travel in a suspended condition. In this condition, they are lifted along the ascending front branches 18 of the same chains 10, 11.

[0045] Where the ascending branches 18 end and the active upper branches 16 begin, the arms are moved from a condition in which they are hung to the chains 10, 11 (first position) to a condition in which they are suspended above the advance branches 16 (second position).

[0046] In this way, the rods 20 can, as they reach the advance branches 16, complete the fold and be positioned onto upper rails 28.

[0047] In particular, wheels 26 are mounted on the pins 21 of each rod 20, which are intended to engage with said respective rails 28. The upper rails 28 extend above the active branches 16 of the chains 10 and 11.

[0048] The distance between each upper rail and the respective active branch is shorter than the length of the arm 24; preferably, such distance is approximately half said length.

[0049] In one embodiment, the wheels 26 are toothed wheels, and the rails 28 consist of respective chains.

[0050] For moving the rods 20 from the first hung position to the second suspended position, the machine 100 comprises an overturning structure 300 (Figures 7-11).

[0051] Figure 1 shows an overturning structure of a known type, which overturns all rods passing in succession from the ascending tract 18 to the advance branch 16.

[0052] In accordance with the invention, instead, the overturning structure 300 selectively moves the rods 20 from the first position to the second position.

[0053] Preferably, the overturning structure 300 moves the rods 20 in an alternate manner. In other words, if a given rod is overturned from the first to the second position, the rod immediately preceding it and the rod immediately following it will remain in the first position also in

the active branch 16.

[0054] In this manner, wider folds can be created, e.g. twice as wide as those normally made by the machine, thus significantly reducing the risk of undesired transfer of ink from one portion to another of the fabric as the fabric advances.

[0055] It should be noted that, in general, the selective overturning of the rods 20 may also be effected according to a different scheme, depending on the fold width to be obtained.

[0056] Preferably, the overturning structure 300 comprises at least one first active element 310 positioned in an initial tract of the active branch 16 and adapted to overturn the rods 20.

[0057] The overturning structure 300 further comprises a first auxiliary element 610 associated with the first active element 310.

[0058] The first auxiliary element 610 is adapted to selectively allow the first active element 310 to act upon the rods 20 in order to move them from the first to the second position.

[0059] In practice, if the first auxiliary element 610 were absent, the first active element 310 would cause all rods 20 to be overturned from the first to the second position, leading to the result shown in Figure 1.

[0060] Preferably, the first active element 310 comprises a shaped plate adapted to cooperate with the rods 20 through a respective lower profile 311.

[0061] In practice, the shaped plate has a substantially rectangular shape, wherein the lower profile 311 is adapted to cause a rod 20 to move from the first to the second position.

[0062] Figure 8 shows one possible embodiment of the first active element 310: the shaped profile 311 may comprise, in succession, a first straight tract 311a at a first height q1, a bend 311b, a convex portion 311c, and a second straight tract 311d at a second height q2, lower than said first height q1.

[0063] Figure 9 shows one possible embodiment of the first auxiliary element 610.

[0064] The first auxiliary element 610 preferably has a respective lower profile 611 through which it selectively acts upon the rods 20.

[0065] Preferably, the lower profile 611 has a substantially straight first tract 611a at a third height q3, and a substantially straight second tract 611b at a fourth height q4.

[0066] Preferably, the third height q3 is substantially equal to the first height q1.

[0067] Preferably, the fourth height q4 is substantially equal to the second height q2.

[0068] Preferably, the first tract 611a and the second tract 611b of the first auxiliary element 611 are connected by a junction tract 611c.

[0069] Preferably, the junction tract 611c joins the first and second tracts 611a, 611b along a profile that is substantially straight, or anyway significantly less concave than the bend 311b of the first active element 310.

[0070] Preferably, the first auxiliary element 610 is provided as a shaped plate having the shape shown by way of example in Figure 9.

[0071] From a practical viewpoint, the first auxiliary element 610 may resemble a first active element 310 with a partially filled bend 311b.

[0072] Preferably, the first active element 310 and the first auxiliary element 610 are so arranged relative to each other, e.g. side by side, that the connection portion 611c is located at the bend 311b. In other words, the portion of the first auxiliary element 610 that is delimited at the bottom by the connection portion 611c closes the gap created, in a side view, by the bend 311b.

[0073] As will become more apparent below, the connection portion 611c of the first auxiliary element 610 prevents some rods 20 (preferably one of two) from being overturned by means of the bend 311b of the first active element 310.

[0074] Figure 10 schematically shows a side view, from the inside of the machine, in which one can see in the foreground the first active element 310 almost totally covering the first auxiliary element 610, except for the terminal part 611d and the portion corresponding to the connection portion 611c.

[0075] Preferably, an arm 24 is mounted to at least one end of each rod 20; the arm 24 has a first end pivoted to a corresponding end of the rod 20, and a second end pivoted to a link of a respective one of the chains 10, 11.

[0076] Preferably, the first active element 310 cooperates with the arms 24 to move the respective rods from the first to the second position.

[0077] More in detail, the first active element 310 intercepts the cranks 35 of the rods 20 in order to move the rods 20 from the first to the second position.

[0078] Conveniently, the cranks 35 are subdivided into a first and a second groups.

[0079] The cranks of the first group (Figure 16a) have a longer longitudinal extension, while the cranks of the second group (Figure 16b) have a shorter longitudinal extension.

[0080] Note that said longitudinal extension is preferably measured in a direction substantially parallel to the rods 20.

[0081] The first active element 310 is, in principle, adapted to intercept the cranks 35 of both groups; the first auxiliary element 610, instead, ensures that only the cranks of the second group (i.e. the shorter ones) will be intercepted by the first active element 310.

[0082] Consequently, the rods 20 fitted with cranks of the second group are rotated about the respective pins 25 and positioned onto the guides 28 at the transition from the ascending tract 18 to the advance branch 16 of the chains 10, 11.

[0083] In particular, the shaped profile 311 of the first active element 310 is adapted to intercept the cranks 35 of the second group to cause a rotation of the respective control levers 34 and, consequently, a rotation of the respective arms 24, so as to promote a movement of the

respective rods 20 from the first position to the second position.

[0084] Instead, the cranks of the first group will be intercepted by the first auxiliary element 610 but not by the first active element 310, and the respective rods 20 will not be overturned, thus staying in the first position, i.e. hung to the chains 10, 11, along the advance branch 16.

[0085] Anyway, the first auxiliary element 610 is so shaped as to arrange the arms associated with cranks of the first group in a substantially horizontal position in the initial part of the advance branch 16, so as not to hinder the fold formation process.

[0086] Preferably, the first auxiliary element 610 is positioned at such a distance from the respective chain 10 as to intercept the cranks 35 of the first group without intercepting the cranks 35 of the second group.

[0087] In practice, the first active element 310 has a planar extension substantially parallel to the planar extension of the first auxiliary element 610; said planar extensions are preferably substantially parallel to the chains 10, 11 and substantially orthogonal to the longitudinal extension of the cranks 35.

[0088] Therefore, the cranks 35 of the second group, being shorter, will not reach the first auxiliary element 610 and will be guided by the first active element 310 alone; instead, the cranks 35 of the first group, being longer, will reach the first auxiliary element 610, which will prevent them from rotating and overturning their respective rods.

[0089] Preferably, the first active element 310 and the first auxiliary element 610 are substantially integral with each other.

[0090] Preferably, the overturning structure 300 comprises also a first motion member 320 acting upon the first active element 310 for alternately moving the latter back and forth, in particular along a direction substantially parallel to the advance direction of the branch 16.

[0091] By way of example, the first motion member 320 (Fig. 11) may comprise an electric motor 321 associated with a cam 322, which is appropriately sized for moving the first active element 310 and the first auxiliary element 610 between the proximal end-of-travel position and the distal end-of-travel position.

[0092] Note that, for simplicity, Figure 11 only shows the first active element 310; as aforesaid, it is preferably arranged next to the first auxiliary element 610 (on the outside) and integral therewith. As schematically shown in Figures 14a-14d, the first active element 310 is initially in a distal end-of-travel position (on the left in the drawing).

[0093] The black circles represent, in a schematic sectional view, cranks 35 of the first group, whereas the (empty) white circle represents a crank 35 of the second group.

[0094] The crank of the second group follows the lower profile of the first active element 310, as shown in Figures 14a-14f.

[0095] When the crank of the second group is at the

second straight tract 311d of the lower profile 311 of the first active element 310, the first motion member 320 will move the first active element 310 towards a proximal end-of-travel position, so as to be able to guide the crank 35 of the first group up to the guide 29a, as shown in Figure 14f.

[0096] The first active element 310 will then be brought back into the distal end-of-travel position, in order to intercept the next crank of the second group.

[0097] The black circles, instead, follow the profile of the first auxiliary element 610, as shown in Figures 15a-15f.

[0098] As aforesaid, thanks to the connection portion 611c, said cranks will not enter the bend 311b of the first active element 310, and their respective rods will not be overturned.

[0099] After following the lower profile of the first auxiliary element 610, the crank of the first group, which is dragged by the advance branch 16, will follow the terminal part 611d of the same first auxiliary element 610, by making use of the interspace H (Figures 15c-15d) available between the end of the second straight tract 611b and the guide 29b.

[0100] Afterwards (Figures 15e-15f), the first auxiliary element 610, which is integral with the first active element 310, will be moved from the distal end-of-travel position, where it was initially located, to the proximal end-of-travel position, thus moving the crank of the first group up to the guide 29b.

[0101] Note that the positions of the first auxiliary element 610 shown in Figures 15a-15f correspond to the positions of the first active element 310 shown in Figures 14a-14f.

[0102] Preferably, the overturning structure 300 further comprises a first guide element 330, which is substantially integral with the frame 200 and which has an arched profile.

[0103] The first guide element 330 is located substantially in the transition area between the ascending tract 18 and the advance branch 16 of the chain 10, 11.

[0104] The first guide element 330 performs the task of starting a rotation of the rod 20 about the pin 25, guiding the crank 35 in such a way that the control lever 34 and the arm 24 will arrange themselves horizontally, from the substantially vertical orientation taken in the ascending tract 18.

[0105] The profile of the first guide element 330 is substantially contiguous to the shaped profile of the first active element 310, and in particular to the first straight tract 311a.

[0106] Preferably, the first guide element 330 is at the same distance from the chain 10, 11 as the first active element 310. In this manner, the first guide element 330 can guide all the cranks 35, both those of the first group and those of the second group, before they are selectively intercepted by the first active element 310 and by the first auxiliary element 610.

[0107] In practice, in the proximity of the upper end of

the front branch 18, the crank 35 of the control lever 34 will first meet the profile of the first guide element 330 and then the shaped profile 311 of the first active element 310. The action of the first guide element 330 and of the first active element 310, combined with the advance of the chain, will prevent the rod 20 from staying in the hung condition taken in the vertical tract 18, and will force the rotation of the arm 24 to move the rod 20 from the hung configuration to the suspended configuration.

[0108] The above applies to the rods associated with cranks of the second group; as for the rods 20 associated with cranks 35 of the first group, the first active element 310 will not be effective: the respective cranks will follow the arched profile of the first guide element 330 and then, instead of undergoing the overturning caused by the shaped profile 311 of the first active element 310, such cranks will follow the lower profile 611 of the first auxiliary element 610; afterwards, the rods will return by gravity into the hung position, staying there along the whole advance branch 16.

[0109] Advantageously, when the cranks 35 of the second group undergo the rotation that causes the overturning of the respective rods 20, the motion structure will impart an acceleration (a so-called "pull") to the chain 10, 11, so as to promote the formation of the fold and prevent the fabric from sliding over the rod.

[0110] The timing of these accelerations can be determined as a function of the angular position of a reference shaft (e.g. the shaft of the above-mentioned drive M3).

[0111] Note that, in practice, the rods 20 associated with cranks of the first group perform no function in the machine thus configured: they are simply deactivated without being physically removed, and remain available for future operations, wherein it may be necessary/desirable to make narrower folds.

[0112] In order to make the rods associated with cranks of the first group operational again, it will be sufficient to displace the first auxiliary element 610 in such a way that the latter does not intercept the cranks of the first group anymore. For example the first auxiliary element 610 can be translated away from the chain 11. Preferably also the first active element 310 is integrally translated; the latter will intercept all the cranks, namely both the cranks of the first group and the cranks of the second group, so that all the rods will be overturned.

[0113] It is envisaged that the first auxiliary element 610 (and preferably the first active element 310) can be displaced by means of a respective actuator (e.g. a hydraulic or electromechanical one) upon a manual or automatic command.

[0114] This displacement preferably occurs in a direction orthogonal to the displacement imposed by the first motion member 320.

[0115] Note that the above description preferably only concerned one end of each rod 20. Merely by way of example, with reference to the schematic top view of Figure 7, the description preferably only concerned the right end of each rod 20, i.e. the end where the first active

element 310 operates.

[0116] Preferably, the overturning structure 300 may comprise a second active element 340 operating at the opposite end of the rod 20.

[0117] The shape and position of the second active element 340 are wholly similar to those of the first active element 310.

[0118] It acts upon the opposite end of the rod (e.g. the left end, still with reference to Figure 7), thus intercepting the respective crank 35 and causing the rotation of the control lever 34 and the arm 24 about the pin 25, very much as described with reference to the first active element 310.

[0119] The second active element 340 is positioned and configured in a manner such as to cause the overturning of the same rods acted upon by the first active element 310.

[0120] In practice, the cranks 35 have a substantially symmetrical design relative to a sagittal/longitudinal axis of the machine 100. The first and second active elements 310, 340 are arranged symmetrically relative to said axis. They will thus intercept the cranks belonging to the second group without however interacting with the cranks of the first group, so that the rods 20 associated with the latter will remain in the hung position.

[0121] Advantageously, the second active element 340 is associated with a second auxiliary element 620.

[0122] The second auxiliary element 620 preferably has a shape which is substantially identical to that of the first auxiliary element 610. The second auxiliary element 620 ensures that only the cranks of the second group will be intercepted and rotated by the second active element 340.

[0123] The cranks of the first group, instead, will follow the profile of the second auxiliary element 620, so that the respective rods will not be overturned.

[0124] Preferably, the second active element 340 and the second auxiliary element 620 are symmetrical to the first active element 310 and to the first auxiliary element 610 relative to the above-mentioned sagittal/longitudinal axis of the machine 100.

[0125] Preferably, the overturning structure 300 further comprises a second motion member 350.

[0126] The structure and operation of the second motion member 350 are preferably the same as those of the first motion member 320.

[0127] The second motion member 350 imparts to the second active element 340, and preferably to the second auxiliary element 620, a motion which is similar to that imparted by the first motion member 320 to the first active element 310, and preferably to the first auxiliary element 610.

[0128] Also the second active element 340 and the second auxiliary element 620 can be displaced, preferably in a direction orthogonal to the longitudinal extension of the active branch 16 and parallel to the floor 5 of the machine 100, so that the second auxiliary element 620 does not intercept any crank, and all the cranks, instead,

are intercepted by the second active element 340, so as to overturn all the rods.

[0129] The motion imparted by the first and second motion member 320, 350 is schematically represented in Figures 14a-14f and 15a-15f.

[0130] The first motion member 320 and the second motion member 350 operate in a synchronized manner, so as to impart the same motion to the first active element 310 (and preferably to the first auxiliary element 610) and to the second active element 340 (and preferably to the second auxiliary element 620) at the same instants.

[0131] In this way, the machine 100 can act in a substantially simultaneous manner upon both ends of each rod, thereby causing the latter either to be overturned or to continue its travel in the hung condition.

[0132] Advantageously, the machine 100 further comprises a processing unit 400, at least associated with the first motion structure M3, 12, 13, 14, 15 and with the first motion member 320 for synchronizing the same.

[0133] Preferably, the processing unit 400 is also associated with the second motion member 340 in order to synchronize the latter with the motion structure M3, 12, 13, 14, 15 and with the first motion member 320.

[0134] In particular, the processing unit 400 can be inputted a parameter representative of the current angular position of a crankshaft taken as a reference, e.g. the shaft of the drive M3 that causes the chain 10, 11 to advance.

[0135] By comparing said parameter with previously stored references, the processing unit 400 can thus determine when the first (and possibly the second) motion member, and hence the first (and possibly the second) active element, needs to be moved.

[0136] In particular, according to predetermined angular positions of the reference shaft, the processing unit 400 will command the first (and possibly the second) motion member to move the first (and possibly the second) active element between the distal end-of-travel position and the proximal end-of-travel position, in accordance with the above description.

[0137] For this purpose, the processing unit 400 will send one of more activation signals S to the first and possibly the second motion members 320, 340.

[0138] In one embodiment, the processing unit 400 initially executes a step of aligning the various motors/drives controlled by it (e.g. the drive M3, the first motion member 320, and possibly the second motion member 340). In this manner, the machine can start operating correctly, and the various parts thereof can be moved with proper synchronism.

[0139] Should any problem or malfunction be detected (e.g. an improperly positioned rod), the processing unit 400 will stop the machine and perform a new alignment operation, so as to allow the machine to correctly resume its operation.

[0140] Preferably, the processing unit 400 may be a PLC configured for managing the whole machine 100.

[0141] The overturning structure 300 may advanta-

geously comprise a second guide element 360, similar to the first guide element 330, positioned upstream of the second active element 340 and second auxiliary element 620.

[0142] Preferably, the cranks of the first and second groups are alternated.

[0143] In other words, each rod 20 is associated with a pair of cranks 35, each one associated with a respective end of the rod itself; both of such cranks 35 belong either to the first group or to the second group. If cranks of the first group are mounted at the ends of a given rod, then cranks of the second group will be mounted at the ends of the immediately preceding rod and at the ends of the immediately following rod.

[0144] Likewise, if cranks of the second group are mounted at the ends of a given rod, then cranks of the first group will be mounted at the ends of the immediately preceding rod and at the ends of the immediately following rod.

[0145] In this manner, one rod out of two will be involved in the fold formation process, while the other rods will remain in the hung condition, i.e. inactive.

[0146] According to a variant of the invention, the overturning structure 300 can selectively overturn rods 20 without moving the first active element 310, the first auxiliary element 610 (and possibly the second active element 340 and second auxiliary element 620).

[0147] This variant is shown in figures 21a-21b, 22a-22b, 23a-23f, 24a-24f, 25a-25b, 26-26b, 27-30.

[0148] In this variant, the first active element 310, the first auxiliary element 610 and preferably the second active element 340 and second auxiliary element 620 are substantially motionless, i.e. integral with the frame 200 of the machine 100. Their position is the aforesaid distal end-of-travel.

[0149] The machine 100 comprises a main guide G1 arranged close to the active branch 16 and adapted to engage cranks 35 such that the respective rods 20 are kept in the second position (i.e. overturned) along the active branch 16.

[0150] Practically the main guide G1, which can replace the aforesaid guides 29a, 29b, can be shaped as a cantilever horizontally extending from the side wall 2, 3.

[0151] The overturning structure 300 further comprises a first directing device 370 configured for selectively allowing the cranks 35 to reach main guide G1.

[0152] More in detail, the first directing device 370 is configured in such a way as to close the gap between the first active element 310 and the main guide G1: when the first directing device 370 closes said gap, then the cranks 35 of the second group can follow the profile of the same first directing device 370 and reach the main guide G1; when the first directing device 370 leaves the gap open, the cranks 35 of the first group "fall" into the gap (because of the gravity that acts on the respective rods) and the respective rods 20 remain in the hung condition, maintaining such condition along the active branch 16.

[0153] It is to be noted that, in the variant previously disclosed, the gap between the first active element 310 and the guide 29a is dynamically filled, when necessary, by the movement of the first active element 310 and first auxiliary element 610.

[0154] In the present variant, instead, at least the first directing device 370 is envisaged.

[0155] Figures 21a-21b schematically show perspective views of the first directing device 370.

[0156] Preferably the first directing device 370 comprises a guide portion 371, adapted to intercept the cranks 35 of the first group.

[0157] Preferably the first directing device 370 comprises a closing portion 372, that selectively closes the gap between the first active element 310 and the main guide G1 and allows the cranks 35 of the second group to reach the same main guide G1.

[0158] Preferably the first directing device 370 is pivotally mounted, preferably at its first end 370a, on the frame 200, in particular on the side wall 2, 3.

[0159] Preferably the first directing device 370 comprises a return element 373, adapted to bring the first directing device 370 back in an initial position, after it has been moved by a crank 35 of the first group.

[0160] Preferably the return element 373 acts on a second end 370b of the first directing device 370, opposite to said first end 370a.

[0161] For example, the return element 373 can be realized as a resilient element (e.g. a spring, as schematically shown in figures 21a-21b).

[0162] As an alternative, the return element 373 can be realized as a pushing element (e.g. of the pneumatic type).

[0163] As an alternative or in addition to the above, the return element 373 can comprise a weight, cantilevered on the first end 370a, so as to favor the clockwise rotation (in the view of figure 21a) of the first directing element 370.

[0164] Preferably the first directing device 370 is arranged so that the closing portion 372 closes the gap between the first active element 310 and the main guide G1.

[0165] Preferably the first directing device 370 is substantially arranged at a lower height than the first active element 310 and the main guide G1.

[0166] Preferably the first directing device 370 is positioned so as to intercept the cranks 35 of the first and second group when the latter are sliding along the lower edge of the first active element 310 or the first auxiliary element 610.

[0167] Preferably the first directing device 370 is arranged at such a distance from the respective chain 11 that the guide portion 371 intercepts the cranks 35 of the first group and not the cranks 35 of the second group.

[0168] In summary, the first directing device 370 is substantially realized as a pivoted lever, including portions having different widths (measured in a direction parallel to rods 20), associated to a return element. The portions

having different widths are the guide portion 371 and the closing portion 372.

[0169] Figure 25a schematically shows a crank 35a of the first group, a crank 35b of the second group, the first active element 310, the first auxiliary element 610, the chain 11, the first directing device 370 and the main guide G1. In this configuration, the cranks 35a of the first group are long enough to be intercepted by the first auxiliary element 610 and by the guide portion 371 of the first directing element 370. Accordingly the respective rod is not overturned. The cranks 35b of the second group, instead, are short enough not to be intercepted by the first auxiliary element and thus cooperate with the first active element 310 and the closing portion 372 of the first directing element 370, so as to reach the main guide G1. Accordingly the respective rod is overturned and maintained in the suspended position.

[0170] Preferably the first directing element 370 is substantially integral with the first active element 310 and the first auxiliary element 610.

[0171] Preferably the first directing device 370 is normally in the position schematically represented in figure 24a. In particular it is maintained in such position by the return element 373.

[0172] When a crank 35 of the first group, dragged by the chain 11, arrives at the first directing device 370 (figures 24b-24c), it is intercepted by the guide portion 371 (figure 24d). Since the crank goes forward, the first directing device 370 rotates counterclockwise (figure 24e) and opens a path for the same crank towards the gap. The crank of the first group, under the action of the respective rod's weight, enters such gap. The crank and the respective rod, always dragged by chain 11, advance along the active branch 16 in the hung condition, without cooperating to the formation of any fold.

[0173] When the first directing device 370 does not undergo the action of the crank of the first group anymore, it is brought back to the initial position by the return element 373 (figure 24f).

[0174] When a crank 35 of the second group, dragged by chain 11, reaches the first directing device 370 (figures 23a-23d), it is not intercepted by the guide portion 371, since the latter is arranged at too a long distance from the chain. The crank of the second group thus advances until it reaches the closing portion 372 (figure 23e), which allows the same crank to arrive at the main guide G1 (figure 23f).

[0175] Accordingly, in this case, the first directing device 370 is not displaced.

[0176] The rod 20 associated to the crank 35 of the second group remains in the overturned condition, thanks to the constraint imposed to the respective crank by the main guide G1 and to the constraint imposed to the pin 25 by the chain 11.

[0177] It is to be noted that the above disclosure concerns only one side of the machine 100, wherein only one end of rods 20 is dealt with. Advantageously, it is envisaged that a similar structure is provided also on the

opposite side of the machine, said similar structure comprising an auxiliary guide G2 and a second directing device 380, entirely analogous to the main guide G1 and the first directing device 360 disclosed hereabove.

[0178] Figure 26a schematically shows a crank 35a of the first group, a crank 35b of the second group, the second active element 340, the second auxiliary element 620, the chain 10, the second directing device 380 and the auxiliary guide G2. The same remarks presented above concerning figure 25a also apply to figure 25a.

[0179] Figure 26b shows the same elements in a different configuration, similar to the one shown in figure 25b, wherein all the rods are overturned, both the rods associated with cranks 35a of the first group and the rods associated with cranks 35b of the second group.

[0180] Preferably the second directing element 380 is substantially integral with the second active element 340 and the second auxiliary element 620.

[0181] It is to be noted that figures 25a-25b and 26a-26b, as far as the transversal displacement of the first active element 310, the first auxiliary element 610, the second active element 340 and the second auxiliary element 620 is concerned, can also be applied to the previous variant of the machine 100.

[0182] Figures 22a-22b schematically show perspective views of the second directing device 380.

[0183] Is it also to be noted that the main guide G1 and preferably the auxiliary guide G2 can be advantageously used also in the previous variant, instead of guides 29a, 29b.

[0184] As already disclosed in the previous variant, it is possible to modify the functioning of the machine, and to overturn all the rods, by displacing the first active element 310 and the first auxiliary element 610 in a direction substantially orthogonal to the longitudinal extension of the active branch 16.

[0185] Figure 25a schematically shows the arrangement of the elements in case only the rods associated with the cranks 35b of the second group are overturned.

[0186] Figure 25b schematically shows the arrangement of the elements in case all the rods are overturned: the first auxiliary element 610 does not intercept any crank anymore, whereas the first active element 310 intercepts all the cranks, namely both those of the first group and those of the second group.

[0187] The same applies to the second active element 340 and the second auxiliary element 640, shown in figures 26a-26b.

[0188] With reference to Figures 4 - 6, the following will describe the operation of the machine 100 during the formation of the fold in the case wherein the first active element 310 can intercept all the cranks 35.

[0189] It should however be noted that, in accordance with the invention, the rods are overturned selectively, preferably in an alternate fashion. The following part of the description, which will refer to Figures 4-6, is merely aimed at illustrating in detail the overturning motion of the rods 20 and the formation of the respective folds.

[0190] With the conveyor T in motion, the cranks 35 of the ascending rods 20a come first into contact with the arched profile of the guide element 330; a rod 20b is in the position immediately upstream of the upper rail 28 and is supported in this position by the second straight tract 311d of the active element 310. In the space between the roller 8 and the rod 20b, the pre-humidification nozzle 33 prevents the fabric from sliding, and an open fold Fi is formed, the front edge 60 of which touches the rod 20c, relative to which said edge is located downstream, with reference to the running direction of the conveyor T. Reference 20a designates the rod that follows the above-mentioned rod 20b.

[0191] This forwards motion simultaneously brings about the following movements: the rod 20a, through the effect of the sliding action of the corresponding cranks 35 along the guide element 330 and of the interaction with the first active element 310 (and possibly with the second active element 340), makes a substantially pendulum-like movement about the pin 25 where its arms 24 are attached to the chains 10, 11. The rod 20c pushes forward the front edge 60 of the open fold, with which it comes in contact on the back side (unprinted part) of the fabric. While continuing to advance along the arched profile of the guide element 330 and interacting with the first active element 310 (and possibly with the second active element 340), the cranks 35 of the rod 20c cause the rod to start rotating upwards, thereby bringing it into the position 20b, i.e. substantially at the same level as the rail 28.

[0192] When these movements are over, while the previously considered fold Fi will be closed and supported by the rod 20b - 20d, which will now occupy the initial position of the active branch 16 of the conveyor T, a new open fold will have been formed between the roller 8 and the rod 20c, thus repeating the fold formation cycle.

[0193] Thanks to the cooperation between the first active element 310 and the first auxiliary element 610, the operation of the machine according to the invention will be similar to that described above, the only difference being that not all the rods 20 will be overturned (preferably, as aforesaid, one out of two) and the folds will therefore be formed only by the overturned rods.

[0194] Figures 12 and 13a-13c, instead, show the operation of the machine according to the invention, wherein the overturning structure 300 operates as described above.

[0195] Reference numeral 20' designates the rods associated with cranks of the first group, i.e. rods which will not be overturned and will remain, downstream of the overturning structure 300, in a position hung to the chain.

[0196] Reference numeral 20" designates the rods associated with cranks of the second group, which will be overturned while following the profile of the first active element 310.

[0197] In particular, Figure 13b shows how the crank of the first group, associated with the rod 20', will "fall" into the free space available downstream of the first ac-

tive element 310, since the latter will be in its distal end-of-travel position.

[0198] Figure 13c shows how the crank of the second group, associated with the rod 20", after having been rotated by the lower profile of the first active element 310, will be "accompanied" by the latter towards the guide 29a; the first active element 310 will, in fact, be moved towards the beginning of the guide 29a, i.e. into its proximal end-of-travel position, so that no gap will be available for the crank, and the rod 20" will be kept in the reached position.

[0199] Note that the machine 100 according to the invention, as aforementioned, can be modified for overturning all the rods 20, i.e. both those associated with the cranks of the first group and those associated with the cranks of the second group.

[0200] For this purpose, the first auxiliary element 610 is removed (or at least moved into a non-operational position); preferably, also the second auxiliary element 620 is removed, or at least moved into a non-operational position.

[0201] With the machine thus configured, it will no longer be necessary to move the first active element 310 (and the second active element 340) as described above.

[0202] The first (and preferably the second) active element 310 (and 340) can be moved by means of the respective actuator, so as to impart an acceleration to the rotation of the crank. This promotes the formation of the folds, and also avoids the necessity of imparting the above-mentioned "pulls" to the chain 10, 11.

[0203] The invention offers significant advantages.

[0204] First and foremost, the machine according to the invention can prevent the formation of undesired duplicates after digital printing processes.

[0205] The same machine can also implement a rod overturning technique which is reliable and which uses little room.

[0206] It should be noted that the above-described rod overturning mechanism can advantageously be used not necessarily for selectively overturning the rods, but for ensuring that the feeding chain will move at a substantially constant speed.

[0207] In this way it is possible to prevent the chain from being subjected to sudden accelerations ("pulls") useful for giving the rods the necessary force for overturning.

[0208] By moving the chain at a substantially constant speed, it is possible to reduce the probability of fold waving, and hence the probability that prints made on different folds might come into contact with each other, thereby ruining each other.

[0209] In accordance with this aspect of the invention, a machine for treating folded printed fabrics comprises:

- a. a frame (200), delimiting at least one fabric (40) treatment chamber (1), the latter being equipped with an inlet (6) and an outlet (7) for the fabric (40);
- b. a conveyor (T) for advancing the fabric within said

chamber (1), comprising:

- i. a pair of endless chains (10, 11), each chain (10, 11) having an active or advance branch (16) extending between said inlet (6) and said outlet (7);
- ii. a first motion structure (M3, 12, 13, 14, 15) for promoting the advance of said chains (10, 11);
- c. a plurality of fabric supporting rods (20), each rod (20) having its ends supported by said chains (10, 11), said rods (20) being associated with said chains (10, 11) such that they can be moved from a first position in which they are hung to said chains (10, 11) to a second position above said chains (10, 11);
- d. a second motion structure (300), at least partially mobile relative to said frame (200), and configured for moving said rods (20) from said first position to said second position.

[0210] Preferably, said second motion structure (300) comprises:

- a. a first active element (310), movable relative to said frame (200) and active upon said rods (20);
- b. a first actuator (320) associated with said first active element (310) for moving the same.

[0211] Preferably, at least at one end of each rod (20), said machine (1) comprises an arm (24), the latter having a first end pivoted to a corresponding end of said rod (20) and a second end pivoted to a link of a respective one of said chains (10, 11), said first active element (310) cooperating with said arm (24) for moving said rod (20) from the first position to the second position.

[0212] Preferably, said first active element (310) has a shaped profile (311) adapted to cooperate with said arm (24) for moving said rod (20).

[0213] Preferably, said arm (24) is pivoted to said link through a pin (25), a control lever (34) fitted with a crank (35) being constrained to said pin (25) on the side opposite to said link with respect to said arm (24).

[0214] Preferably, said shaped profile (311) is adapted to intercept said crank (35) to cause a rotation of said control lever (34) and, consequently, a rotation of said arm (24), so as to promote a movement of the respective rod (20) from the first position to the second position.

[0215] Preferably, said first actuator (320) is adapted to place said first active element (310) into a position in which said first active element (310) intercepts said crank (35), and then to move said first active element (310) in a manner such that the latter drags said crank (35) and promotes the rotational movement of the respective rod (20).

[0216] Preferably, said second motion structure (300) further comprises a guide element (330) substantially integral with said frame (200) and having an arched profile located substantially at an upper end of an ascending

tract (18) of said chain (10, 11).

[0217] Preferably, said machine (1) further comprises a processing unit (400) associated with said first and second motion structures (M3, 12, 13, 14, 15; 300) for synchronization thereof.

[0218] Preferably, said processing unit (400) is configured for sending one or more activation signals (S) to said second motion structure (300) as a function of positions reached by the first motion structure.

[0219] Preferably, upon reception of at least one of said activation signals (S), said first actuator (320) effects a first movement of said first active element (310) into a position in which it intercepts said crank (35), and a second movement of said first active element (310) to cause the respective arm (24) to rotate and, consequently, the corresponding rod (20) to move.

[0220] Preferably, said second motion structure (300) is configured for moving said rods (20) from the first position to the second position while said chains (10, 11) are advancing.

[0221] Preferably, to each end of said rod (20) a respective arm is pivoted, which in turn is pivoted, at its opposite end, to a link of a respective one of said chains (10, 11), wherein said first active element (310) cooperates with one of said arms, said machine further comprising a third motion structure (500), which is at least partially movable relative to said frame (200) and active upon the other arm for promoting the movement of said rod from the first position to the second position.

[0222] Preferably, said third motion structure (500) comprises:

- a. a second active element (510), movable relative to said frame (200) and active upon the other arm of said rod (20);
- b. a second actuator (520) associated with said second active element (510) for moving the same.

[0223] The general structure of the machine according to this embodiment is similar to the one shown in Figures 1-6; the features described above with reference to these drawings may therefore be also included in the machine according to this second embodiment.

[0224] In this second embodiment, the first and second auxiliary elements 610, 620 are not used.

[0225] The overturning of the rods is thus obtained by means of the second motion structure 300 and, preferably, of the third motion structure 500.

[0226] Preferably, the second motion structure 300 is positioned and operates in the final part of the ascending tract 18 and in the initial tract of the advance branch 16.

[0227] Preferably, the second motion structure 300 is positioned and operates at the toothed wheel 15.

[0228] Preferably, the first active element 310 (Figure 18) has a shaped profile 311 adapted to cooperate with said arm 24.

[0229] In the preferred embodiment, the shaped profile 311 is suitable for intercepting the crank 35 so as to cause

a rotation of the control lever 34 and hence a rotation of the arm 24, thus promoting the movement of the rod 20 from the first position to the second position.

[0230] Preferably, the shaped profile 311 may be a lower profile of the first active element 310. For example, the first active element 310 may be implemented as a suitably shaped plate.

[0231] The shaped profile 311 may comprise, in succession, a first straight tract 311a at a first height q1, a bend 311b, a convex portion 311c, and a second straight tract 311d at a second height q2, lower than said first height q1.

[0232] Under the action of the first actuator 320, the first active element 310 is first positioned in a manner such that the first active element will intercept the crank 35 (Figures 18a, 18b). In practice, the crank 36 will be intercepted by the bend 311b.

[0233] Afterwards, the first actuator 320 will act upon the first active element 310 in a manner such that the latter will drag the crank 35 and, through the above-described mechanism comprising the control lever 34, the pin 25 and the arm 24, will promote the rotational movement of the rod 20 (Figures 19a, 19b).

[0234] Preferably, the motion of the first active element 310 is an alternate linear motion, i.e. a so-called to-and-fro motion.

[0235] The position where the first active element 310 intercepts the crank 35 corresponds to a proximal end-of-travel position (Figures 18a, 18b) of the linear trajectory. The movement towards the distal end-of-travel position (Figures 19a, 19b) causes the rod 20 to move as described above.

[0236] The movement of the first active element 310 after it has intercepted the crank 35 occurs in a direction opposite to the advance direction of the active branch 16.

[0237] Due to the combined motions of the active element 310 (which drags the crank 35 to the left in the drawings) and of the chain 10, 11 (which drags the pin 25 to the right in the drawings), the rod 20 will be rotated about the pin 25.

[0238] More in detail, the following motion steps can be generally defined:

1. The crank 35 dragged by the chain 10, 11 follows the first straight tract 311a (Figures 20a-20d).
2. The crank 35 is then intercepted by the bend 311b (Figure 20e).
3. The first active element 310 is moved from the proximal end-of-travel position X1 to the distal end-of-travel position X2, and the crank 35, being constrained into the bend 311b, undergoes a sudden acceleration, opposite to the forward motion of the active branch 16 of the chain (Figure 20f).
4. The crank 35 goes on, dragged by the chain 10, 11, following the convex portion 311c (Figures 20g, 10h).
5. The crank 35 goes on, dragged by the chain 10, 11, following the second straight tract 311d (Figure

20i).

[0239] Preferably, the first height q1 of the first straight tract 311a is substantially equal to the height at which the pin 25 is located. In fact, during step 1, the control lever 34 and the arm 24 are substantially horizontal (or anyway only slightly inclined).

[0240] As aforesaid, the second height q2 of the second straight tract is preferably lower than the first height q1, and is therefore lower than the height at which the pin 25 is located. During step 5, the control lever 34 and the arm 24 are so inclined that the rod 20 is higher than the active branch 16, being in particular sufficiently high for positioning the wheels 26 onto the guides 28.

[0241] Preferably, at the beginning of step 1 the first active element 310 is in the distal end-of-travel position X2, which was reached at the end of the motion of the preceding rod (Figure 20a). When the crank 35 is about to reach the bend 311b (Figure 20b), the first actuator 320 moves the first active element 310 into the proximal end-of-travel position X1 (Figure 20c). The crank 35 will thus follow the first straight tract 311a again (Figures 20c, 20d), until it is intercepted by the bend 311b (step 2, Figure 20e).

[0242] Preferably, step 3 occurs in such a way that the motion of the first active element 310 allows the rod 20 to rise above its minimum height relative to the advance branch 16.

[0243] As schematically shown in Figure 19c, the rotation imparted to the rod 20 is opposite (counterclockwise) to the general advance direction of the chains 10, 11 (clockwise).

[0244] In particular, the arrows A1, A2, A3 indicate the direction of motion of the first active element 310, the direction of motion of the chains 10, 11, and the direction of rotation of the arm 24, which defines the rotational motion of the rod 20 about the axis of the pins 25.

[0245] Note that the dimensional proportions of the various elements shown in Figure 19c do not correspond to the actual proportions: the proportions have been changed merely for better presenting the features of the parts shown.

[0246] Preferably, the second overturning structure 300 further comprises a guide element 330 which is substantially integral with the frame 200 and which has an arched profile.

[0247] The guide element 330 is located substantially in the transition area between the ascending tract 18 and the advance branch 16 of the chain 10, 11.

[0248] The guide element 330 performs the task of starting a rotation of the rod 20 about the pin 25, guiding the crank 35 in such a way that the control lever 34 and the arm 24 will arrange themselves horizontally, from the substantially vertical orientation taken in the ascending tract 18.

[0249] The profile of the guide element 330 is substantially contiguous to the first straight tract 311a of the first active element 310, when the latter is in the distal end-

of-travel position X2.

[0250] In practice, in the proximity of the upper end of the front branch 18, the crank 35 of the control lever 34 will first meet the profile of the guide element 330 and then the shaped profile 311 of the first active element 310. The action of the first guide element 330 and of the first active element 310, combined with the advance of the chain, will prevent the rod 20 from staying in the hung condition taken in the vertical tract 18, and will force the rotation of the arm 24 to move the rod 20 from the hung configuration to the suspended configuration.

[0251] The first actuator 320 may comprise an electric motor 321 associated with a cam 322, appropriately sized for moving the first active element 310 between the proximal end-of-travel position X1 and the distal end-of-travel position X2.

[0252] It should be noted that the above description preferably only applies to the second motion structure 300, which, through its own first active element 310, acts upon an arm 24 (by means of the respective control lever 34 and the crank 35) that is constrained to a first end of the rod 20. The machine 100 advantageously comprises a third motion structure 500, which is wholly similar to the second motion structure 300. The third motion structure 500 is at least partially movable relative to the frame 200, and is active upon the arm constrained to the second end of the rod 20 itself.

[0253] The third motion structure 500 operates in the same way as the second motion structure 300 and is synchronized therewith, so as to jointly promote the rotational motion of the rod 20 about the respective pin 25 and move the rod 20 from the first position to the second position.

[0254] Preferably, the third motion structure 500 comprises:

- a. a second active element 510, movable relative to the frame 200 and active upon the arm 24 pivoted to the second end of the rod 20;
- b. a second actuator 520 associated with the second active element 510 for moving the same.

[0255] The structure and shape of the second active element 510 are wholly similar to those of the first active element 310.

[0256] The motion imparted to the second active element 510 is wholly similar to that imparted to the first active element 310.

[0257] The second actuator 520 can be implemented in the same manner as the first actuator 320.

[0258] The third motion structure 500 may also be provided with a guide element 530 wholly similar to the guide element 330 of the second motion structure 300.

[0259] In brief, when a rod 20 needs to be rotated about the pins 25 so that it can be laid onto the guides 28, the second and third motion structures 300, 500 will act on a respective arm 24 pivoted to a corresponding end of the rod 20, thus effecting the described movement.

[0260] Advantageously, the machine 100 further comprises a processing unit 400 associated with at least the first and second motion structures M3, 12, 13, 14, 15; 300 for synchronization thereof.

[0261] Preferably, the processing unit 400 is also associated with the third motion structure 500 for synchronizing the latter with the first and second motion structures.

[0262] In particular, the processing unit 400 can be inputted a parameter representative of the current angular position of a crankshaft taken as a reference, e.g. the shaft of the drive M3 that causes the chain 10, 11 to advance.

[0263] By comparing said parameter with previously stored references, the processing unit 400 can determine when the first (and possibly the second) active element needs to be moved.

[0264] In particular, according to predetermined angular positions of the reference shaft, the processing unit 400 will command the first (and possibly the second) actuator to move the first (and possibly the second) active element into the proximal end-of-travel position, and then to move the same active element into the distal end-of-travel position.

[0265] For this purpose, the processing unit 400 will send one or more activation signals S to the second (and possibly the third) motion structure.

[0266] In one embodiment, the processing unit 400 initially executes a step of aligning the various motors/drives controlled by it (e.g. the drive M3, the first actuator 320, and possibly the second actuator 520). In this manner, the machine can start operating correctly, and the various parts thereof can be moved with proper synchronism.

[0267] Should any problem or malfunction be detected (e.g. an improperly positioned rod), the processing unit 400 will stop the machine and perform a new alignment operation, so as to allow the machine to correctly resume its operation.

[0268] Preferably, the processing unit 400 may be a PLC configured for managing the whole machine 100.

Claims

1. A machine for treating folded printed fabrics, comprising:

- a. a frame (200), delimiting at least one fabric (40) treatment chamber (1), the latter being equipped with an inlet (6) and an outlet (7) for the fabric (40);
- b. a conveyor (T) for advancing the fabric within said chamber (1), comprising:

- i. a pair of endless chains (10, 11), each chain (10, 11) having an active or advance branch (16) extending between said inlet (6)

- and said outlet (7);
 ii. a first motion structure (M3, 12, 13, 14, 15) for promoting the advance of said chains (10, 11);
- c. a plurality of fabric supporting rods (20), each rod (20) having its ends supported by said chains (10, 11), said rods (20) being associated with said chains (10, 11) such that they can be moved from a position in which they are hung to said chains (10, 11) to a second position above said chains (10, 11);
 d. a second motion structure (300), at least partially mobile relative to said frame (200), and configured for moving said rods (20) from said first position to said second position.
2. A machine according to claim 1, wherein said second motion structure (300) comprises:
- a. a first active element (310), movable relative to said frame (200) and active upon said rods (20);
 b. a first actuator (320) associated with said first active element (310) for moving the same.
3. A machine according to claim 2, comprising, at least at one end of each rod (20), an arm (24), the latter having a first end pivoted to a corresponding end of said rod (20) and a second end pivoted to a link of a respective one of said chains (10, 11), said first active element (310) cooperating with said arm (24) for moving said rod (20) from the first position to the second position.
4. A machine according to claim 3, wherein said first active element (310) has a shaped profile (311) adapted to cooperate with said arm (24) for moving said rod (20).
5. A machine according to claim 3 or 4, wherein said arm (24) is pivoted to said link through a pin (25), a control lever (34) fitted with a crank (35) being constrained to said pin (25) on the side opposite to said link with respect to said arm (24).
6. A machine according to claims 4 and 5, wherein said shaped profile (311) is adapted to intercept said crank (35) to cause a rotation of said control lever (34) and, consequently, a rotation of said arm (24), so as to promote a movement of the respective rod (20) from the first position to the second position.
7. A machine according to claim 6, wherein said first actuator (320) is adapted to place said first active element (310) into a position in which said first active element (310) intercepts said crank (35), and then to move said first active element (310) in a manner
- such that the latter drags said crank (35) and promotes the rotational movement of the respective rod (20).
8. A machine according to claim 2 and any one of claims 3 to 7, wherein said second motion structure (300) further comprises a guide element (330) substantially integral with said frame (200) and having an arched profile located substantially at an upper end of an ascending tract (18) of said chain (10, 11).
9. A machine according to any one of the preceding claims, further comprising a processing unit (400) associated with said first and second motion structures (M3, 12, 13, 14, 15; 300) for synchronization thereof.
10. A machine according to claim 9, wherein said processing unit (400) sends one or more activation signals (S) to said second motion structure (300) as a function of positions reached by the first motion structure.
11. A machine according to claim 10, wherein, upon reception of at least one of said activation signals (S), said first actuator (320) effects a first movement of said first active element (310) into a position in which it intercepts said crank (35), and a second movement of said first active element (310) to cause the respective arm (24) to rotate and, consequently, the corresponding rod (20) to move.
12. A machine according to any one of the preceding claims, wherein said second motion structure (300) is configured for moving said rods (20) from the first position to the second position while said chains (10, 11) are advancing.
13. A machine according to claim 3 and any one of claims 4 to 12, wherein to each end of said rod (20) a respective arm is pivoted, which in turn is pivoted, at its opposite end, to a link of a respective one of said chains (10, 11), wherein said first active element (310) cooperates with one of said arms, said machine further comprising a third motion structure (500), which is at least partially movable relative to said frame (200) and active upon the other arm for promoting the movement of said rod from the first position to the second position.
14. A machine according to claim 13, wherein said third motion structure (500) comprises:
- a. a second active element (510), movable relative to said frame (200) and active upon the other arm of said rod (20);
 b. a second actuator (520) associated with said second active element (510) for moving the same.

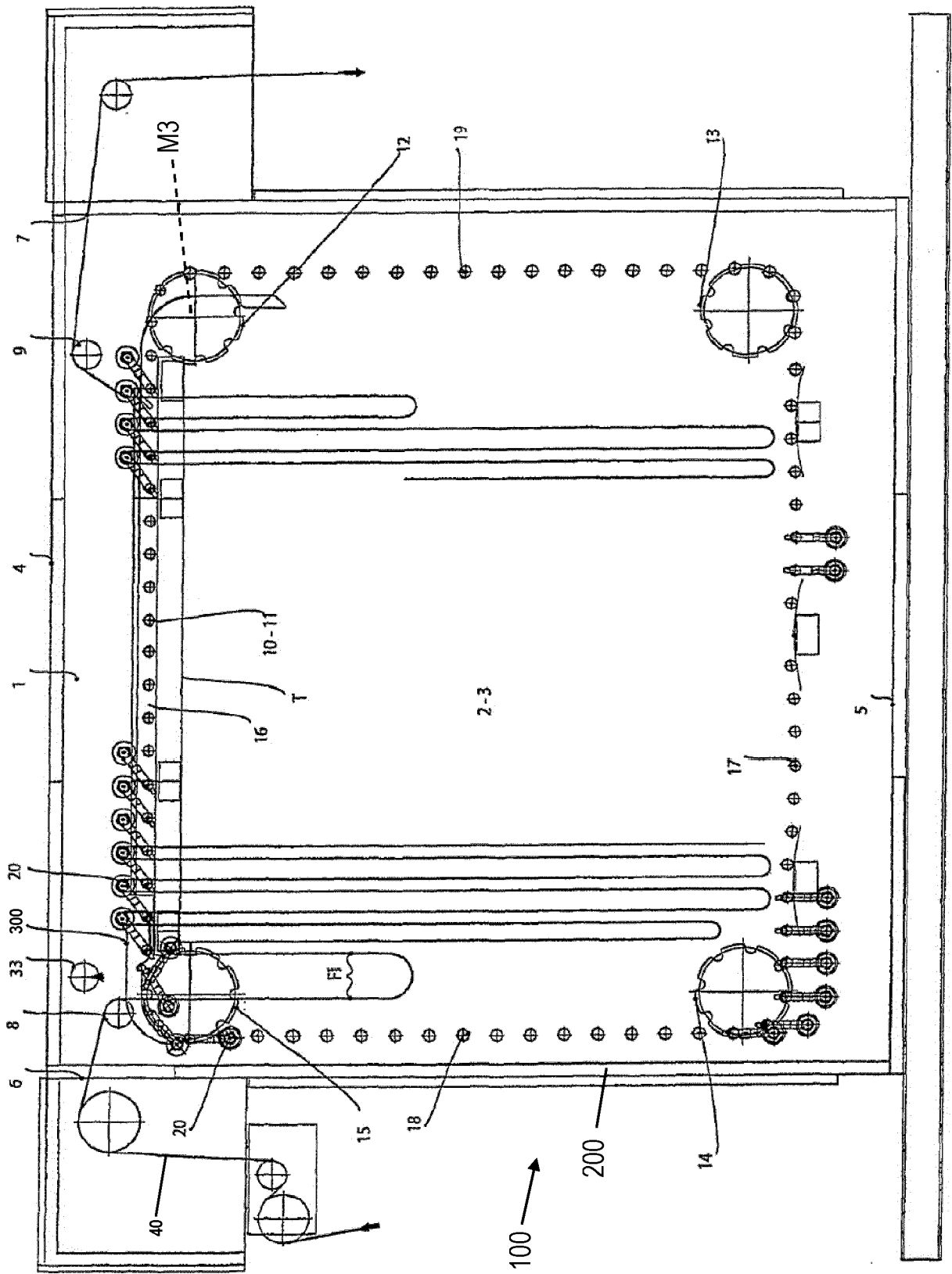


Fig.1

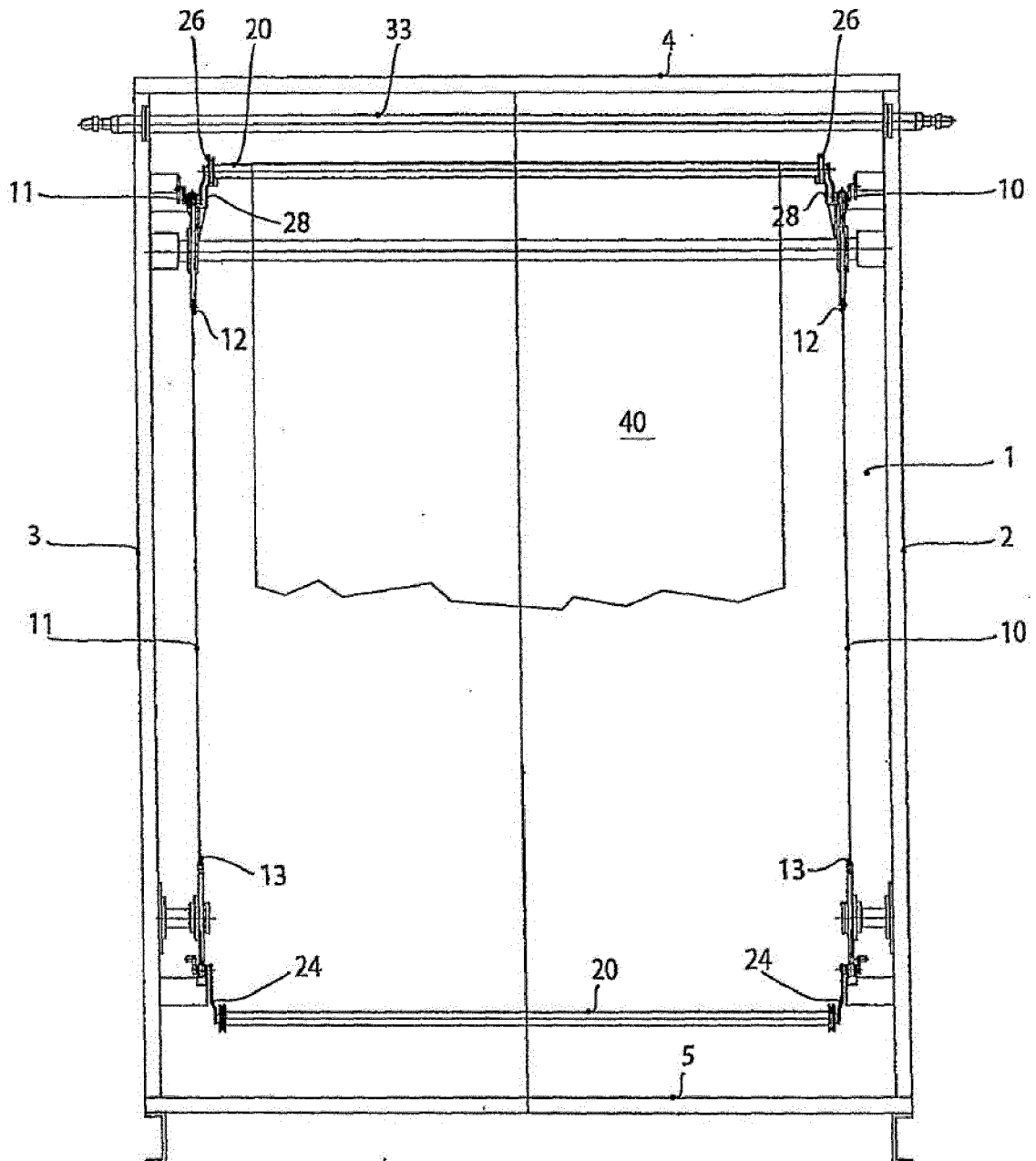


Fig. 2

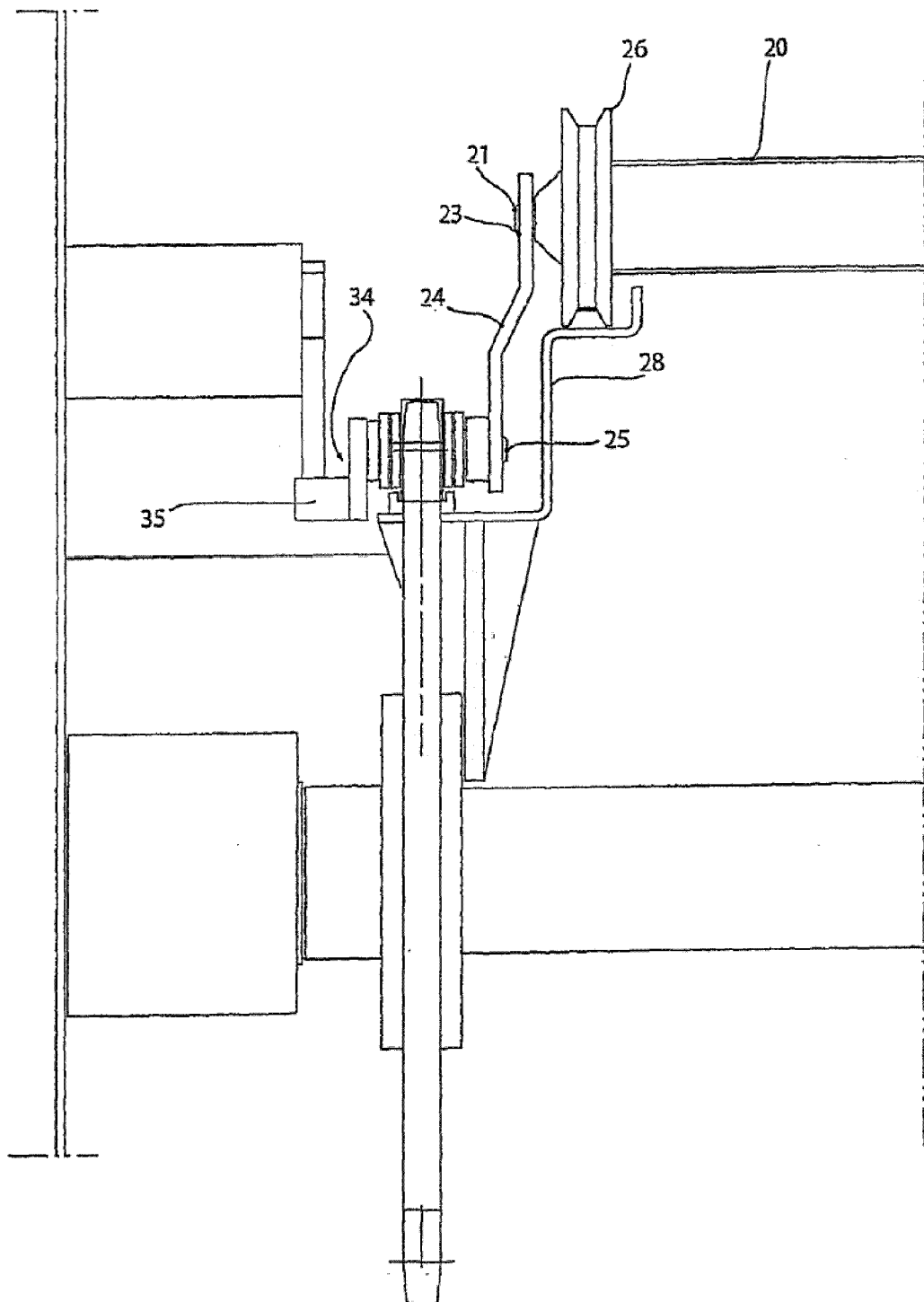


Fig. 3

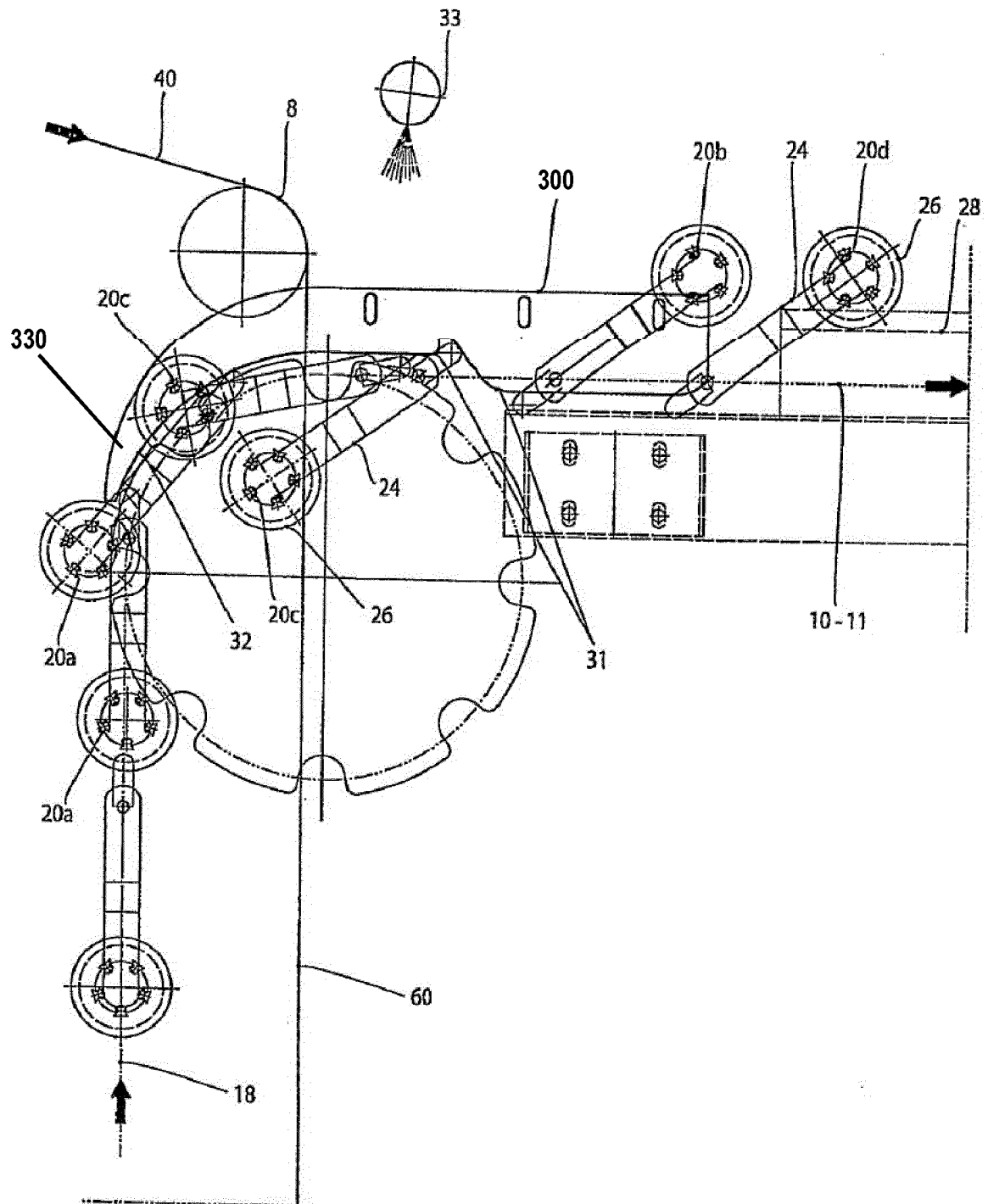


Fig. 4

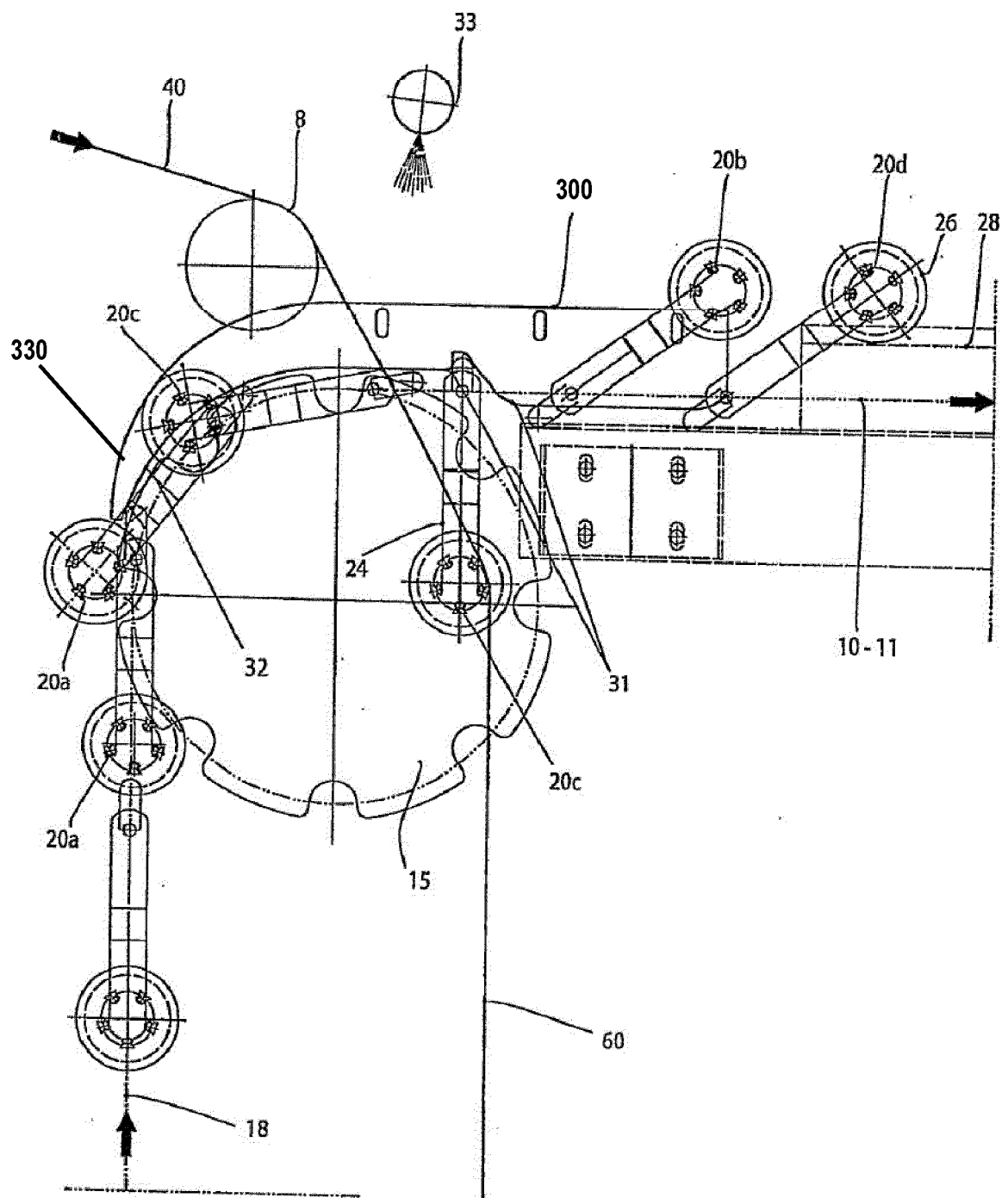


Fig. 5

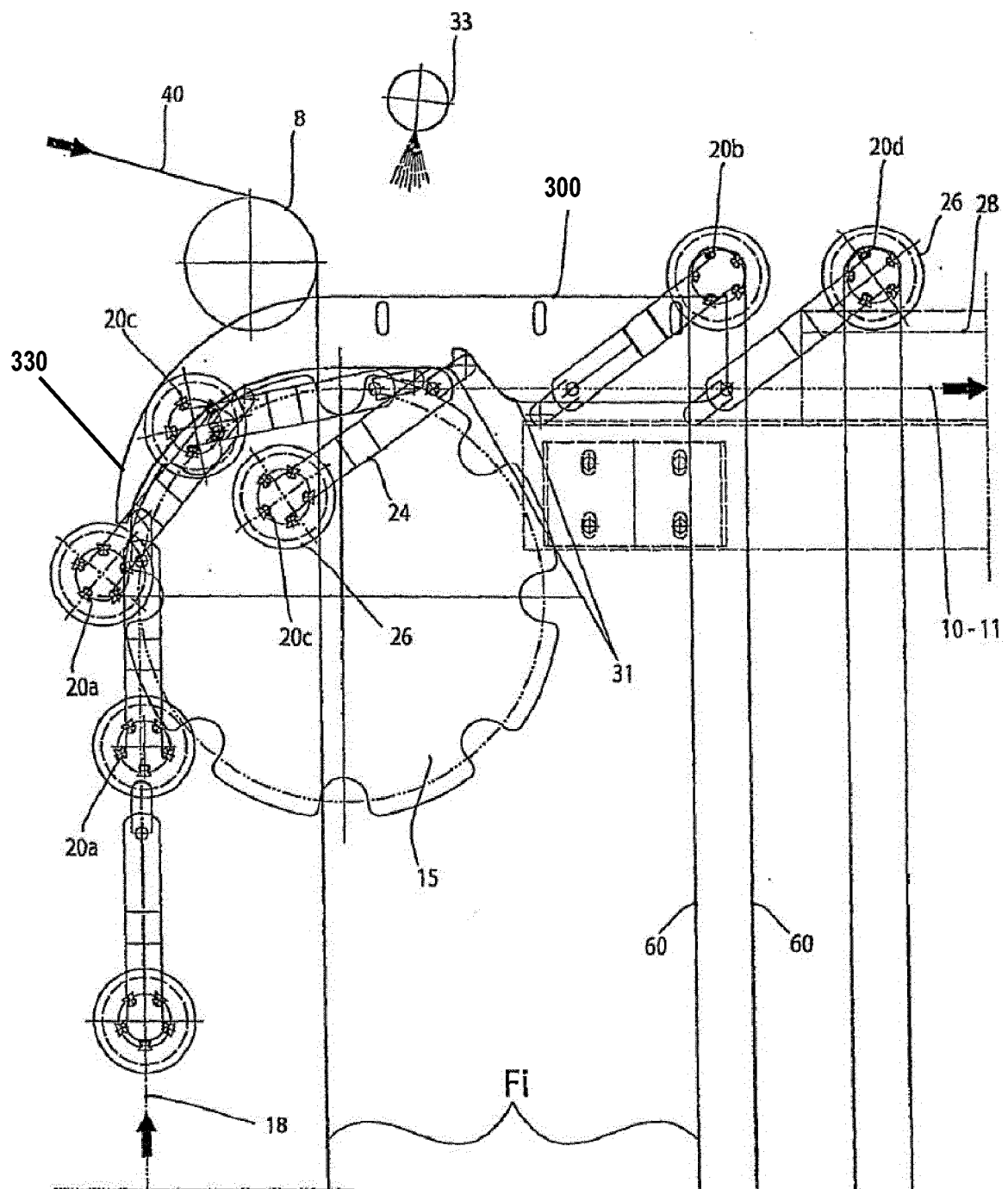
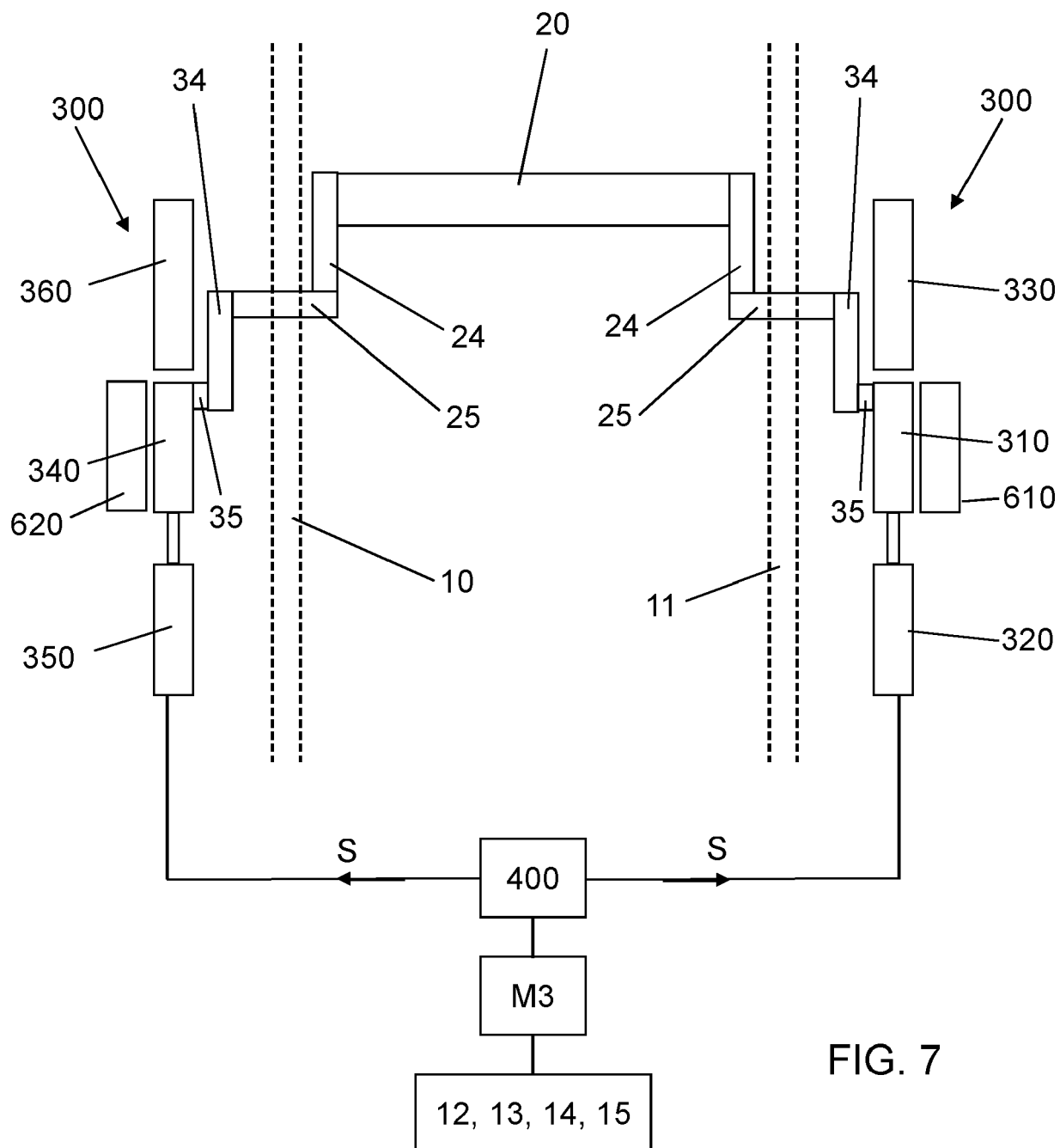


Fig. 6



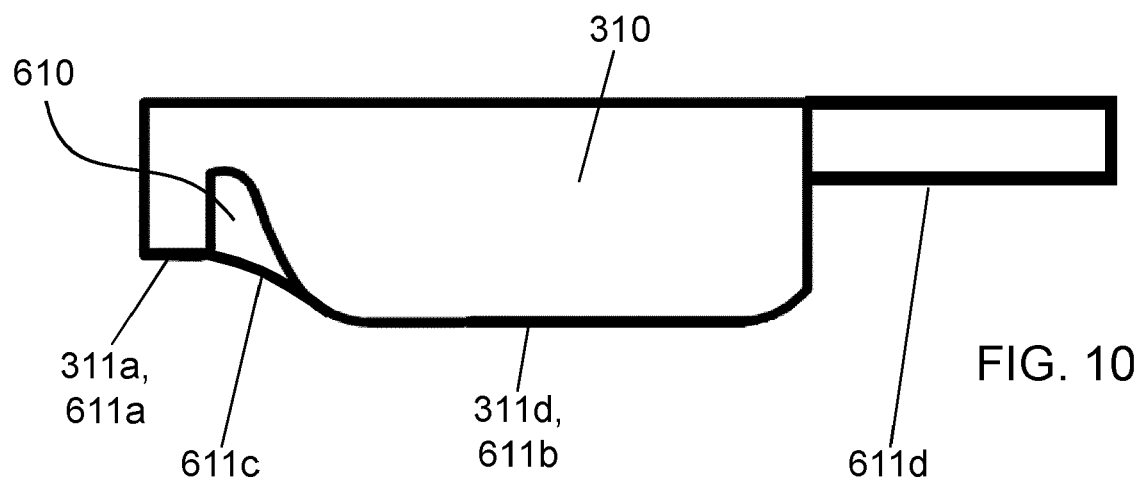
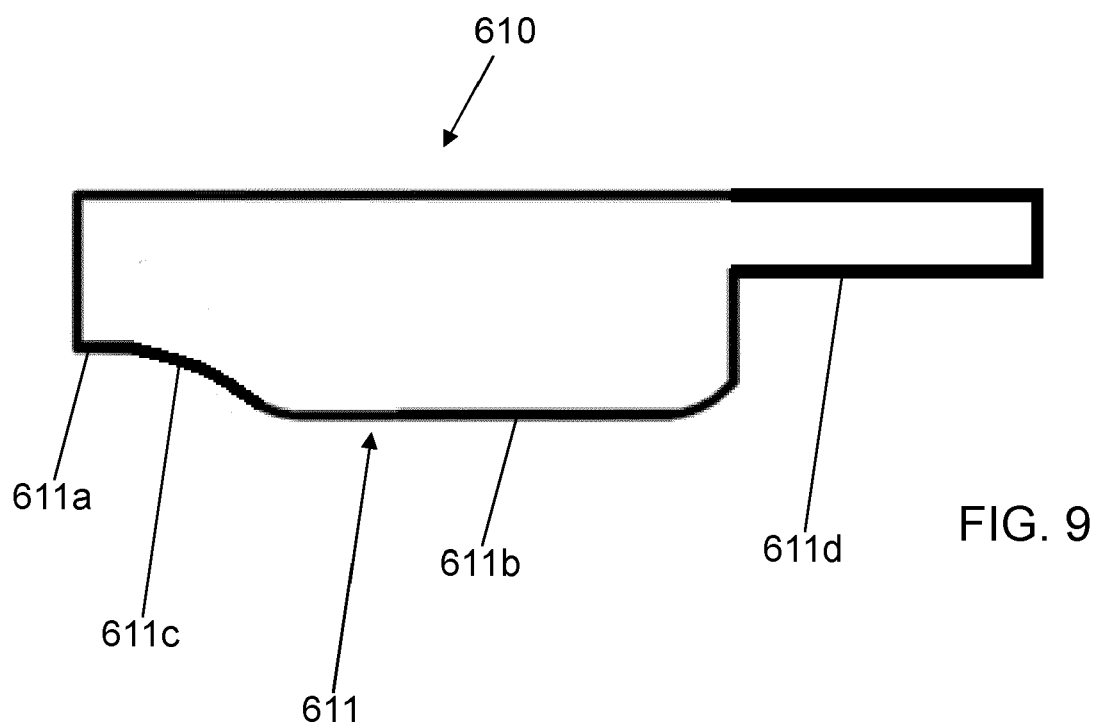
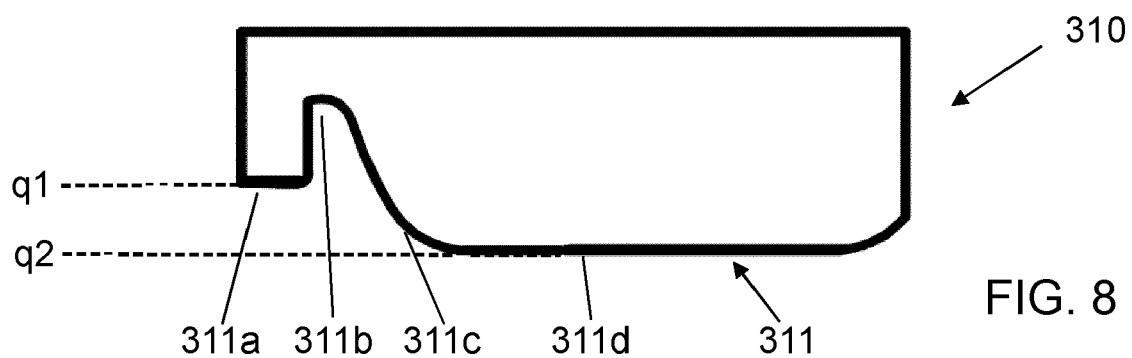


FIG. 11

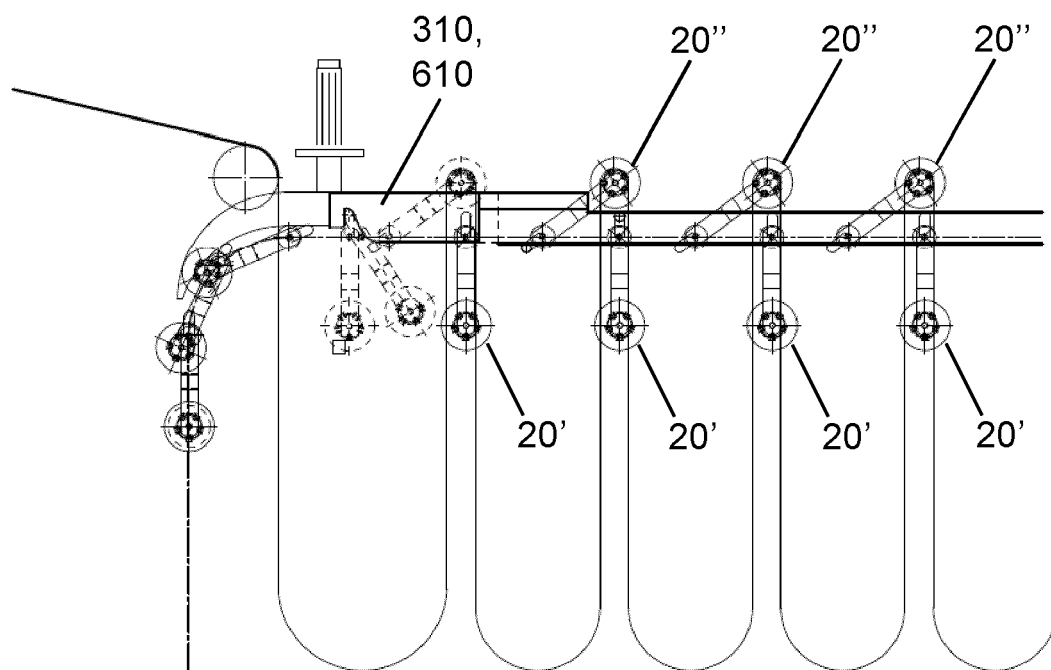
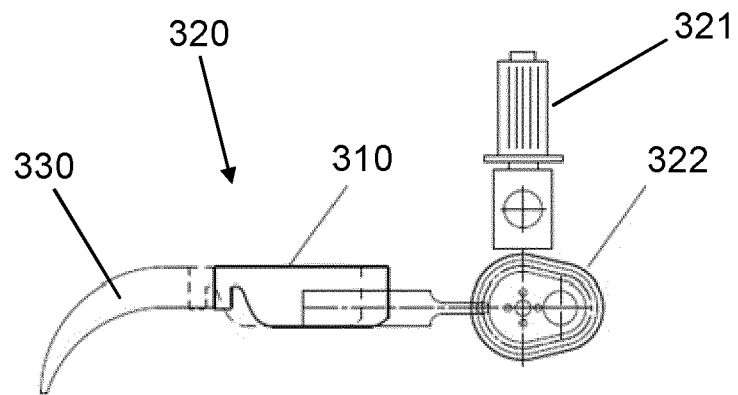


FIG. 12

FIG. 13a

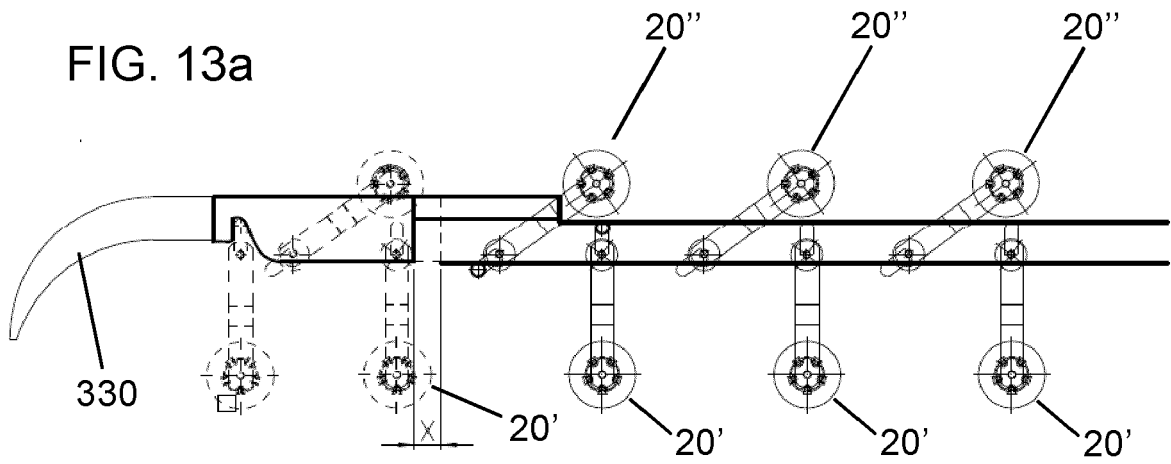


FIG. 13b

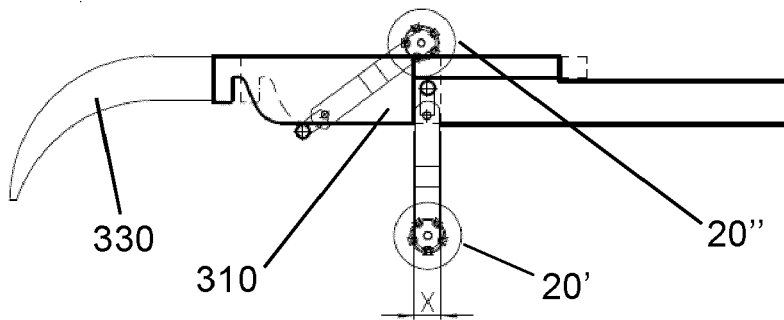
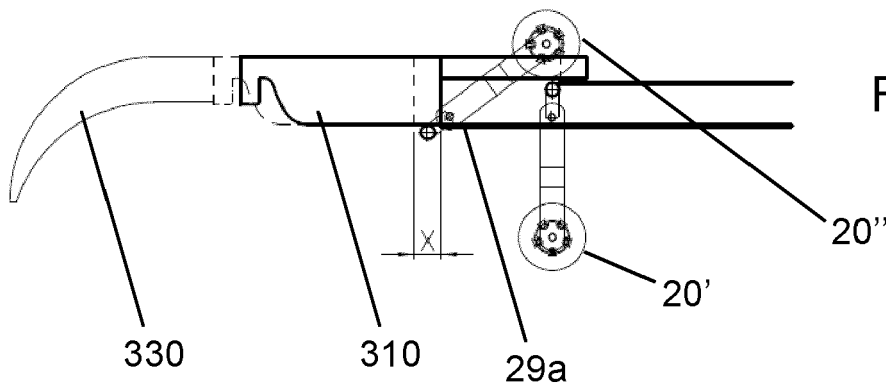
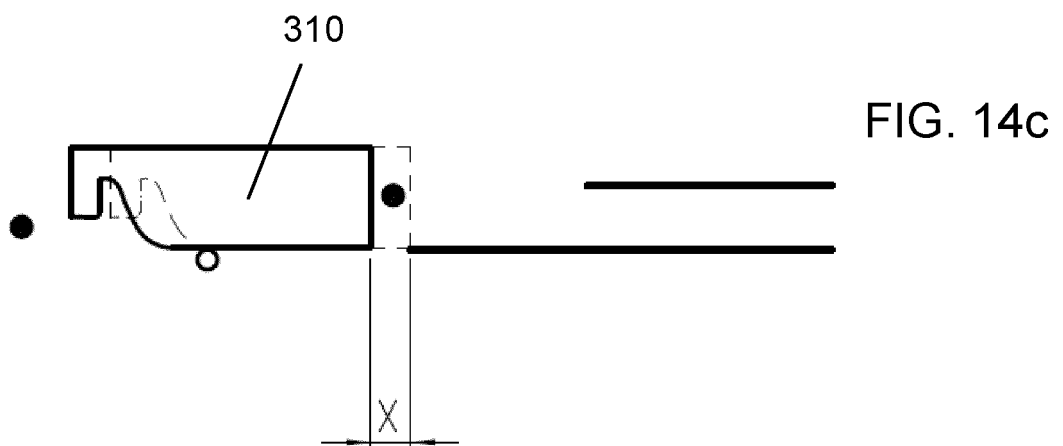
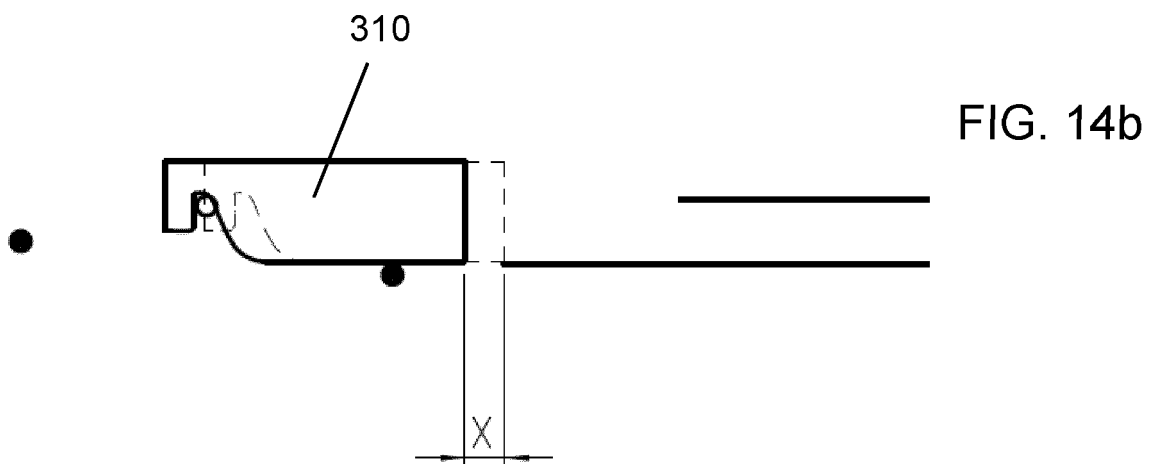
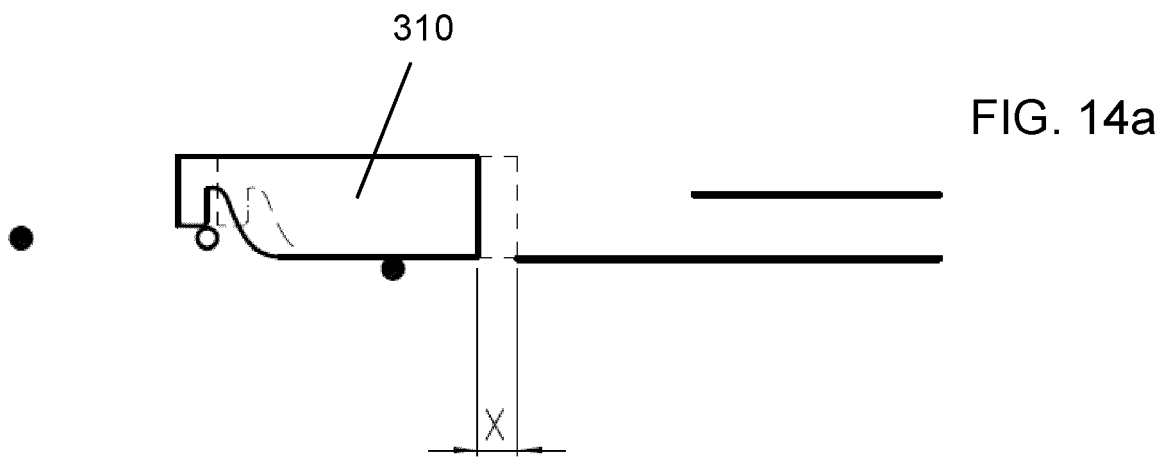
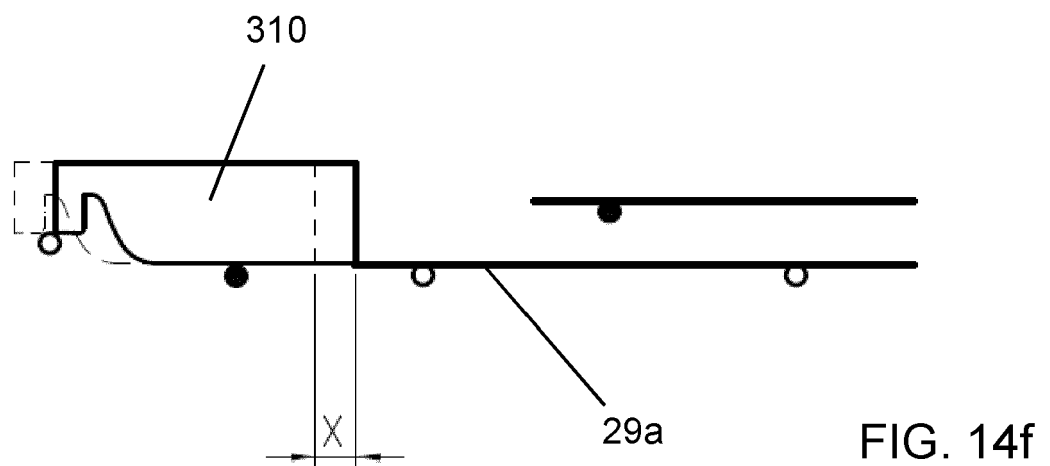
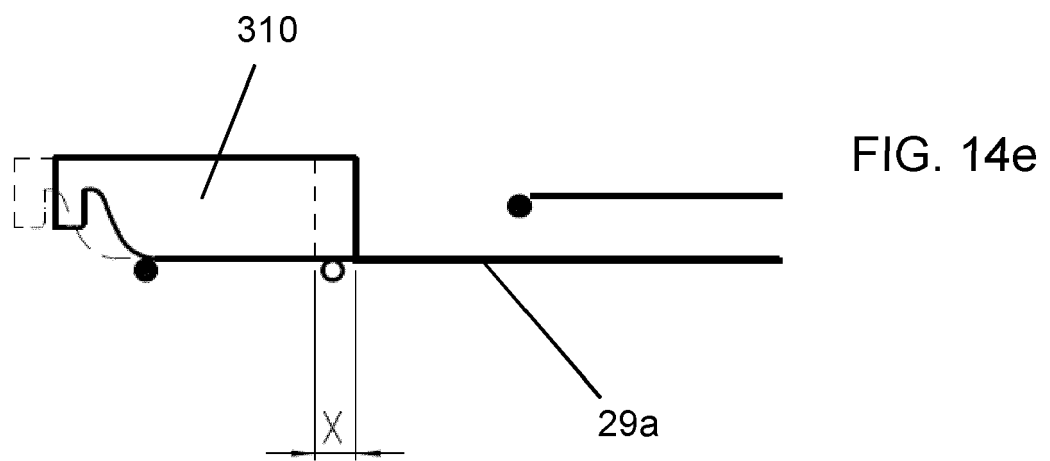
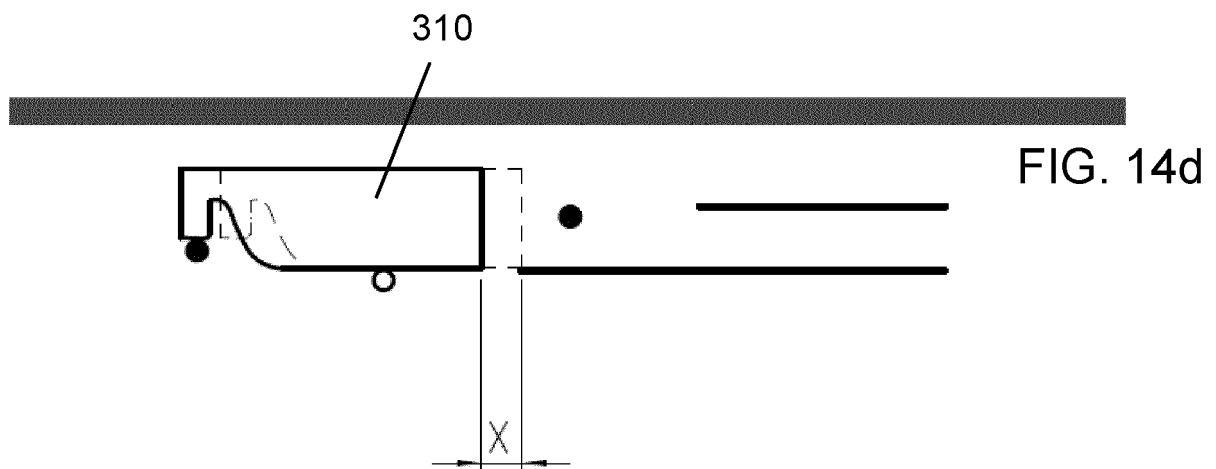
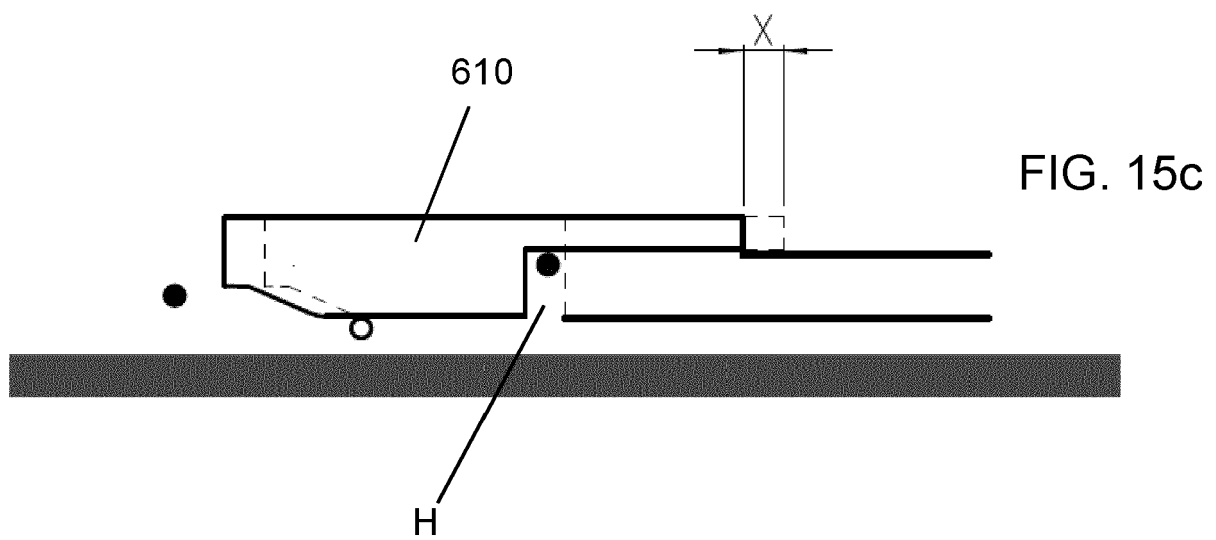
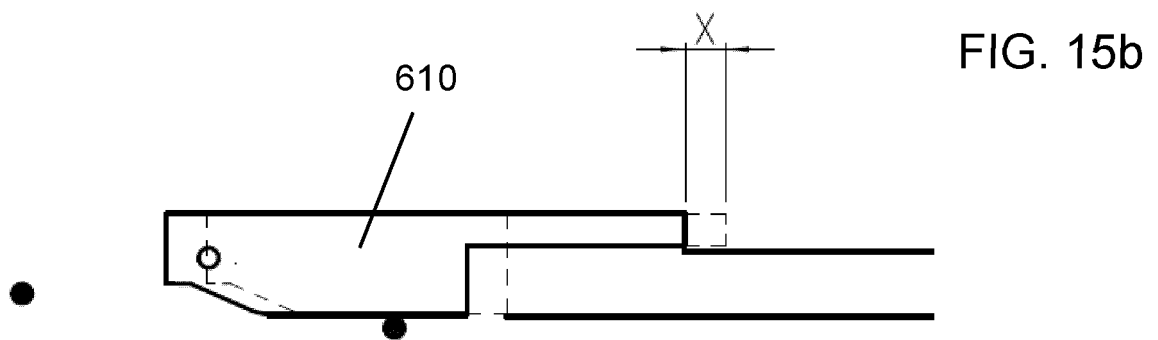
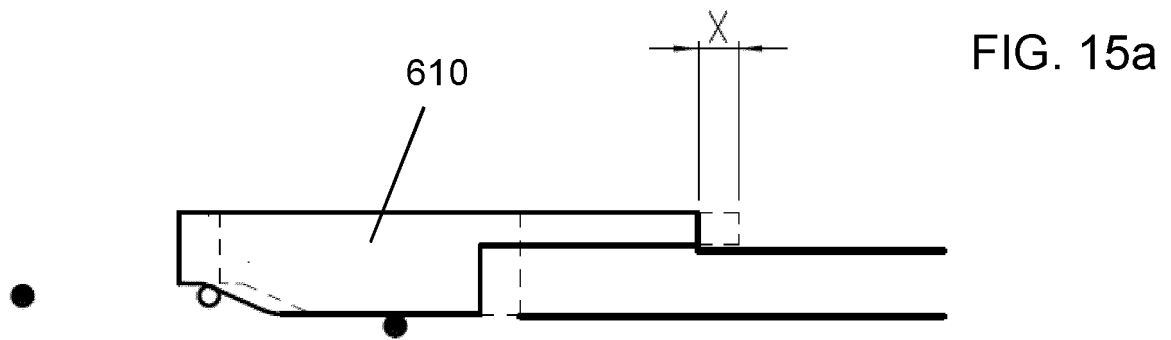


FIG. 13c









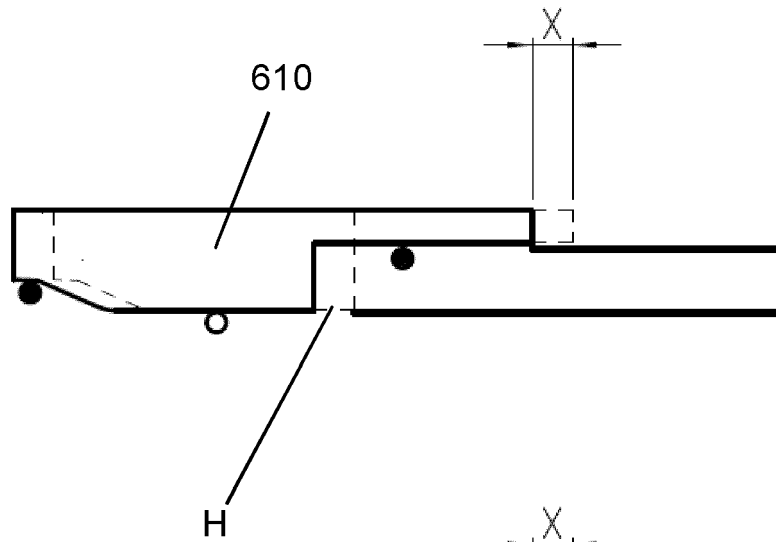


FIG. 15d

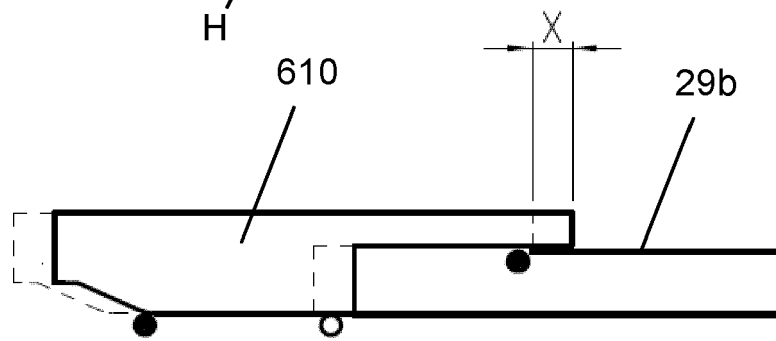


FIG. 15e

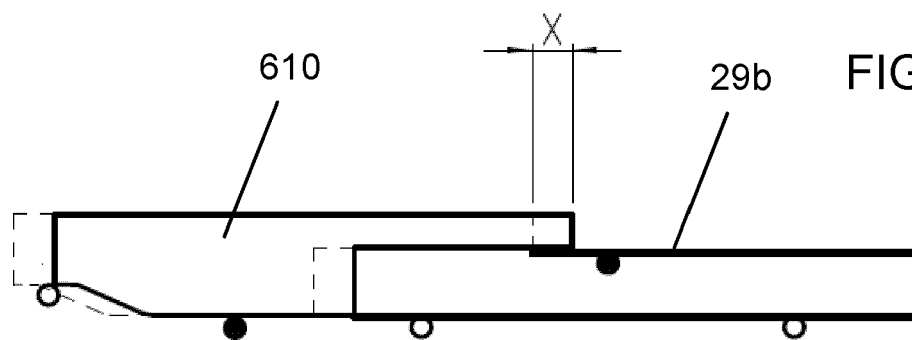


FIG. 15f

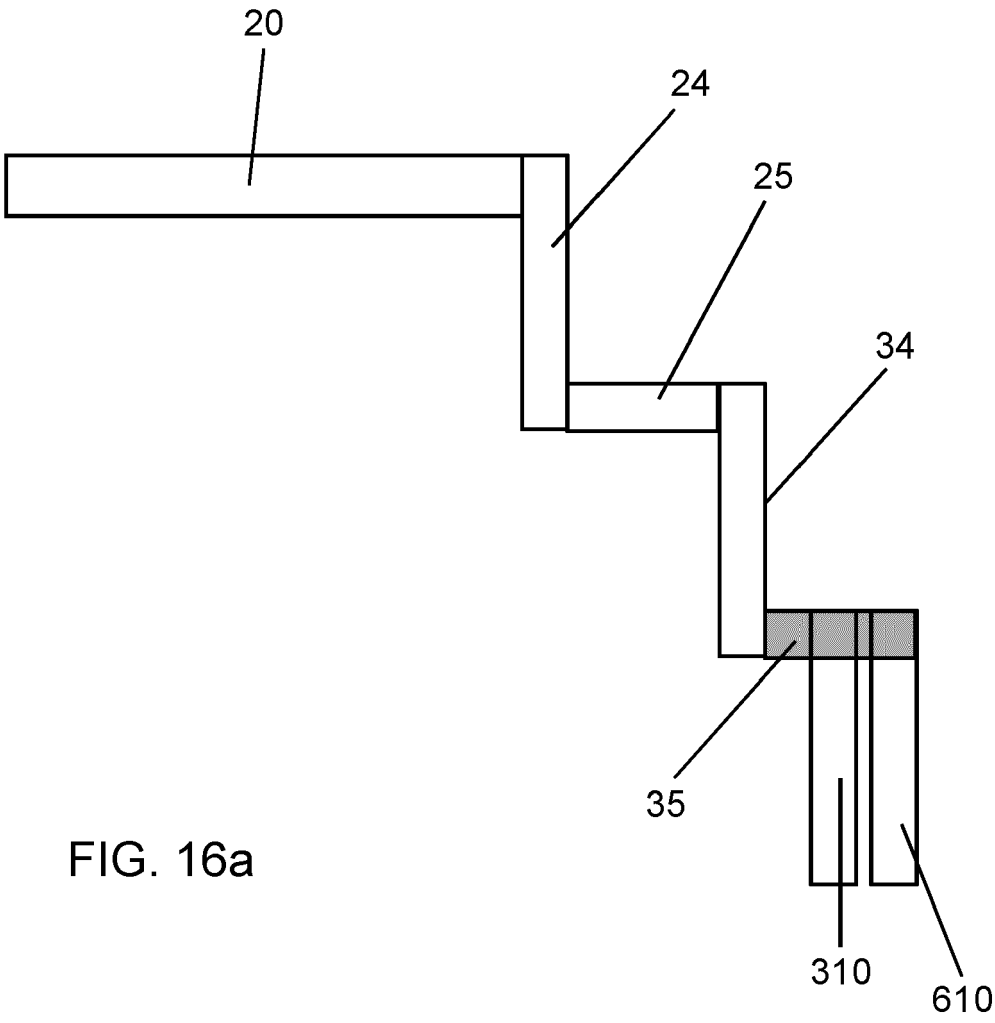


FIG. 16a

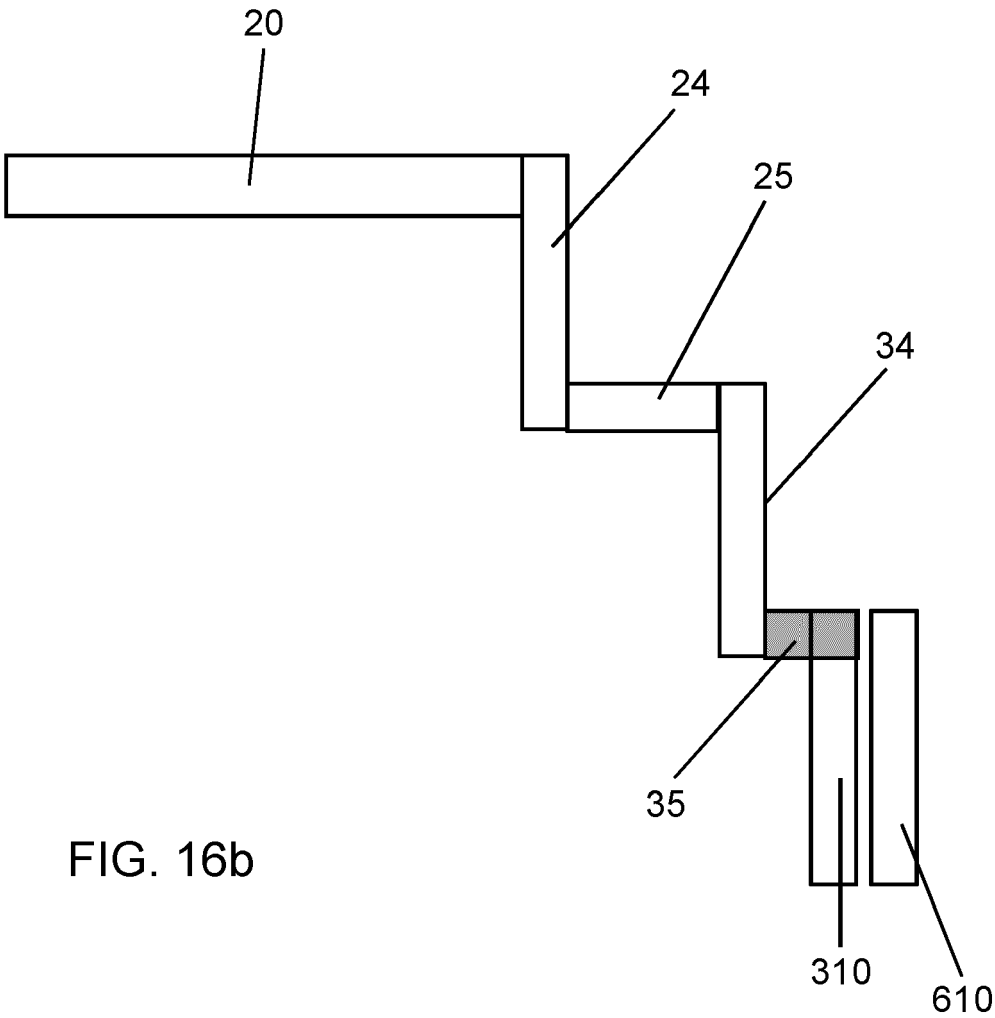
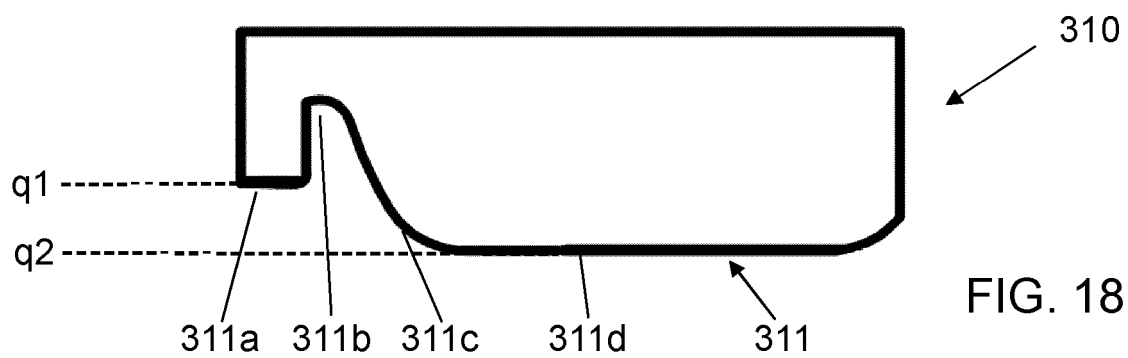
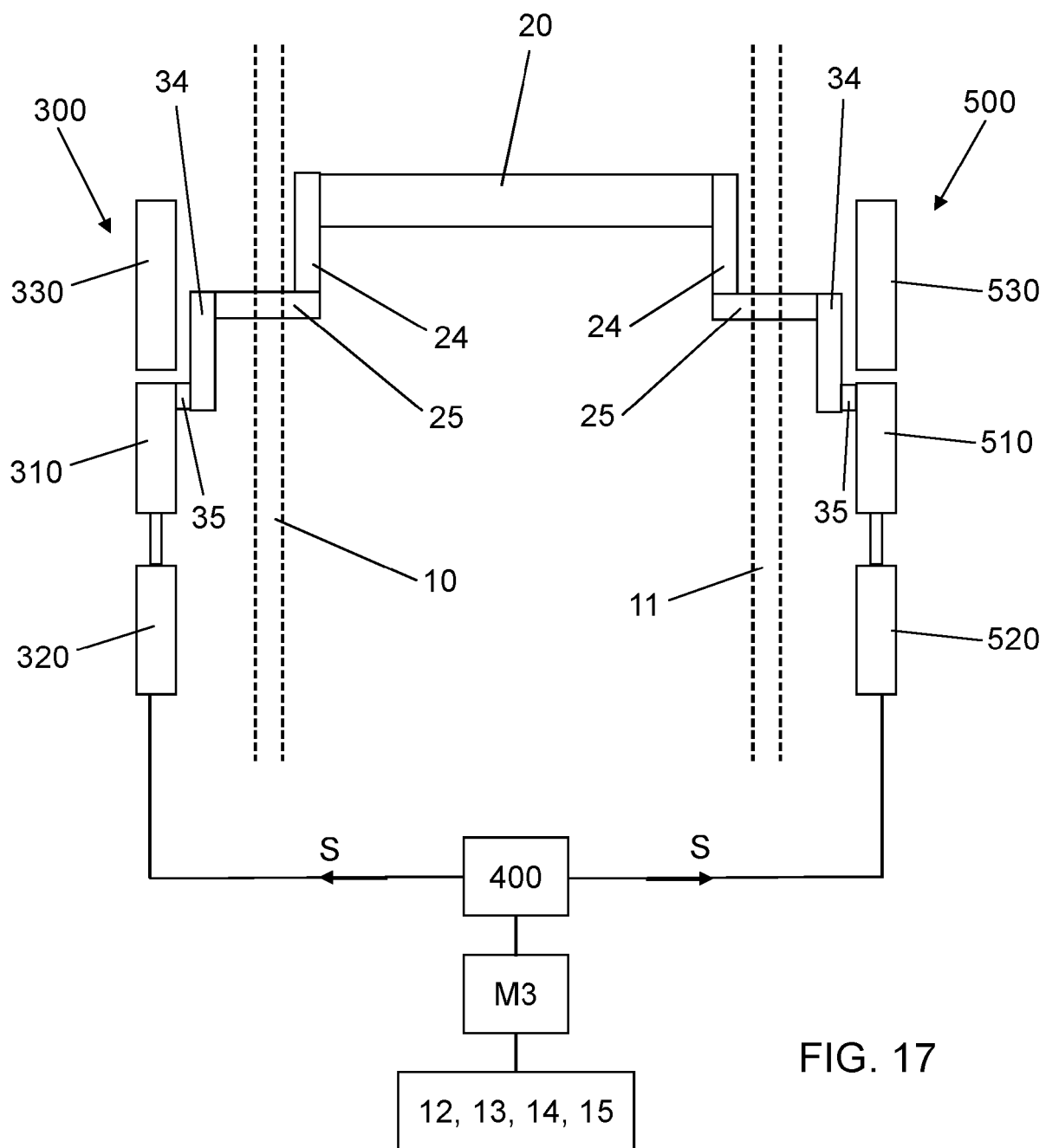
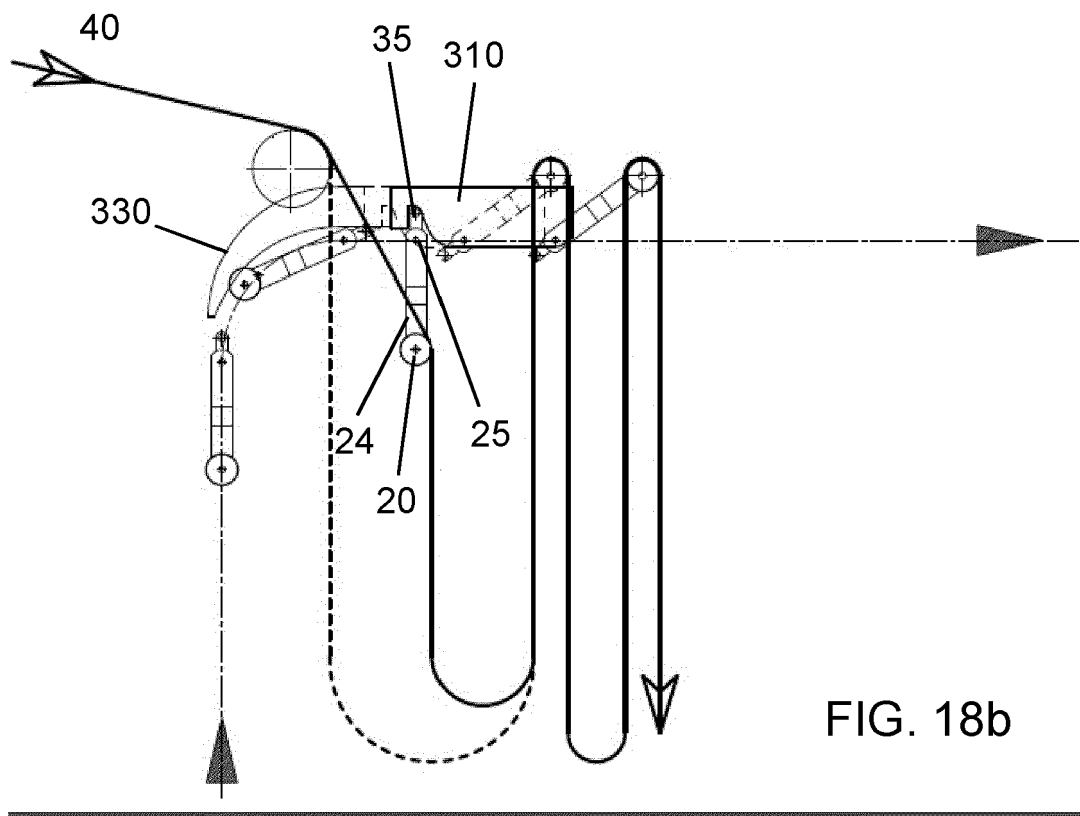
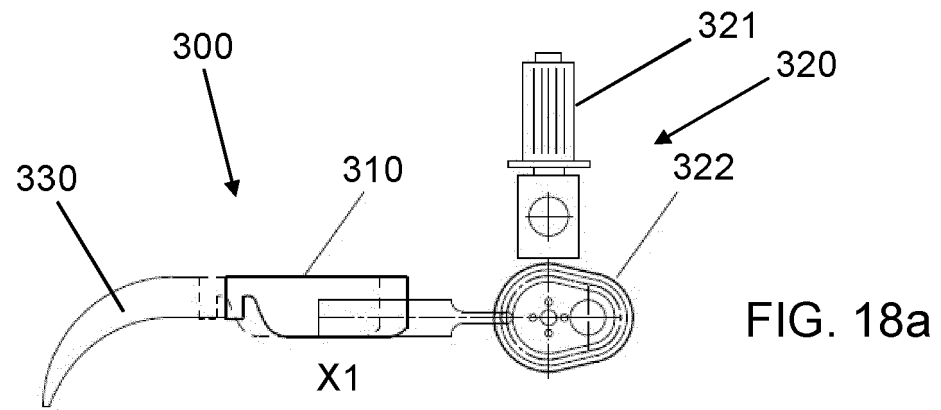
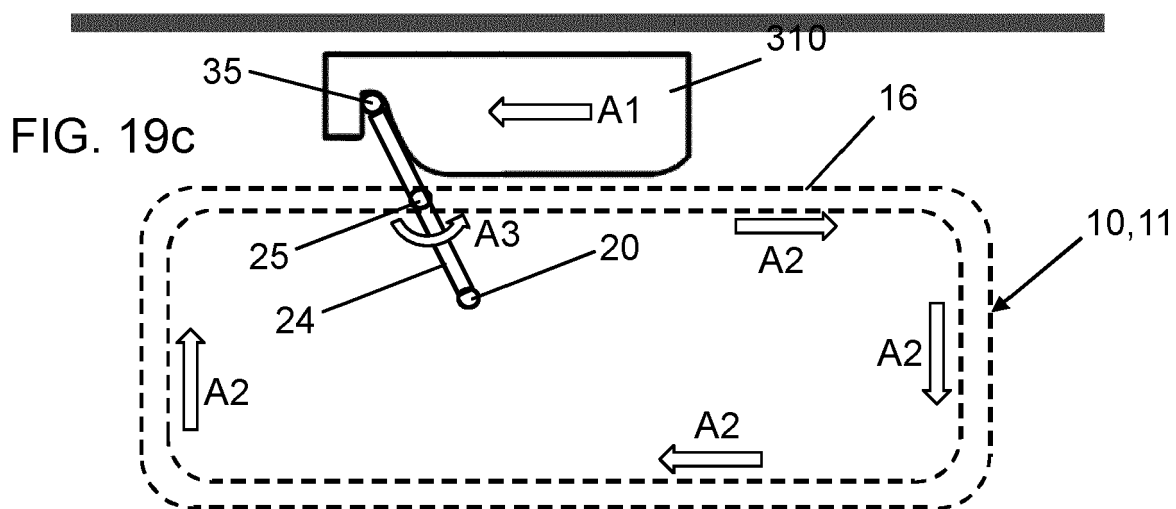
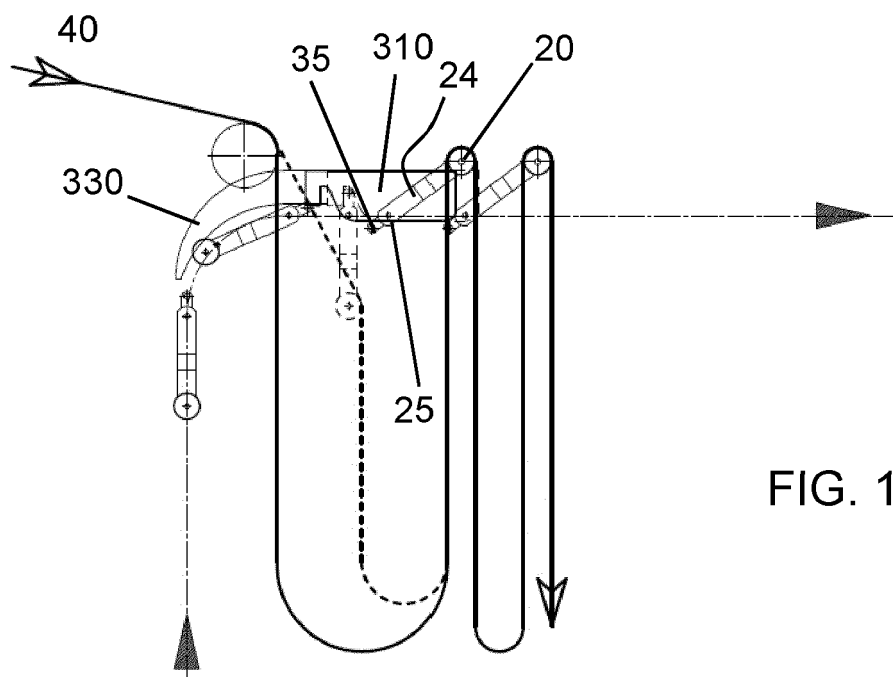
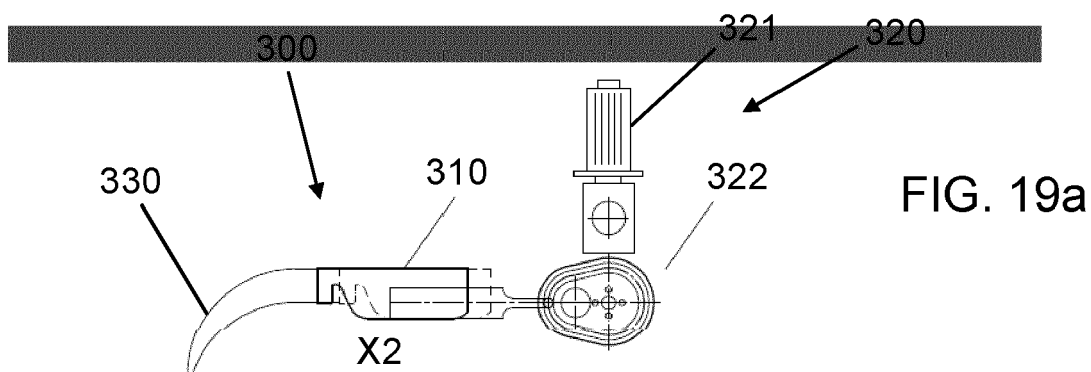
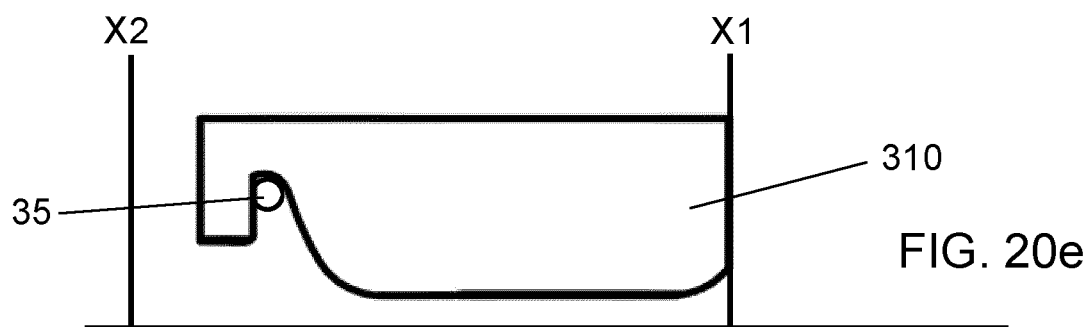
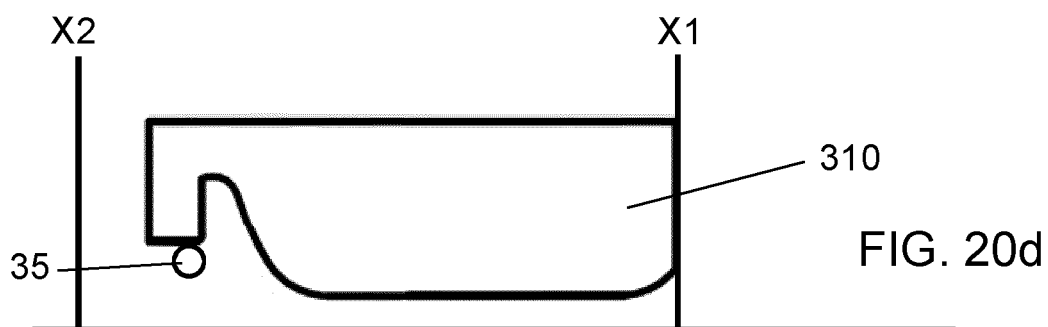
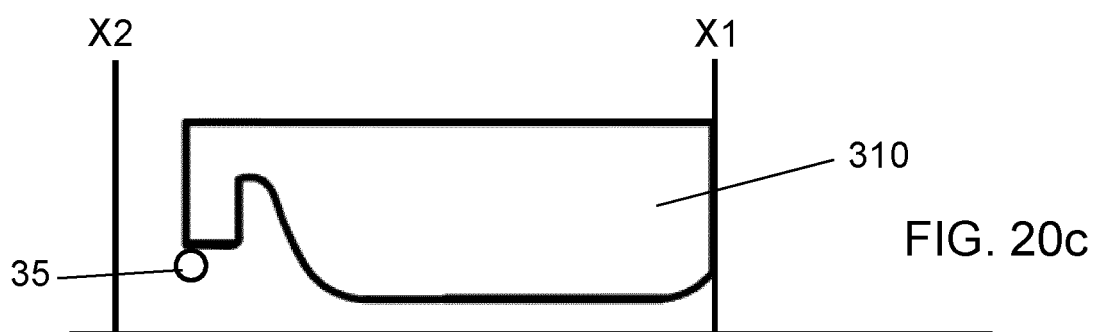
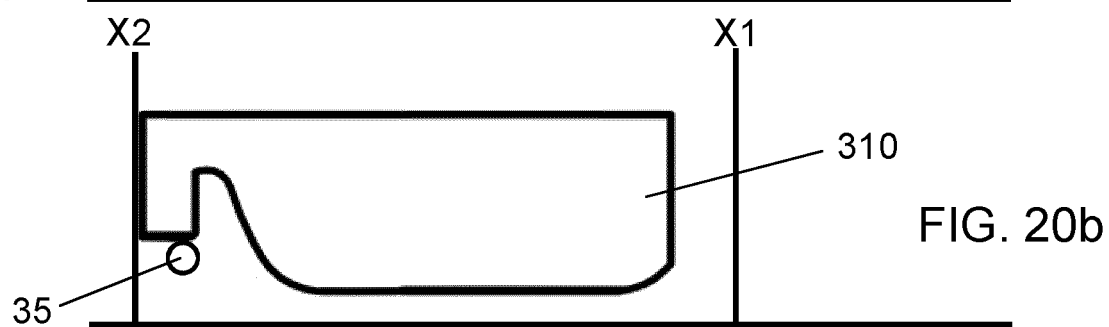
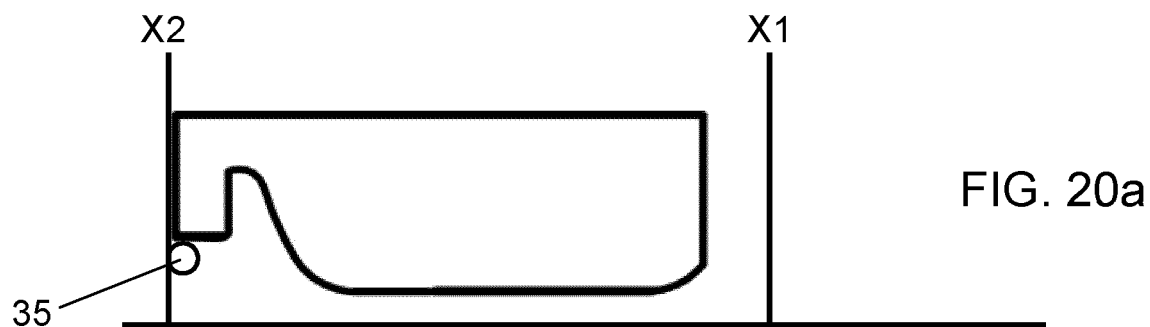


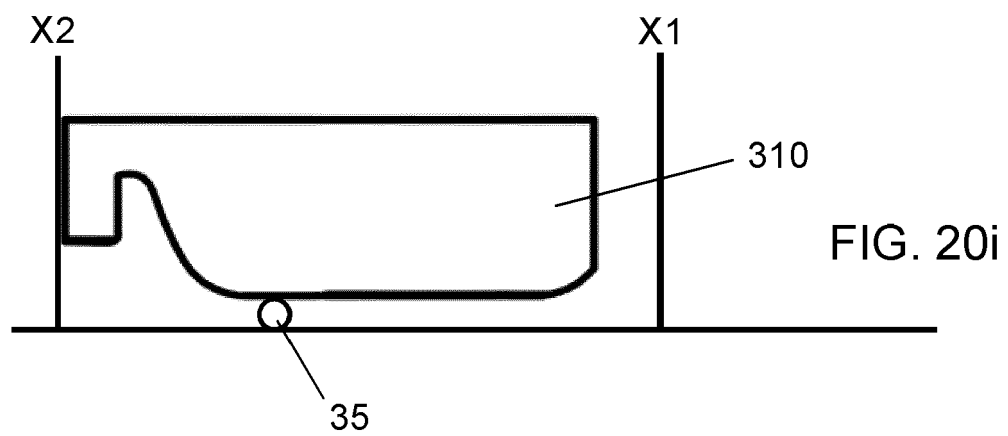
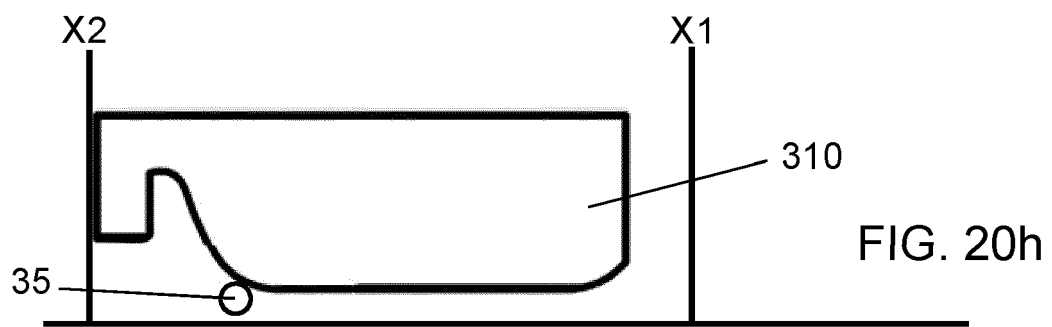
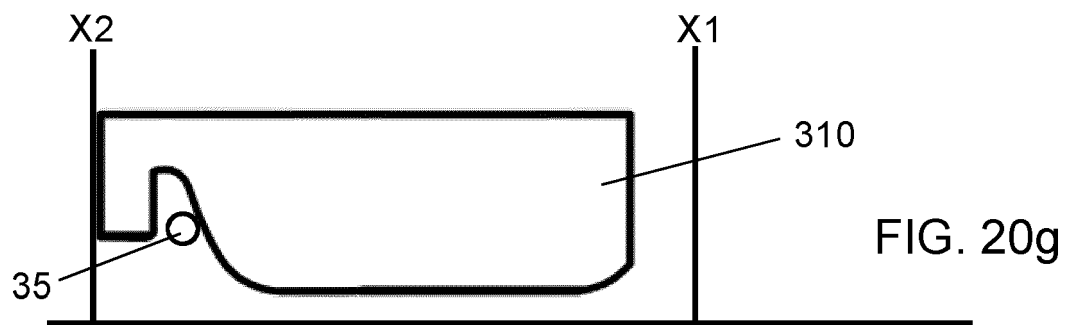
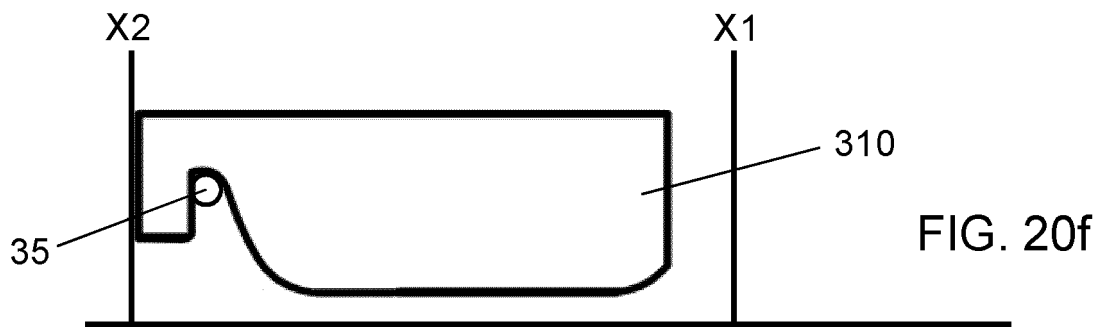
FIG. 16b











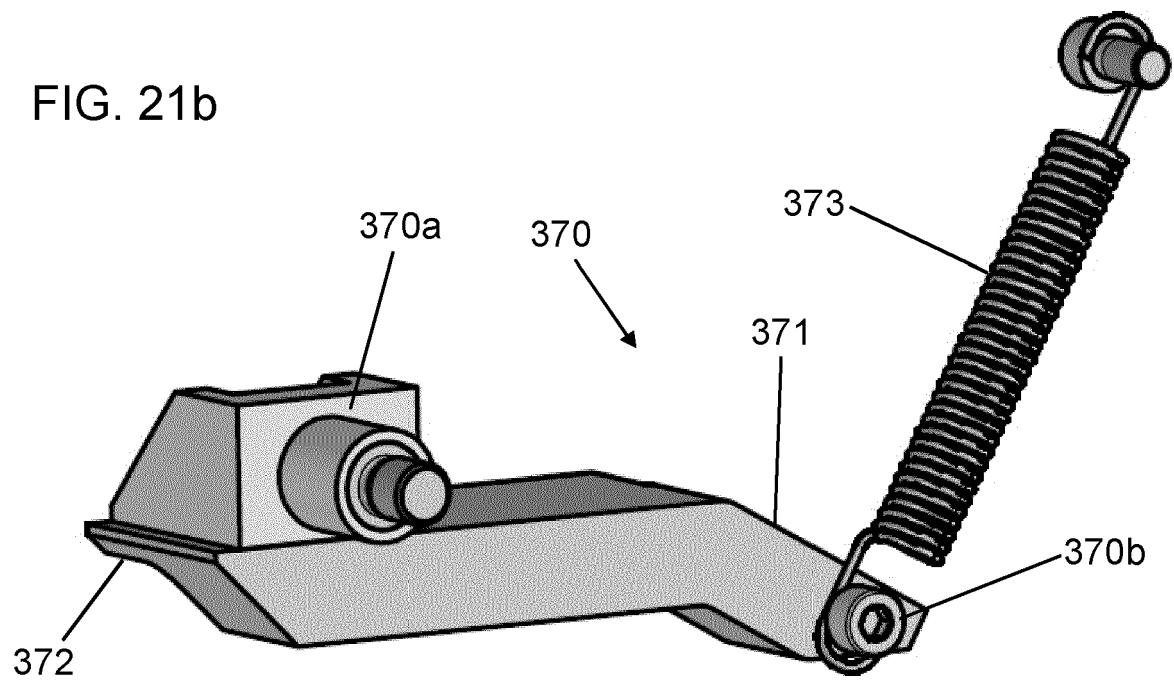
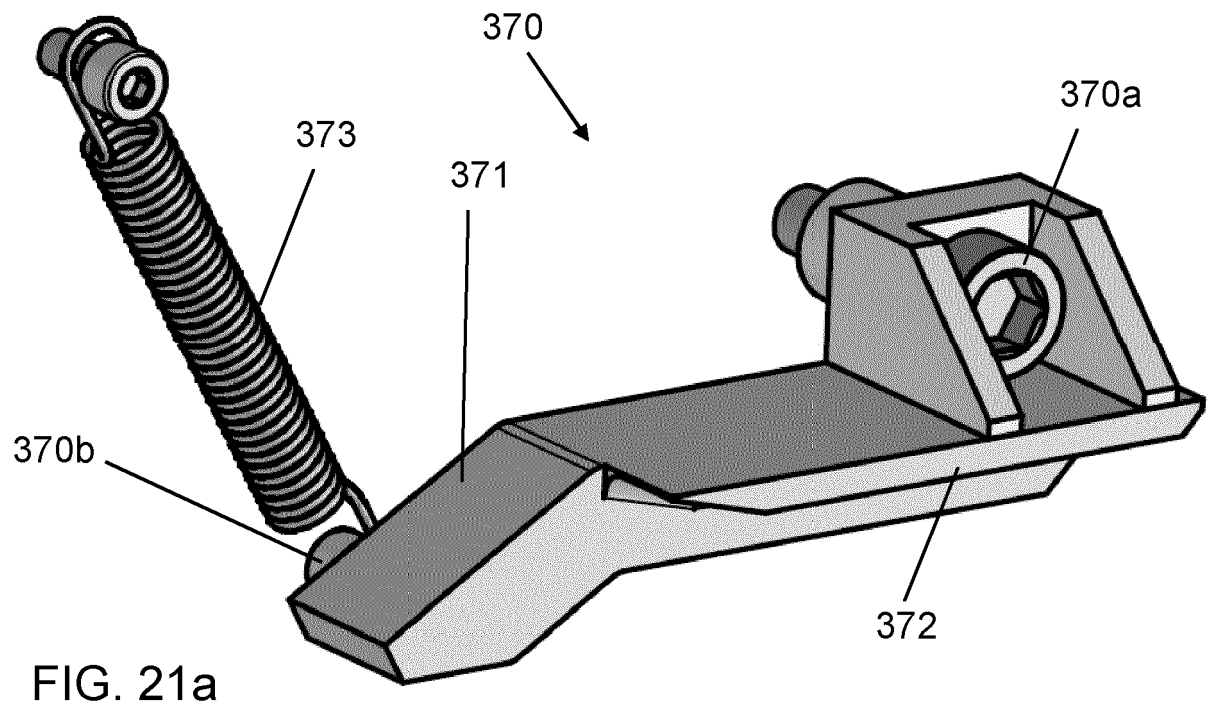


FIG. 22a

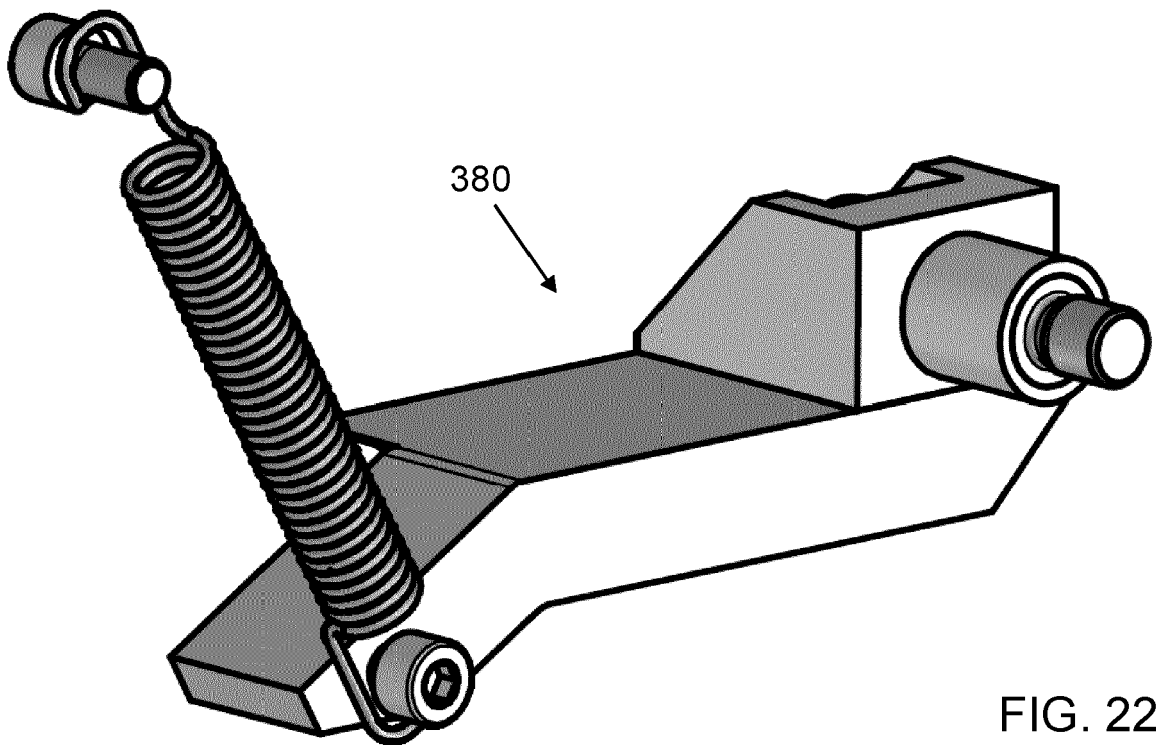
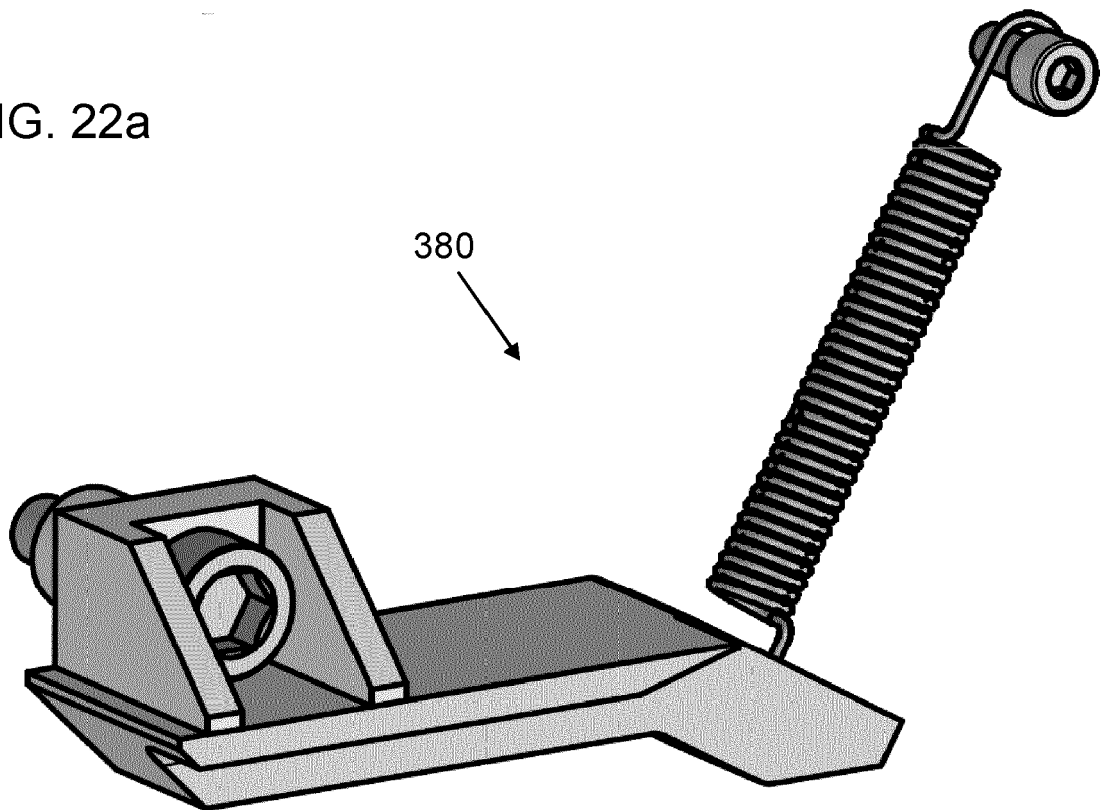


FIG. 22b

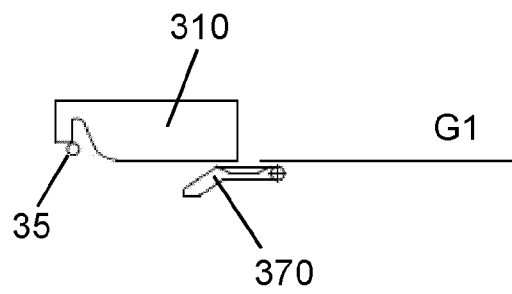


FIG. 23a

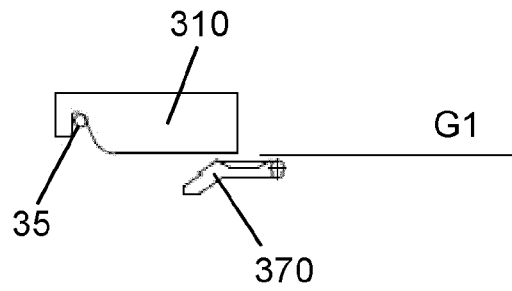


FIG. 23b

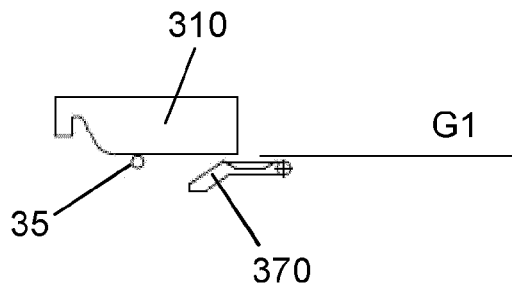


FIG. 23c

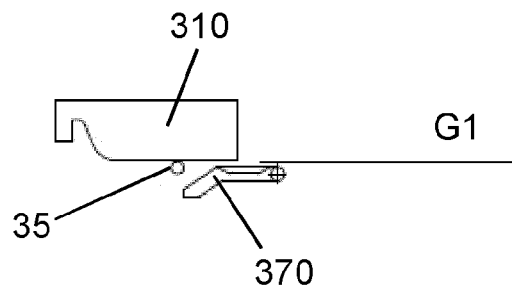


FIG. 23d

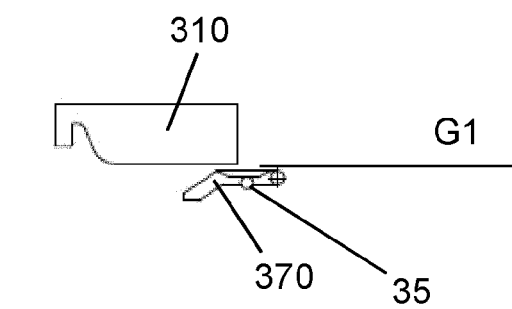


FIG. 23e

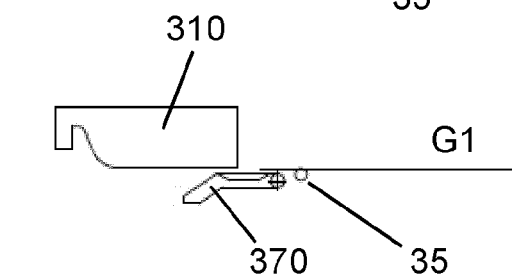


FIG. 23f

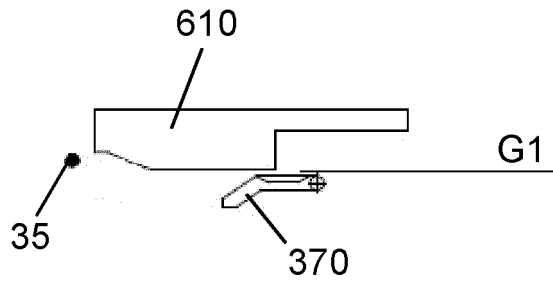


FIG. 24a

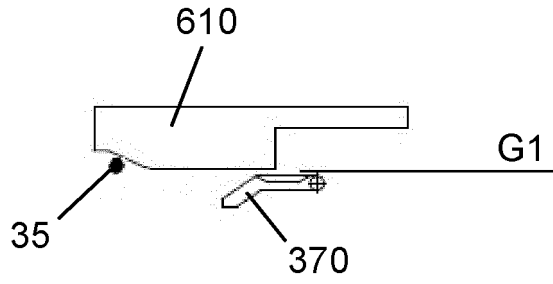


FIG. 24b

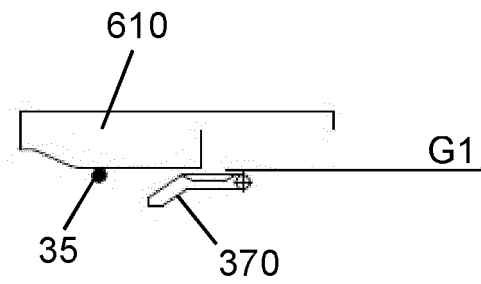


FIG. 24c

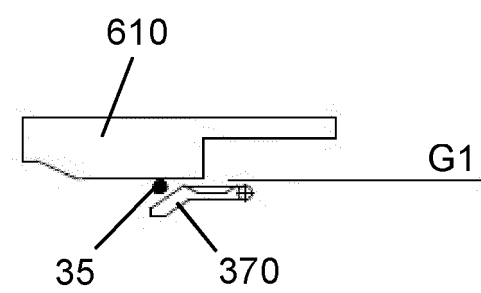


FIG. 24d

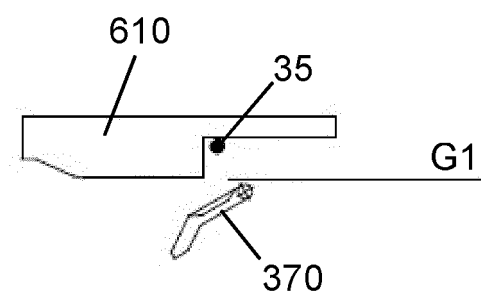


FIG. 24e

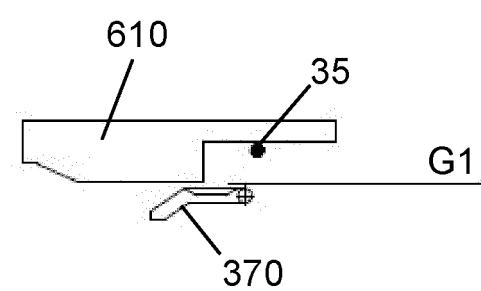


FIG. 24f

FIG. 25a

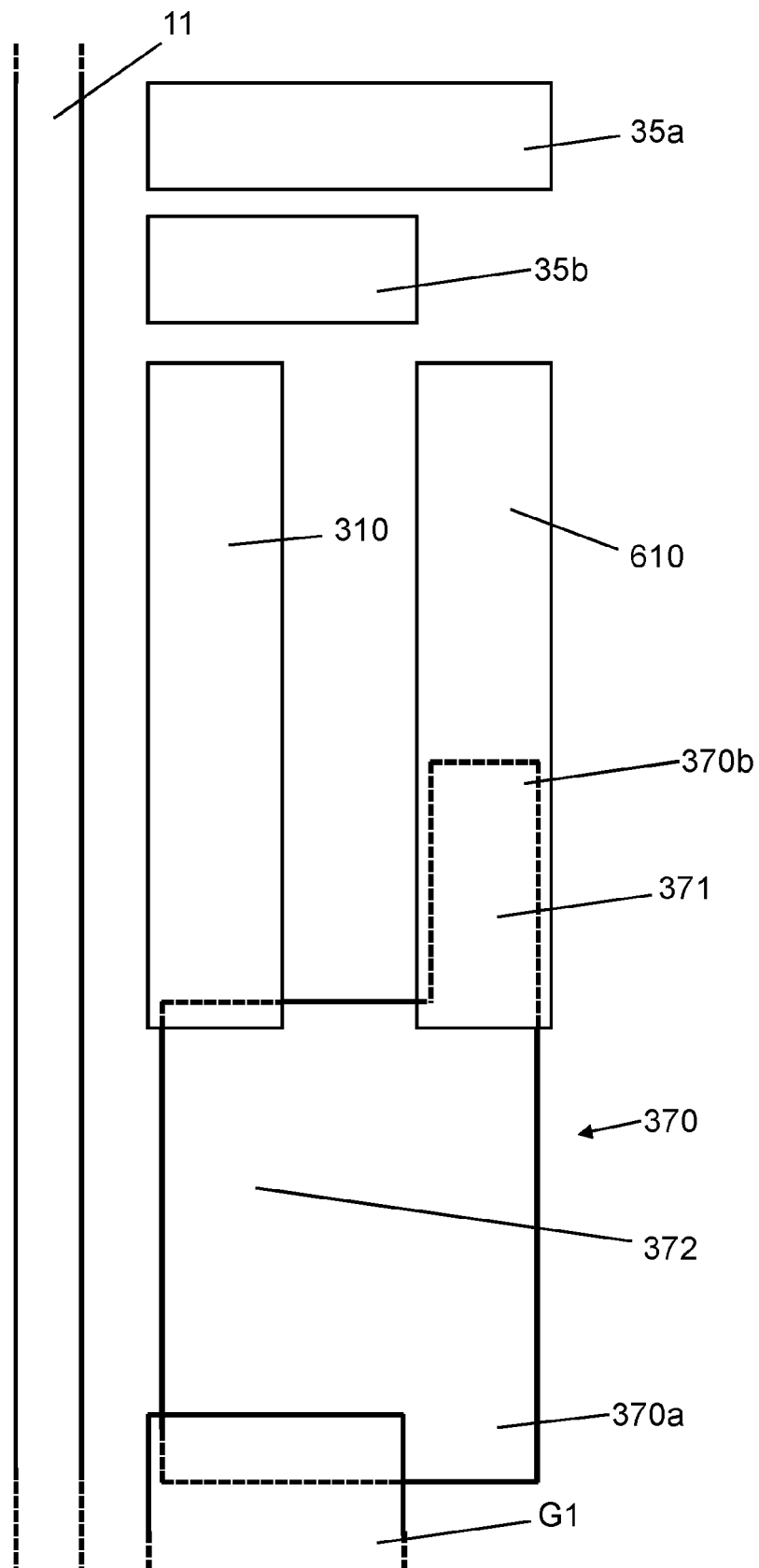


FIG. 25b

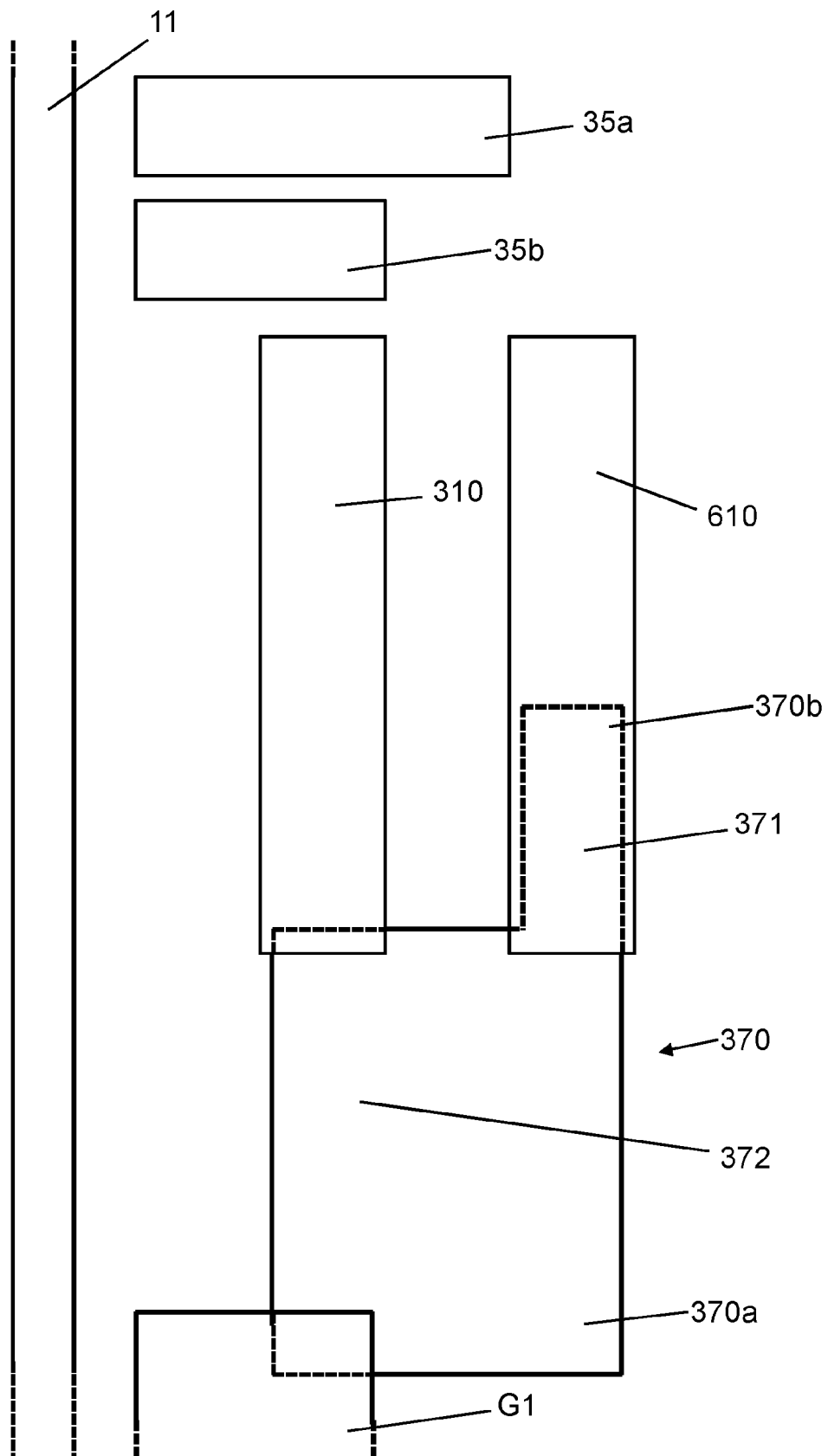


FIG. 26a

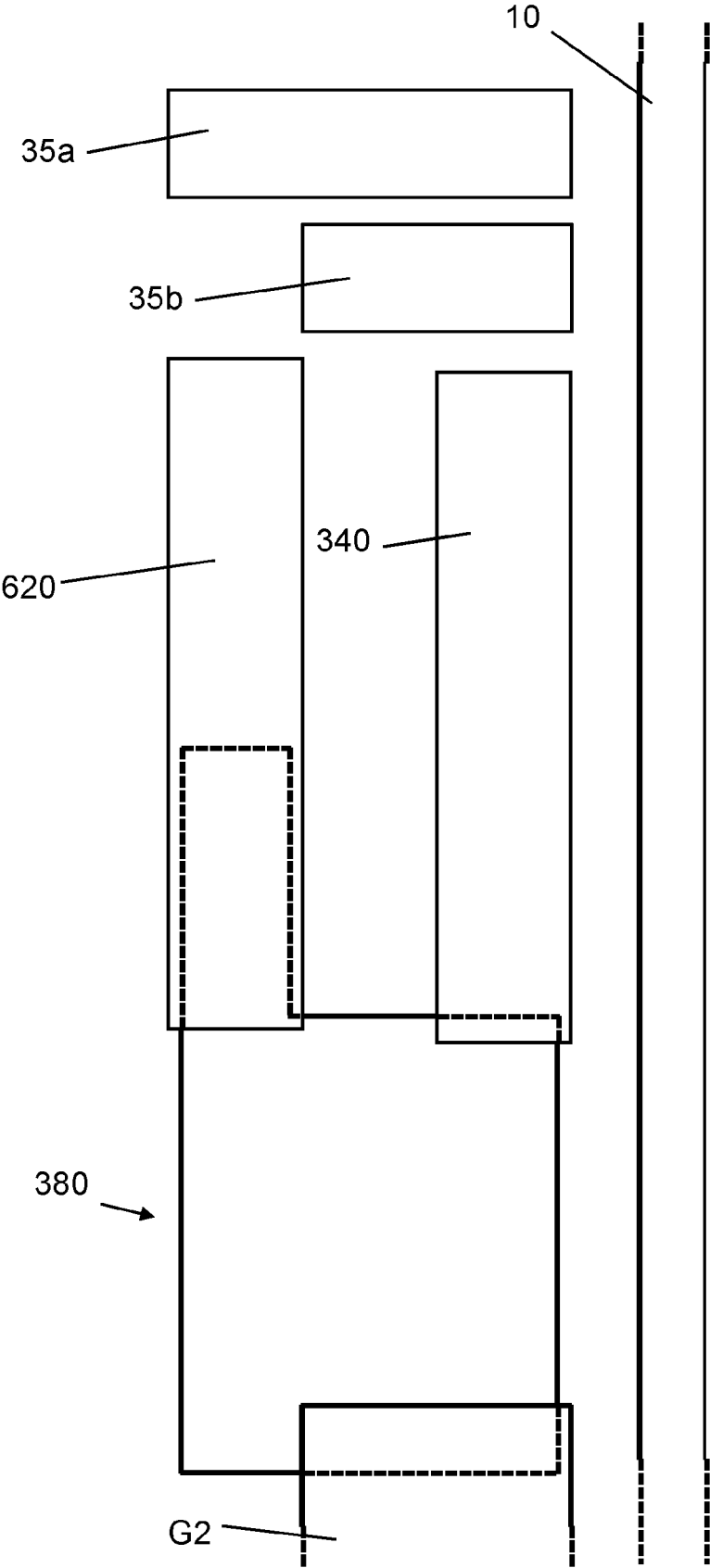


FIG. 26b

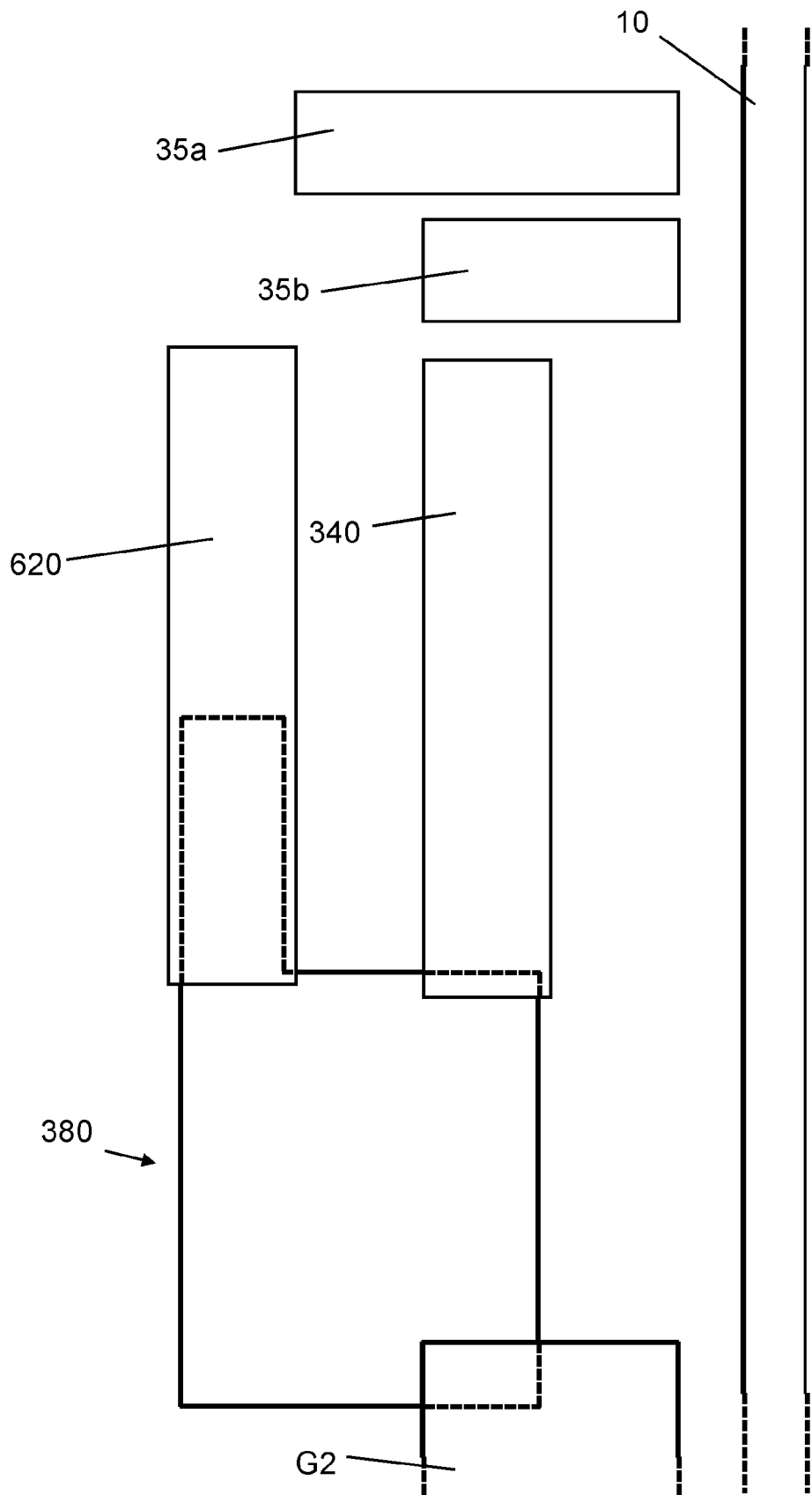


FIG. 27

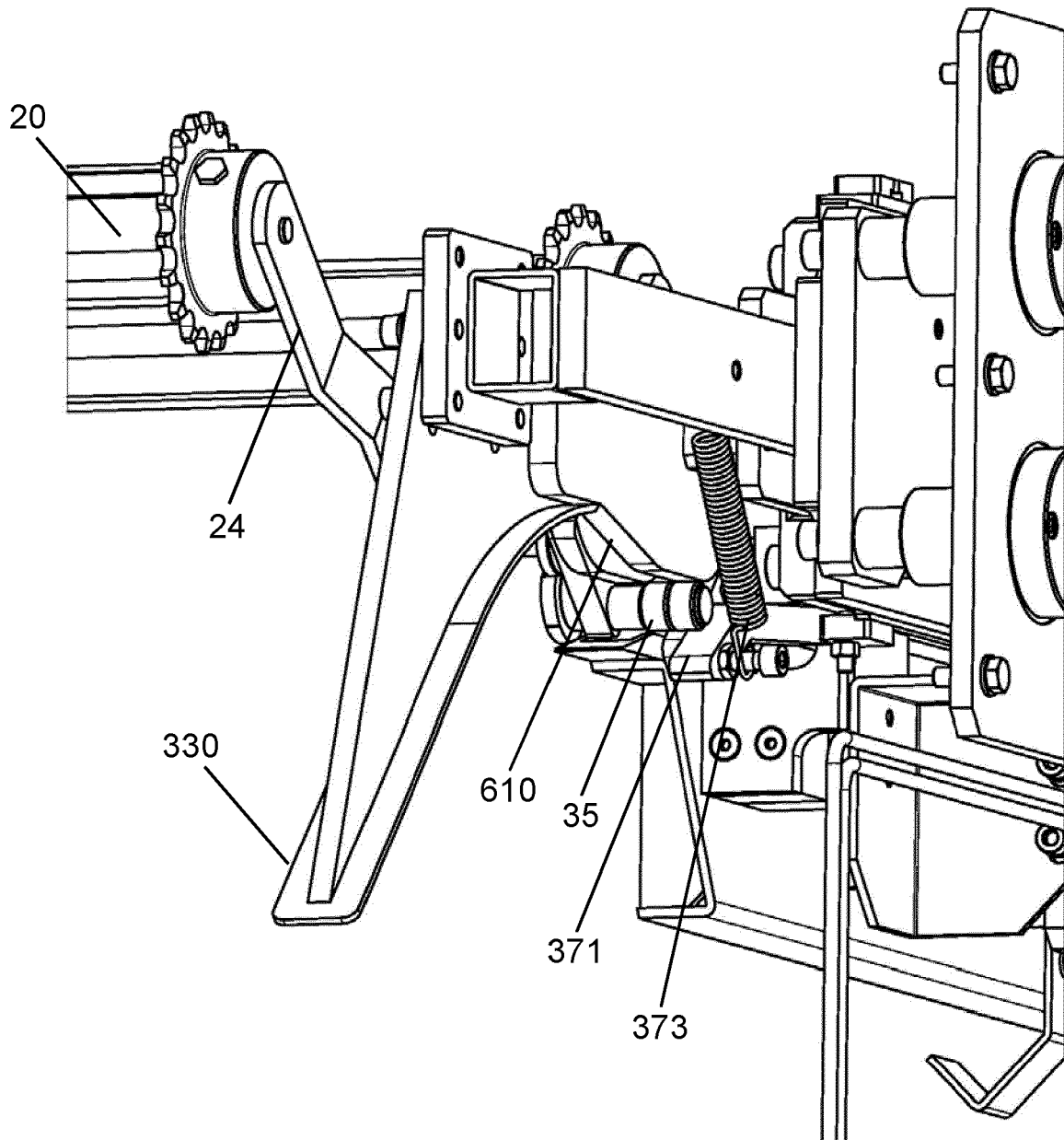


FIG. 28

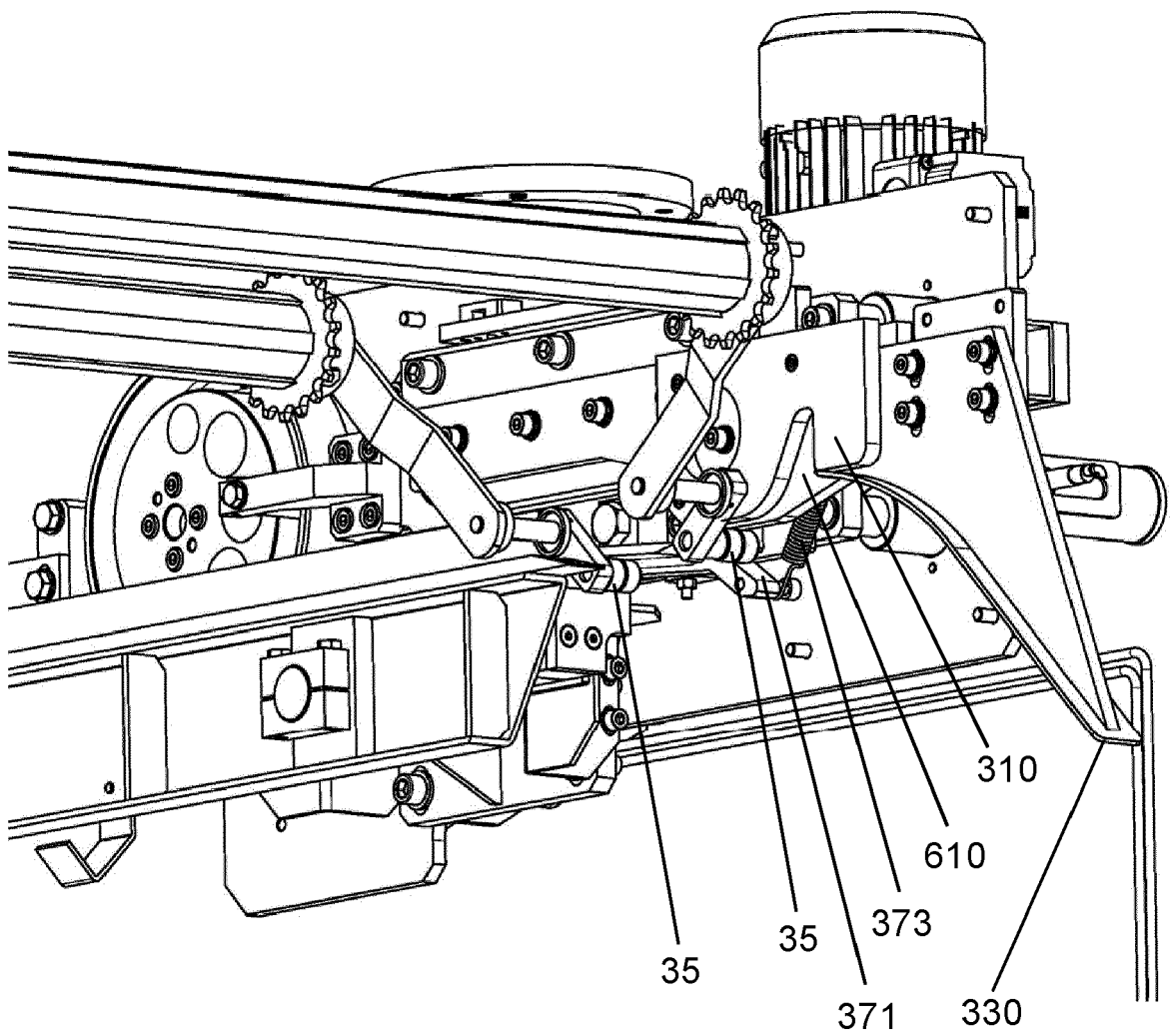


FIG. 29

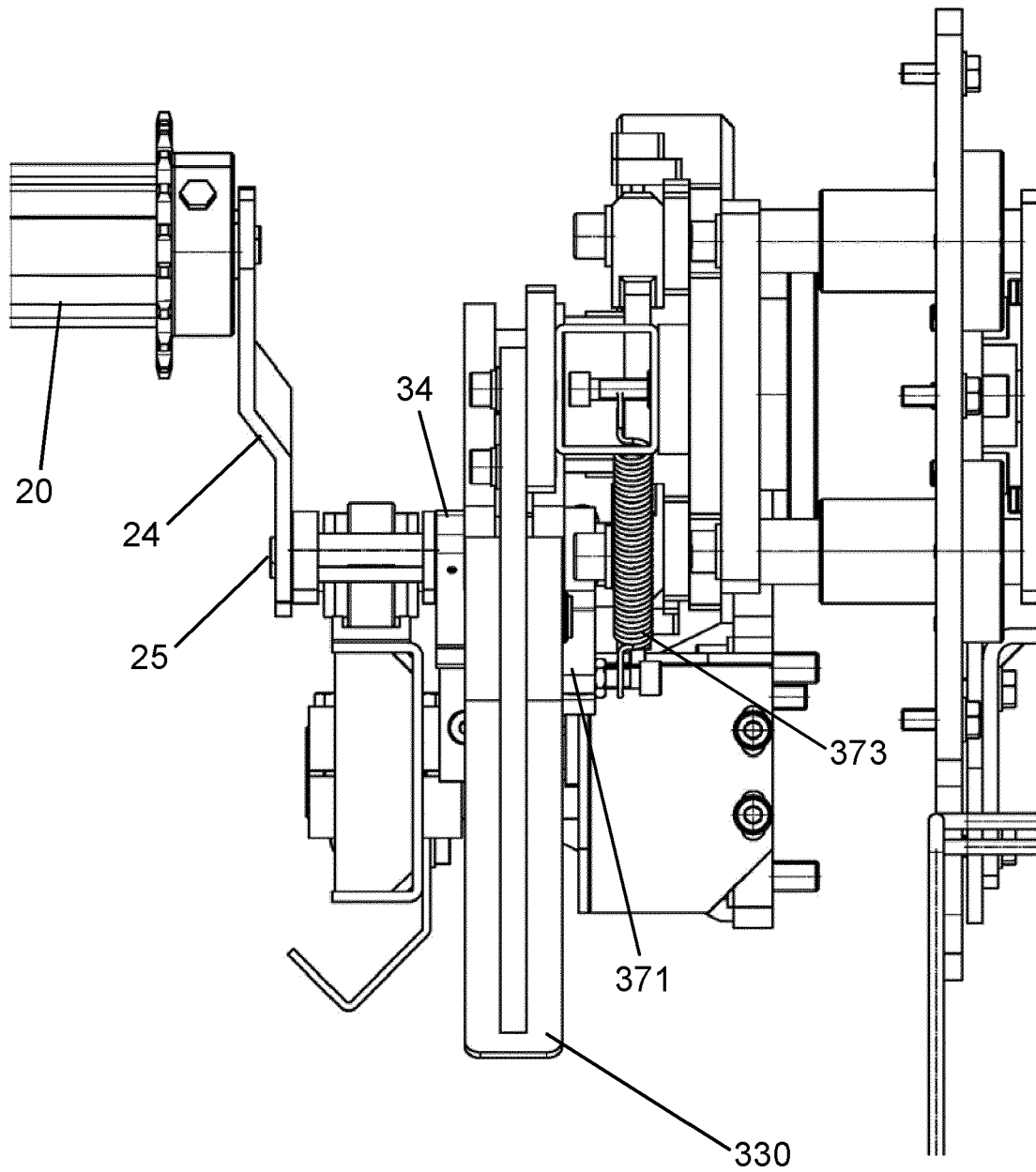
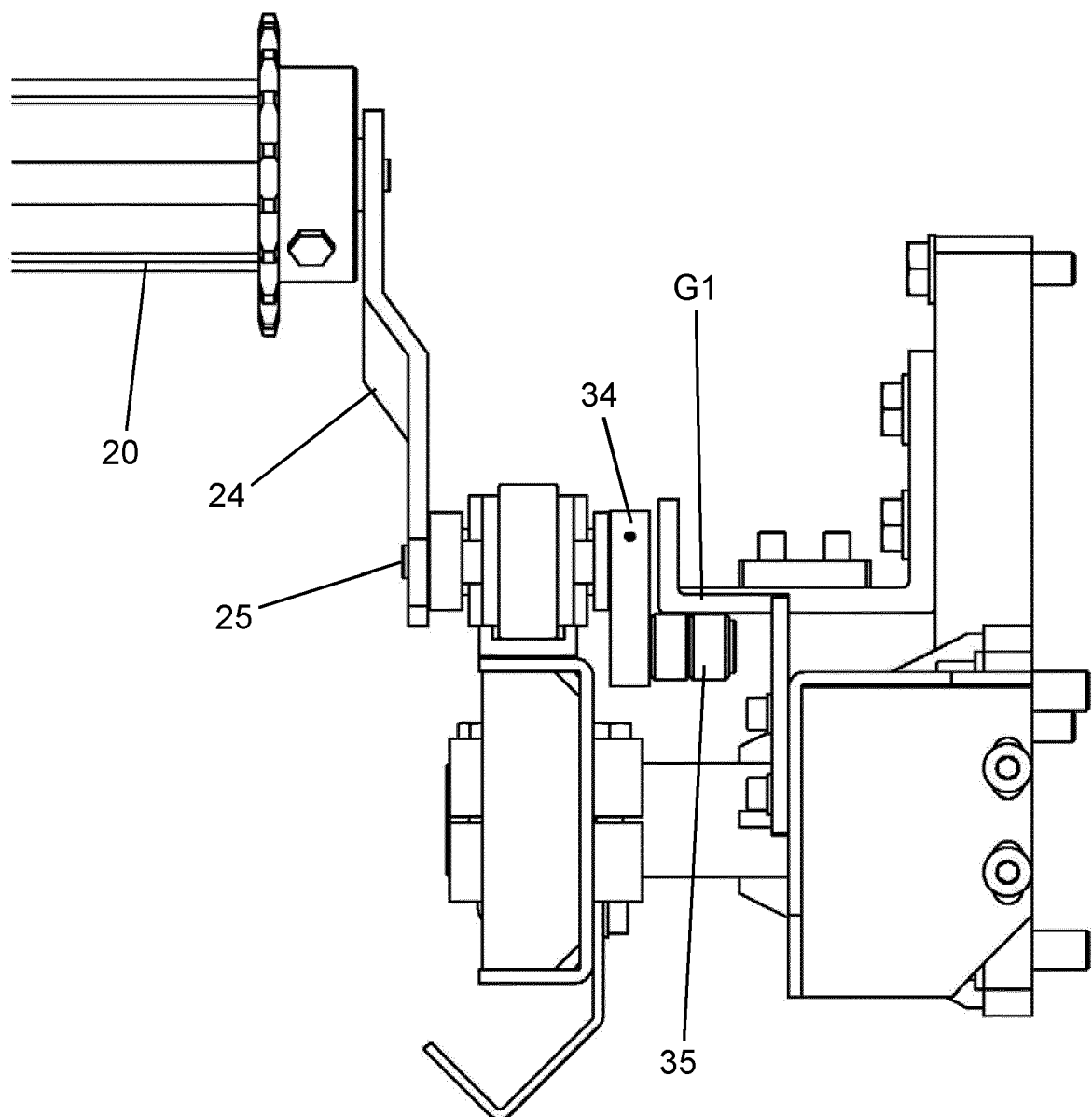


FIG. 30





EUROPEAN SEARCH REPORT

 Application Number
 EP 19 16 3342

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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)
X A	EP 0 145 670 A1 (ARIOLI SRL C [IT]) 19 June 1985 (1985-06-19) * page 5, line 5 - page 14, line 25; figures 1,4-6 *	1,2, 8-10,12 3-7,11, 13,14	INV. D06B17/06 D06B19/00 F26B13/10
X A	US 3 974 950 A (VERTEGAAL JACOBUS GERARDUS) 17 August 1976 (1976-08-17) * column 2, line 26 - column 4, line 3; figures 1,2 *	1,2 3-14	
X A	DE 42 14 674 C1 (BABCOCK) 19 August 1993 (1993-08-19) * column 1, line 14 - column 6, line 1; figures 1-5 *	1,2 3-10	
A,D	WO 2004/074567 A1 (ARIOLI S P A [IT]; BASILICO DANIELE [IT]) 2 September 2004 (2004-09-02) * the whole document *	1-14	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06B F26B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 July 2019	Examiner Uhlig, Robert
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			

 2
 EPO FORM 1503 03.82 (P04C01)

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

EP 19 16 3342

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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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15-07-2019

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