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(71) Applicant: **Marchetti, Antonio**
20142 Milano (IT)

(72) Inventor: **Marchetti, Antonio**
20142 Milano (IT)

(74) Representative: **Mittler, Enrico**
Mittler & C. s.r.l.,
Viale Lombardia, 20
20131 Milano (IT)

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(54) **Forming machine for essentially parallelepiped boxes.**

(57) A forming machine (100) for essentially parallelepiped boxes (1) is described, comprising a base frame (68) which supports collection means (27-29) of flattened boxes (1), forming means (29, 37-39, 59, 56, 105) adapted to convert said flattened boxes (1) into parallelepiped boxes provided with lower (120) and upper flaps (121), flap closing means (52, 60, 67, 71, 72, 74) adapted to close the bottom of the box by folding said lower flaps (120). Said forming means comprise a front forming assembly (200) and a rear forming assembly (201) displaceable from a home position to a working position in which they engage the flattened box (1) to respectively square, with a synchronised movement, a front side (130) and a rear side (131) of the box (1) itself, and further displaceable again to home position so as to allow the horizontal displacement of the formed box (1) towards an outlet arranged beyond said front forming assembly (38).

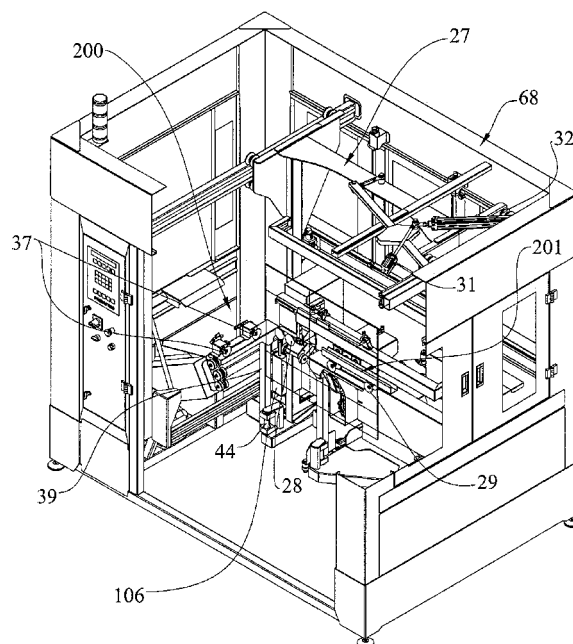


FIG.5

Description

[0001] The present invention relates to a forming machine for essentially parallelepiped boxes.

[0002] A forming machine is a machine adapted to manipulate a cut cardboard box, so as to open said box which at entrance has a closed configuration.

[0003] In closed configuration or prior to forming, a box is essentially flat (flattened) and thus adapted to be transported because the occupied volume is limited.

[0004] In open or formed configuration, a box is three-dimensional or squared, having the surfaces of the box been manipulated so as to identify a central space to be subsequently closed.

[0005] Said machine further folds the lower flaps so that a subsequent taping machine may seal the lower part of the open box, which thus takes a configuration adapted to accommodate filling material.

[0006] Forming machines of various type are known, for example those described in US-3608440, US-3739696, EP-0260794 and EP-0834395.

[0007] It is the object of the present invention to make a forming machine for essentially parallelepiped boxes, having structure and operative peculiarities such to allow a more cost-effective productivity with respect to the known forming machines.

[0008] According to the invention, such object is reached by a forming machine for essentially parallelepiped boxes, comprising a base frame which supports flattened box collection means, forming means adapted to convert said flattened boxes into parallelepiped boxes provided with lower and upper flaps, flap closing means adapted to close the bottom of the box by folding said lower flaps, characterised in that said forming means comprise a front forming assembly and a rear forming assembly displaceable from a home position to a working position in which they engage the flattened box to respectively square with a synchronised movement a front side and a rear side of the box itself, and further subsequently displaceable again to home position so as to allow the horizontal displacement of the formed box towards an outlet arranged beyond said front forming assembly.

[0009] These and other features of the present invention will be further explained in the following detailed description of a practical embodiment example shown by way of non-limitative example in the attached drawings, in which:

figure 1 shows a perspective view of a system for preparing essentially parallelepiped boxes to accommodate filling material, comprising a forming machine according to the present invention;

figure 2 shows a perspective view of a feeding machine for boxes to be formed arranged upstream of the forming machine;

figure 3 shows a reversed perspective view of a portion of the feeding machine in figure 2;

figure 4 shows a perspective view of the forming machine in the initial position of pick-up of the box to be formed;

figure 5 shows a perspective view of the forming machine in a position subsequent to that of figure 4;

figure 6 shows a rear perspective view of the forming machine in figure 5;

figure 7 shows a front perspective view of the forming machine in a position subsequent to that of figure 5;

figure 8 shows a magnified detail of figure 6;

figure 9 shows the same magnified detail of figure 7, in the position subsequent to that of figure 6;

figure 10 shows a perspective view of the forming machine in a position subsequent to that of figure 6;

figure 11 shows a front view of a magnified detail of figure 10;

figure 12 shows a front view of the forming machine in a position subsequent to that of figure 10;

figure 13 shows a front view of the forming machine in a position subsequent to that of figure 12;

figure 14 shows a magnified detail of figure 13 in home position;

figure 15 shows the detail of figure 14 in working position;

figure 16 shows a perspective view of the forming machine in a position subsequent to that of figure 13;

figure 17 shows a magnified detail of figure 10;

figure 18 shows a further magnified detail of figure 10;

figure 19 shows a perspective view of the forming machine in a position subsequent to that of figure 16;

figure 20 shows a perspective view of the forming machine in a position subsequent to that of figure 19, corresponding to the initial collection position of figure 4.

[0010] A system for preparing essentially parallelepiped boxes 1 to accommodate filling material, the boxes having lower, front 120, rear 121, right side 122 and left side 123, and upper 124 flaps, comprises a forming machine 100 which collects flattened boxes 1 from a feeding machine 101, and sends boxes 1 in open or formed (squared) configuration to a taping machine 102 (figure 1).

[0011] Feeding machine 101 (figures 2-3) comprises a frame 23 which supports a supporting chain 2 of boxes 1 to be formed held in vertical position by adjustable contrasts 3 integral with a pushing carriage 4 mobile along guides 10.

[0012] A pneumatic control lever assembly 7 actuates said chain 2 by means of a splined shaft 8 and a pinion 9.

[0013] Said pushing assembly 4 advances in synchronicity with boxes 1 maintaining them in vertical position by means of ratchets 11 meshing with chain 2, releasable by means of a lever 16, to front supporting springs 12.

[0014] The feeding machine further comprises box advancement stopping limit stops 13, limit stops 14 indicating the depletion of boxes 1 which activate an indicating

lamp 15, and limit stop 17 for stopping the advancement of pushing carriage 4.

[0015] Adjustment components 103 adapt feeding machine 101 to the different dimensions of box 1.

[0016] Forming machine 100 comprises a collection carriage 27 which supports mobile withholding suction caps 28, a front forming assembly 200 and a rear forming assembly 201.

[0017] Rear forming assembly 201 comprises mobile rear forming suction caps 29 supported by a mobile frame 50 by means of rear arm 81.

[0018] Said withholding suction caps 28 are actuated by a pneumatic cylinder 84 fastened to collection carriage 27 by means of rear fastening 85 (figure 18).

[0019] Collection carriage 27, supported by wheels 35 and guided by suitable guides 36, translates by means of the combined action of cylinders 30 and 31 and of a lever 32, integral with collection carriage 27 by means of a connecting rod 33 and pivoting on a fixed frame 68 by means of a pin 34 (figure 1, 4).

[0020] Front forming assembly 200 comprises front forming suction caps 37 fastened to a mobile front arm 38 integral with a frame 39 by means of a pin 44. Said front arm 38 is actuated by a pneumatic control assembly 105, comprising pneumatic cylinders 41 and 46, a magnetic sensor 49, and an accelerator/decelerator device 106 (figure 8) described in Italian patent application MI2006A000211 by the same Applicant.

[0021] Frame 50 supports, by means of crossbar 51, a rear flap closing assembly 52 and an ejector assembly 53.

[0022] Rear arm 81, on which rear forming suction caps 29 are fastened (figure 10), is connected to an ejector cylinder 82, with magnetic sensor 88, integral with crossbar 51 by means of a support 83 (figure 17).

[0023] Said frame 50 is rotationally controlled about a pin 55 by means of a pneumatic cylinder 56 (figure 6).

[0024] Rear flap closing assembly 52 comprises a rear flap closing lever 60 integral with a support 59 by means of a pin 61 and actuated by a pneumatic cylinder 107 (figure 11).

[0025] The enabling of magnetic sensors 64-66 activates a pneumatic cylinder 67 which is fastened to frame 68 by means of a rear attachment 69 and a supporting plate 70. A roller holder plate 71 which supports front flap closing rollers 72 is fastened on the front side of said pneumatic cylinder 67 (figure 12).

[0026] A magnetic sensor 73 controls the activation by means of a pneumatic cylinder 77 (figures 14-15), with magnetic sensor 80, of a right longitudinal flap closing lever 74 fastened by means of a pin 75 to a support 76 integral with collection carriage assembly 27.

[0027] Forming machine 100 further comprises a left side flap closer 92 (figure 6 and 16) and adjustment means which adapt forming machine 100 to the different dimensions of box 1.

[0028] Taping machine 102 comprises side conveyor belts 89 actuated by a motor assembly 90, and a taping

assembly 91 (figure 16).

[0029] Said taping machine 102 further comprises adjustment means 111 to adapt said machine 102 to the various dimensions of formed box 1.

5 **[0030]** As regards the operation of the system shown in the figures, boxes 1 to be formed are supportingly inserted on chain 2 of feeding machine 101 and are induced to advance by means of control assembly 7 which turns splined shaft 8, which advances chain 2 by means of pinion 9. During feeding, boxes 1 are maintained in vertical position by means of contrasts 3. Said contrasts are integral with pushing carriage 4, guided by dedicated guides 10, which, by means of ratchets 11 meshing with chain 2, advances in synchronicity with boxes 1 maintaining them in vertical position and accompanying them to the front support springs 12.

10 **[0031]** Boxes 1 are made to advance, as described above, until the first box 1 actuates one of the two stopping limit stops 13. Whenever the forming machine collects a box 1, and both limit stops 13 are clear, control assembly 7, which advances boxes 1 until one of the two limit stop 13 is engaged again, is actuated. During use of feeding machine 101, when boxes 1 are reduced in quantity and clear a suitable indicating limit stop 14, an indicating lamp 15 is activated. By means of the rotation of lever 16, ratchet 11 may be released from chain 2 and stop pushing carriage 4 so as to load other boxes 1. If feeding machine 101 is not refilled, at the end of boxes 1, a suitable limit stop 17 will stop the advancement of pushing carriage 4.

20 **[0032]** Initially, forming machine 100 is arranged with collection carriage assembly 27 in the position of figure 4, i.e. with mobile withholding suction caps 28 and rear forming suction caps 29 in contact with the first box to be formed 1.

30 **[0033]** The suction caps are actuated by a vacuum system (not shown in the figures).

[0034] By means of the combined action of cylinders 30 and 31 and of lever 32, collection carriage 27 translates from the position in figure 4 to that in figure 5. With this movement, box 1 is collected from feeding machine 101 thus starting the forming cycle of the box.

35 **[0035]** During the translation motion of collection carriage 27, front forming suction caps 37, by means of the actuation of front arm 38 by pneumatic cylinder 41, are taken to horizontal position (figure 5). During this movement, pneumatic cylinder 41 is assisted by accelerator/decelerator device 106.

40 **[0036]** Having reached the horizontal position, front forming suction caps 37 are made to adhere to front wall 130 of box 1 by rotating frame 39, fastened to collection carriage 27 by means of pin 44 (figure 7). This control is activated by magnetic sensor 45 arranged on pneumatic cylinder 41 and is performed by pneumatic cylinder 46 fastened to collection carriage 27.

45 **[0037]** After completing the stroke of cylinder 46, thus with front forming suction caps 37 in contact with box 1, a suitable magnetic sensor 49 arranged on pneumatic

cylinder 46 controls the opening or squaring of box 1 (figure 10). The opening of box 1 occurs by returning front forming suction caps 37 to initial position and by rotating rear forming suction caps 29 by means of rear arm 81.

[0038] Rear forming suction caps 29 perform the forming step of box 1 by rotating frame 50. During the rotation of frame 50, rear lower flap 121 of box 1 is further closed by means of rear flap closing assembly 52 (figures 10-11). Furthermore, during the rotation of frame 50, rear flap closing lever 60 rotates from vertical position to horizontal position by means of pneumatic cylinder 107. With this movement, during the rotation of frame 50, rear flap closing lever 60 folds lower rear flap 121 of box 1 inwards.

[0039] Having completed the opening step of box 1, with corresponding closing of rear lower flap 121, pneumatic cylinder 67 which moves rollers 72 is activated by means of the enabling of magnetic sensor 64 arranged on front box opening pneumatic cylinder 46, of magnetic sensor 65 arranged on rear box opening pneumatic cylinder 56 and of magnetic sensor 66 arranged on rear flap closing pneumatic cylinder 107. During the advancement movement, rollers 72 meet front lower flap 120 of box 1, folding it towards the inside thereof. Pneumatic cylinder 67, having reached end of stroke, activates magnetic sensor 73 which controls the activation of right longitudinal flap closing lever 74 and the return to initial position of front flap closing rollers 72. Said lever, by means of pneumatic cylinder 77, rotates from home position to horizontal position, as shown in figure 15, folding right side flap 122 of box 1. Simultaneously to the movement of right longitudinal flap closing lever 74, the vacuum to front forming suction caps 37 is deactivated, and mobile front arm 38, onto which said suction caps are fastened, returns to start of cycle position by means of the action of pneumatic cylinder 41.

[0040] Having completed the stroke of right longitudinal flap closing lever 74, magnetic sensor 80 (figure 14), arranged on pneumatic cylinder 77, is activated thus activating box ejection device 53 and mobile withholding suction caps 28. Rear forming suction caps 29, figure 17, push box 1 towards taping machine 102. During this step, box 1 is accompanied also by mobile withholding suction caps 28. The latter, by means of pneumatic cylinder 84 fastened to collection carriage assembly 27, translate from the position of figure 5 to the position of figure 16, thus accompanying box 1 within taping machine 102.

[0041] Having reached end of stroke, ejector cylinder 82 activates magnetic sensor 88, figure 17, which controls the repositioning of mobile withholding suction caps 28, the repositioning of rear forming suction caps 29, the repositioning of rear flap closing lever 60 and the repositioning of frame 50, onto which ejector assembly 53 and rear flap closing assembly 52 are fastened.

[0042] At this point, formed box 1 is fed by side conveyor belts 89, figure 19, driven by motor assembly 90 described in patent EP-04106560.8 by the present Applicant.

[0043] During translation step towards taping assem-

bly 91, the left side flap of box 1 meets the dedicated flap closer 92 which folds it inwards thus completing the closing step of the bottom of box 1.

[0044] During the translation step, box 1 clears limit stop 93, figure 19, which controls the repositioning of right longitudinal flap closing lever 74 and the repositioning of collection carriage assembly 27, as shown in figure 20, ready for a new box forming cycle.

[0045] Box 1 proceeding on taping machine 102, by means of side conveyor belts 89, meets taping assembly 91 which tapes the bottom of the box thus completing the forming and taping step of box 1.

[0046] Box 1 formed and taped on the bottom is ready to accommodate filling material.

Claims

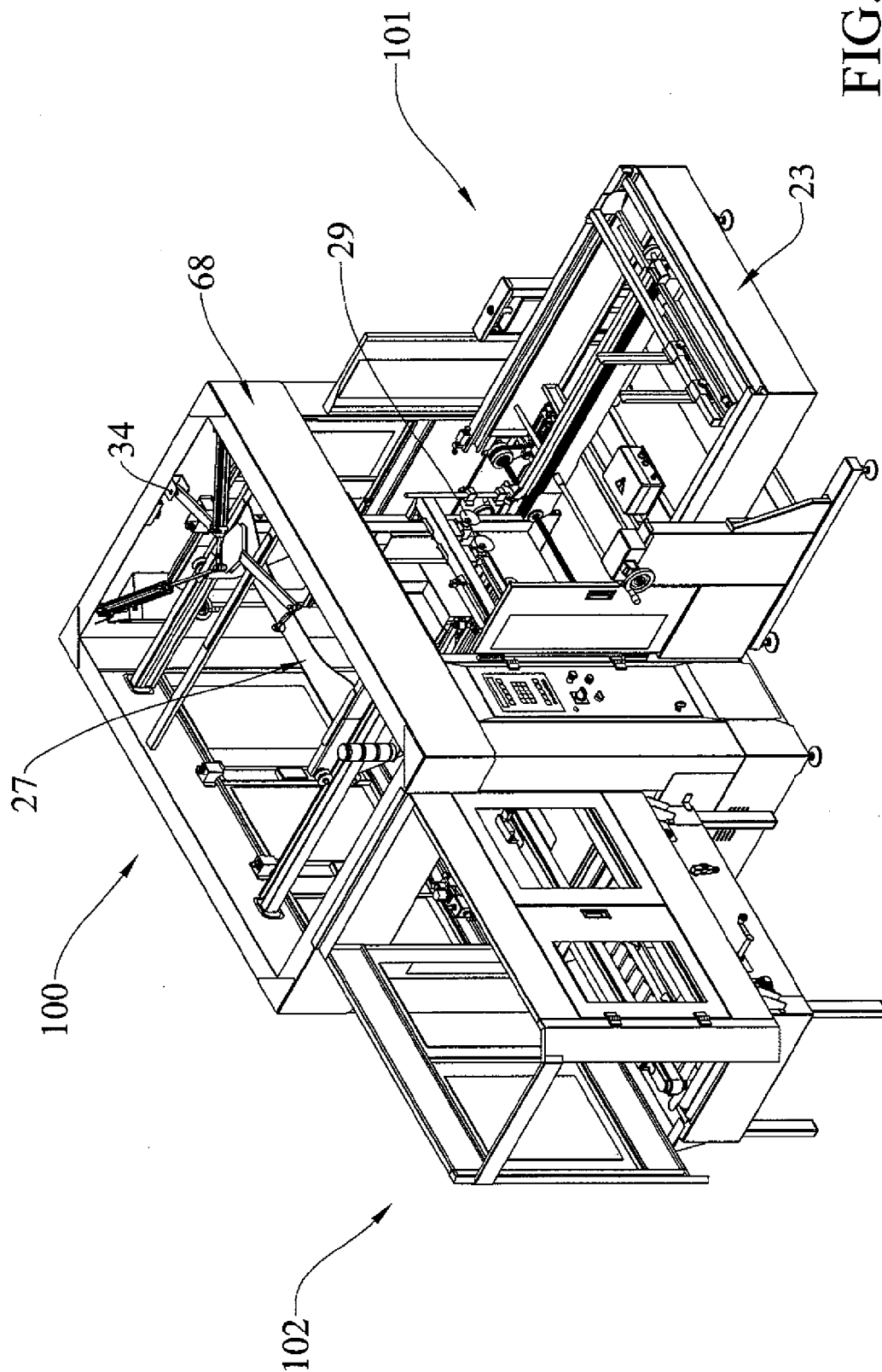
1. A forming machine (100) for essentially parallelepiped boxes (1), comprising a base frame (68) which supports collection means (27-29) of flattened boxes (1), forming means (29, 37-39, 59, 56, 105) adapted to convert said flattened boxes (1) into parallelepiped boxes provided with lower (120) and upper flaps (121), flap closing means (52, 60, 67, 71, 72, 74) adapted to close the bottom of the box by folding said lower flaps (120), **characterised in that** said forming means comprise a front forming assembly (200) and a rear forming assembly (201) displaceable from a home position to a working position in which they engage the flattened box (1) to respectively square with a synchronised movement a front side (130) and a rear side (131) of the box (1) itself, and further subsequently displaceable again to home position so as to allow the horizontal displacement of the formed box (1) towards an outlet arranged beyond said front forming assembly (200).
2. A forming machine according to claim 1, **characterised in that** said front forming assembly (200) comprises a front arm (38) mobile between a vertical home position and a horizontal working position in which withholding means (37) supported by the latter engage with the front side (130) of the box.
3. A forming machine according to claim 2, **characterised in that** said front arm (38) is supported by a rotatable frame (39) pivoted onto the collection means (27).
4. A forming machine according to any of the claims 2-3, **characterised in that** said front arm (38) is actuated by a pneumatic cylinder (41) assisted by an accelerator/decelerator device (106).
5. A forming machine according to any of the preceding claims, **characterised in that** said rear forming assembly (201) comprises a rotatable frame (50) which

supports a rear arm (81) having withholding means (29) engageable with the rear side (131) of the box.

6. A forming machine according to claim 5, **characterised in that** said rear forming assembly comprises ejector control means (53) which actuate said rear arm (81) to allow the output of the formed box (1) from the forming machine. 5
7. A forming machine according to any of the preceding claims, **characterised in that** said collection means comprise a mobile carriage (27) which support withholding means (28). 10
8. A forming machine according to claim 5 or 7, **characterised in that** said withholding means comprise at least one suction cap (29, 37). 15
9. A forming machine according to any of the preceding claims, **characterised in that** said flap closing means comprise a front flap closing assembly (67, 69-72), a rear flap closing assembly (52) and at least one side flap closing assembly (74-77). 20
10. A forming machine according to claim 9, **characterised in that** said rear flap closing assembly (52) is supported by the rear forming assembly (201). 25
11. A forming machine according to any of the claims 9-10, **characterised in that** said rear flap closing assembly comprises a lever (60) actuated by a pneumatic cylinder (107) during the rear forming step. 30
12. A forming machine according to any of the claims 9-11, **characterised in that** said front flap closing assembly comprises a pneumatic cylinder (67) which actuates contrast means (72) which push a front lower fold (120) of box (1). 35
13. A forming machine according to any of the claims 9-12, **characterised in that** said side flap closing assembly comprises a lever (74) actuated by a pneumatic cylinder (77). 40
14. A forming machine according to any of the preceding claims, **characterised in that** it is connected upstream of a feeding machine (101) of boxes (1) to be formed. 45
15. A forming machine according to any of the preceding claims, **characterised in that** it is connected downstream of a taping machine (102). 50

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FIG.1



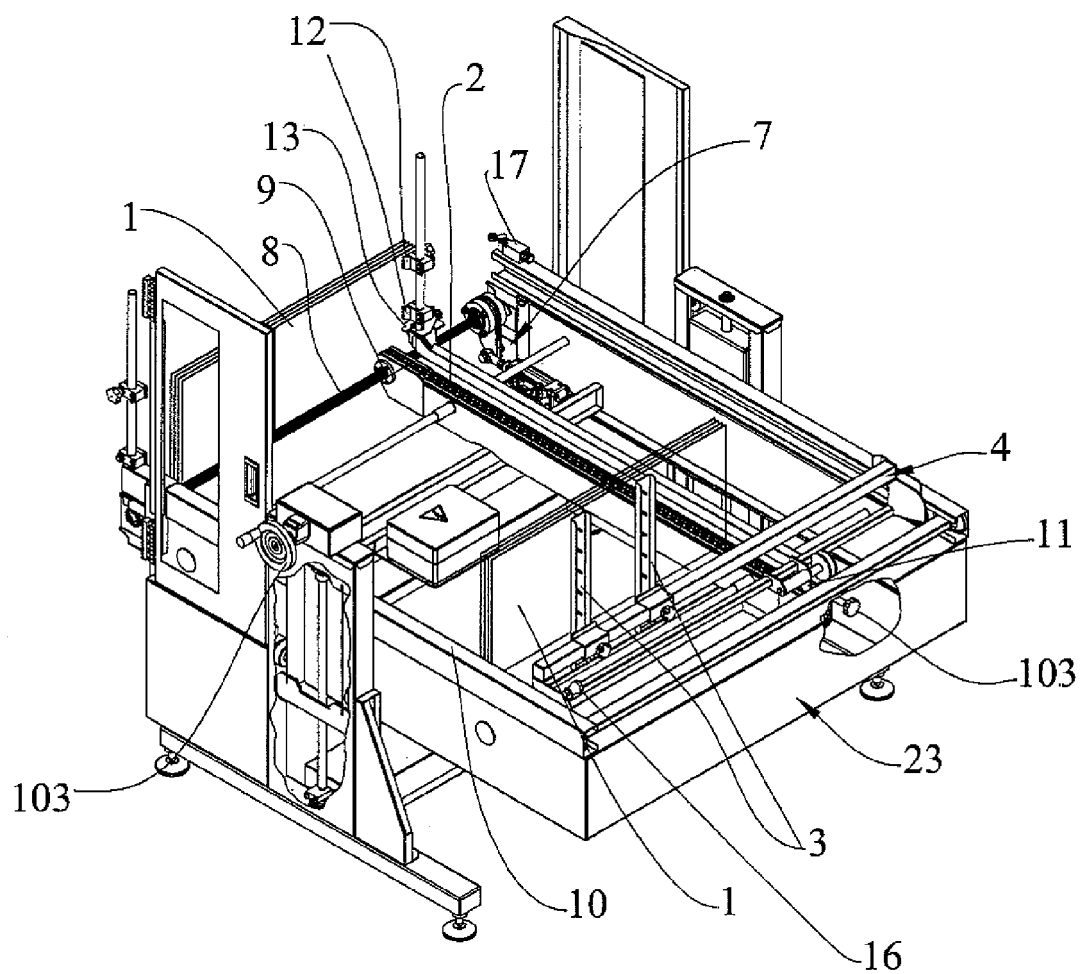


FIG.2

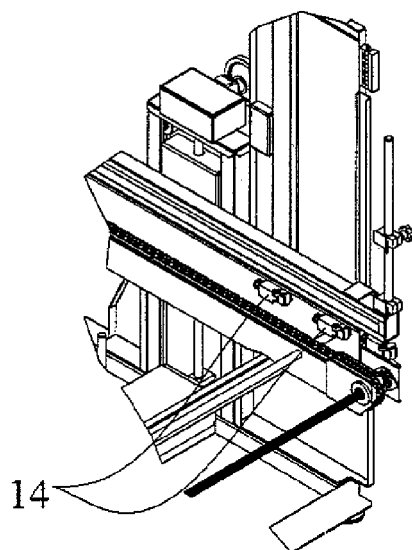


FIG.3

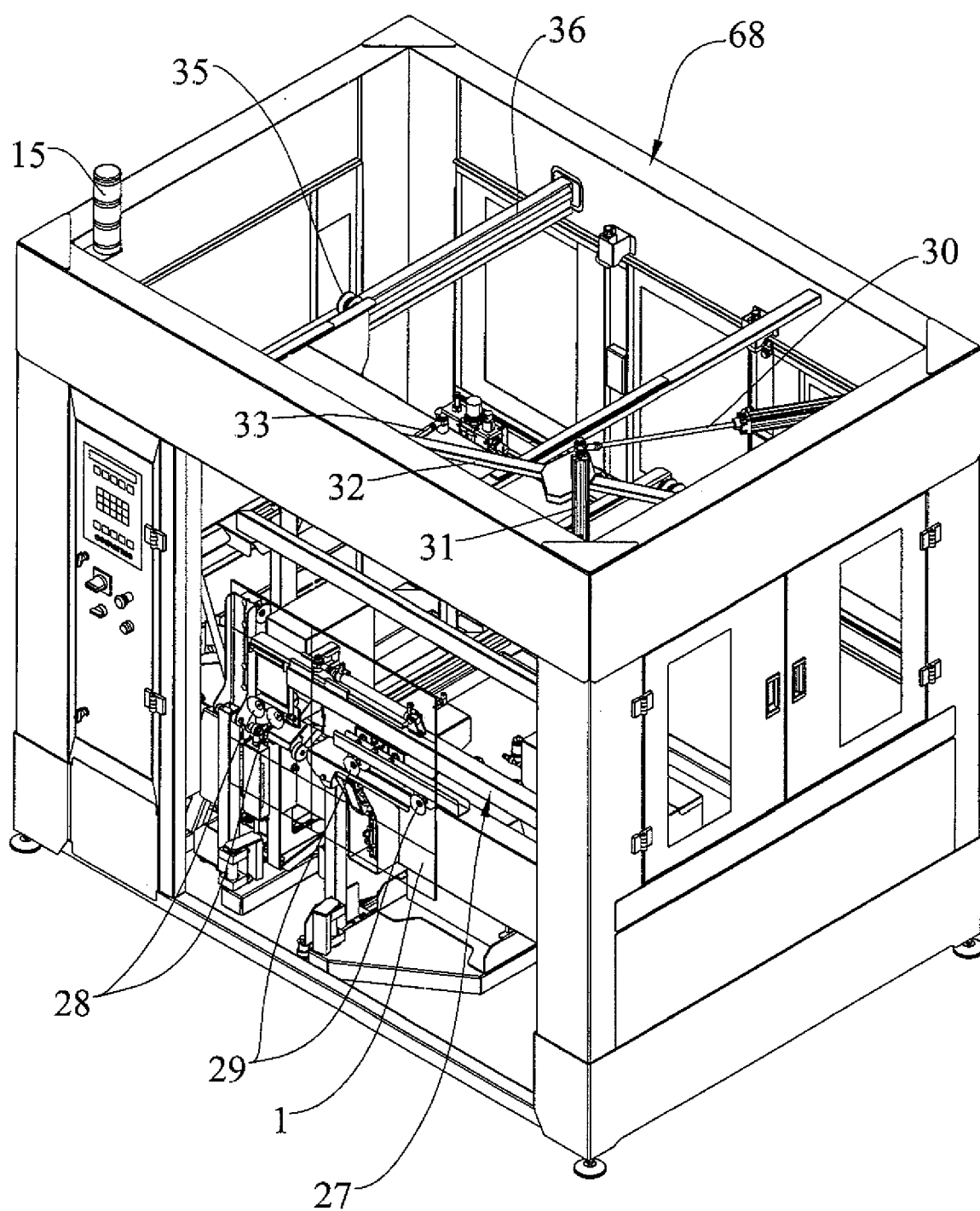


FIG.4

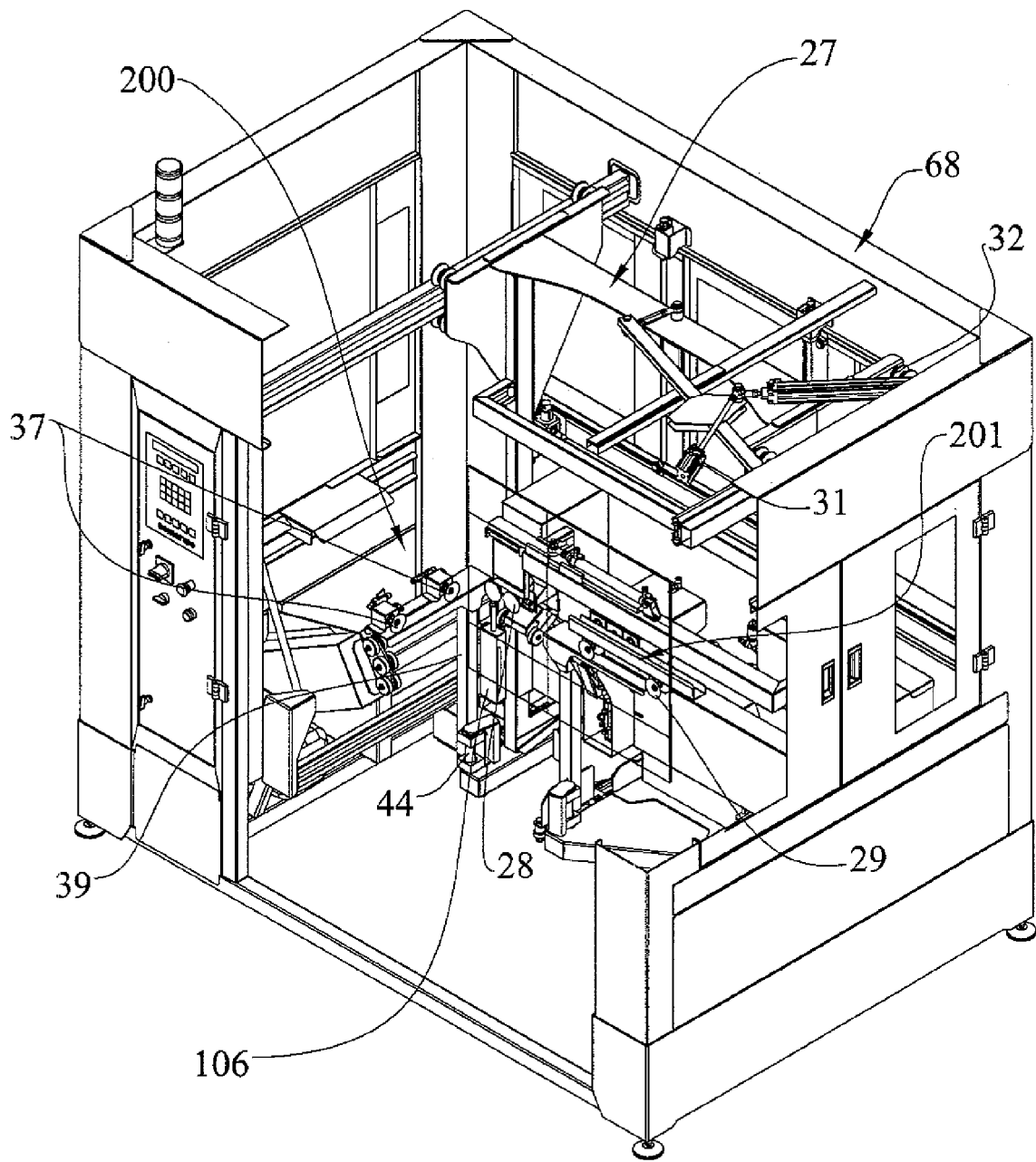


FIG.5

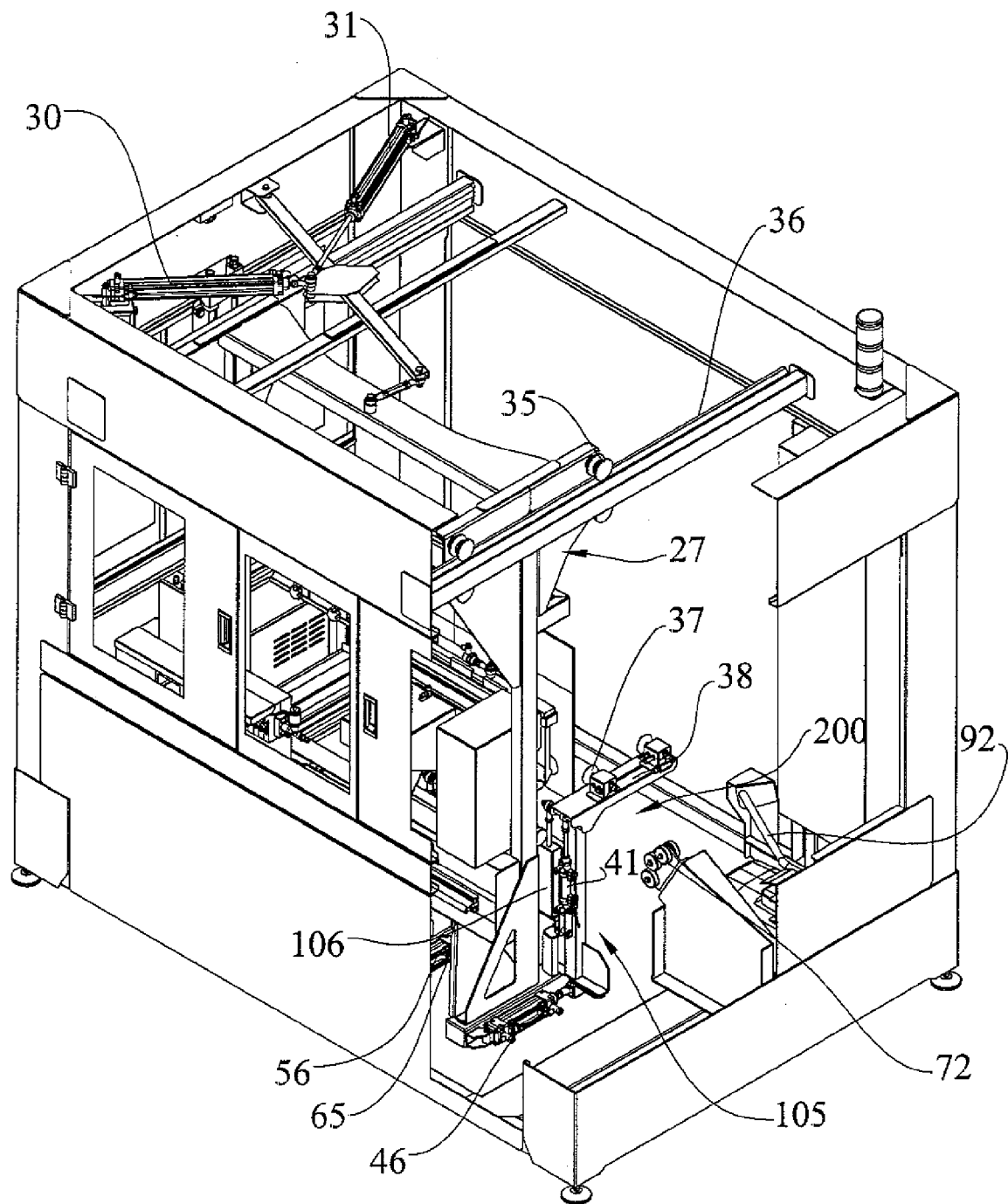


FIG.6

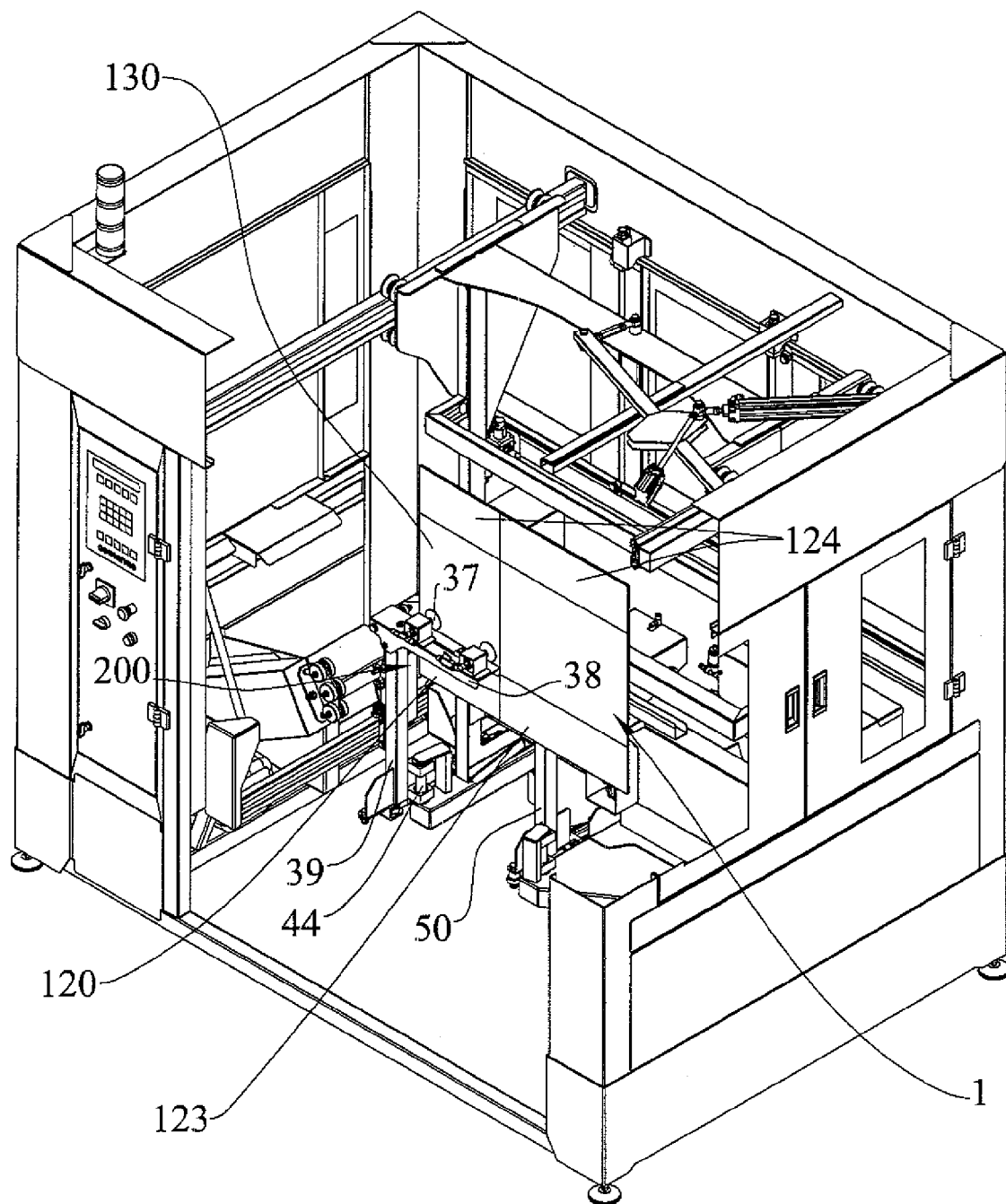


FIG.7

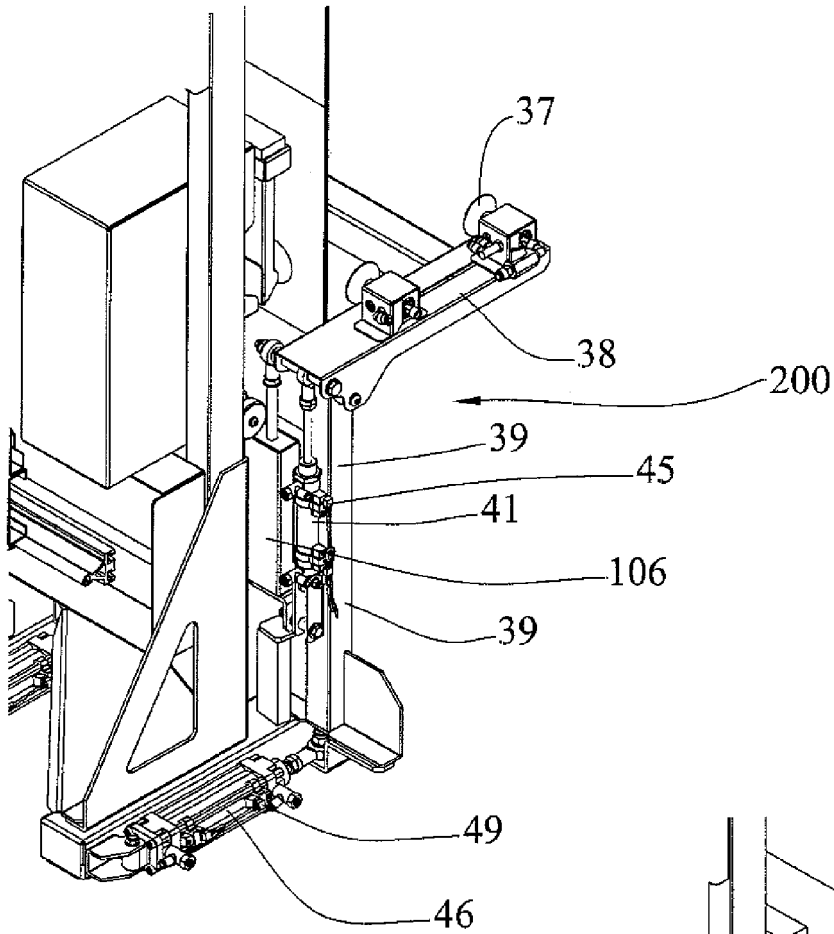
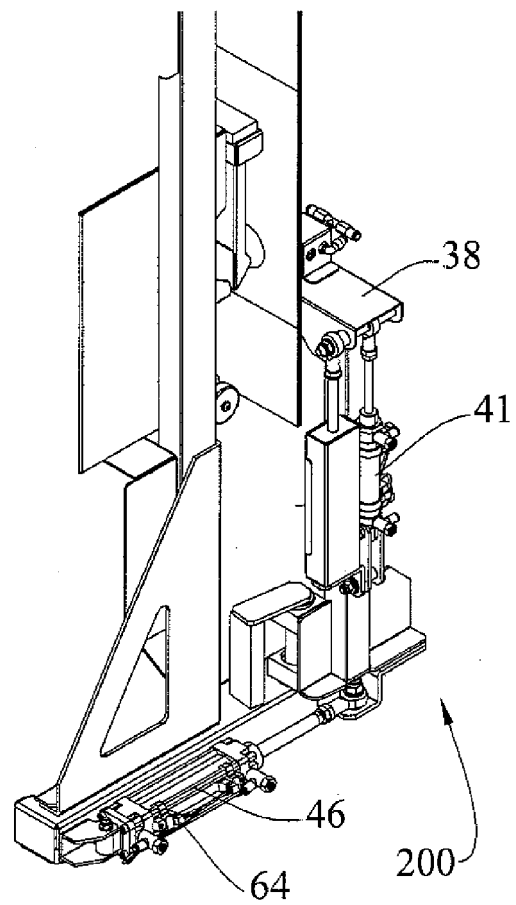


FIG. 8

FIG. 9



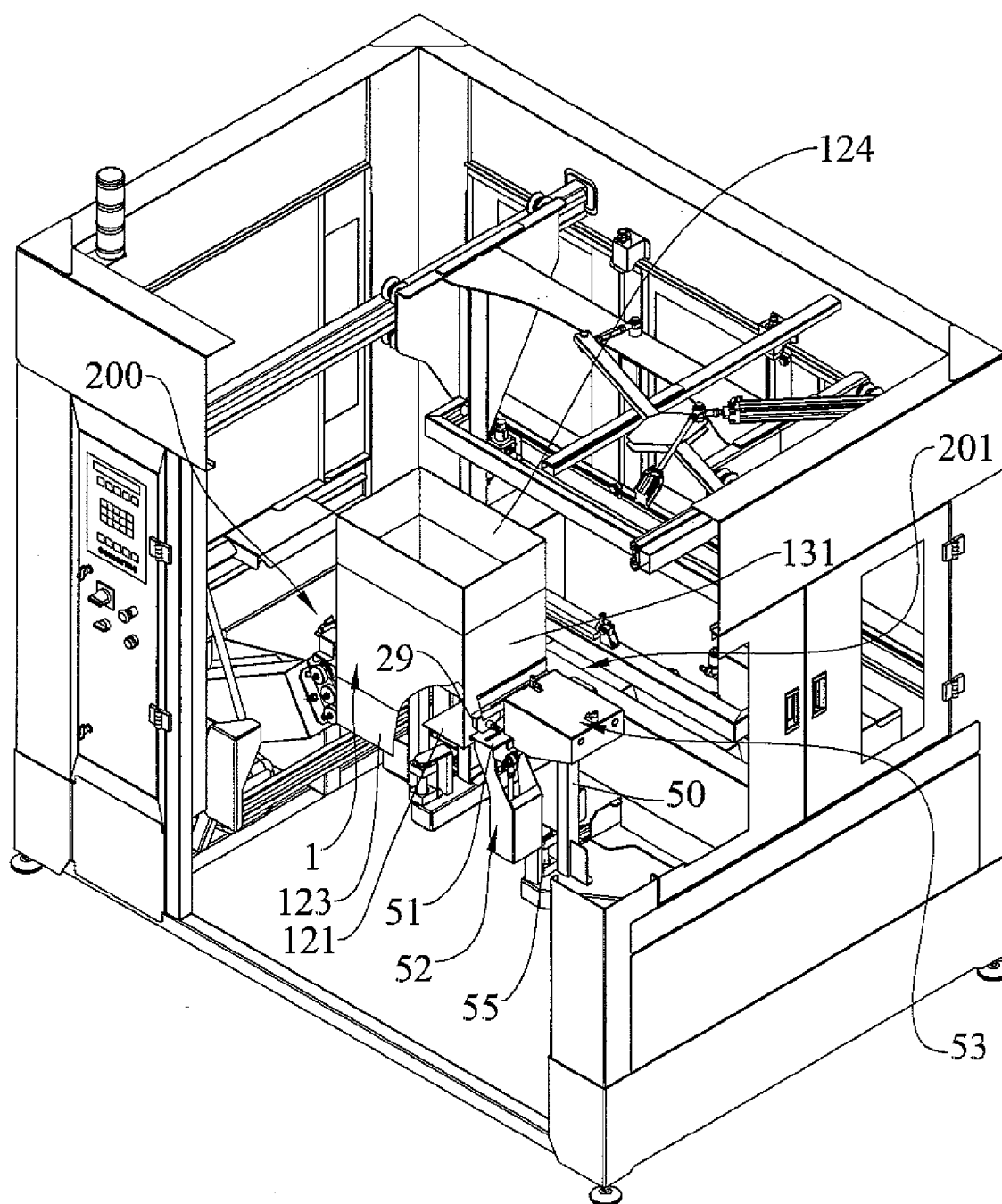


FIG.10

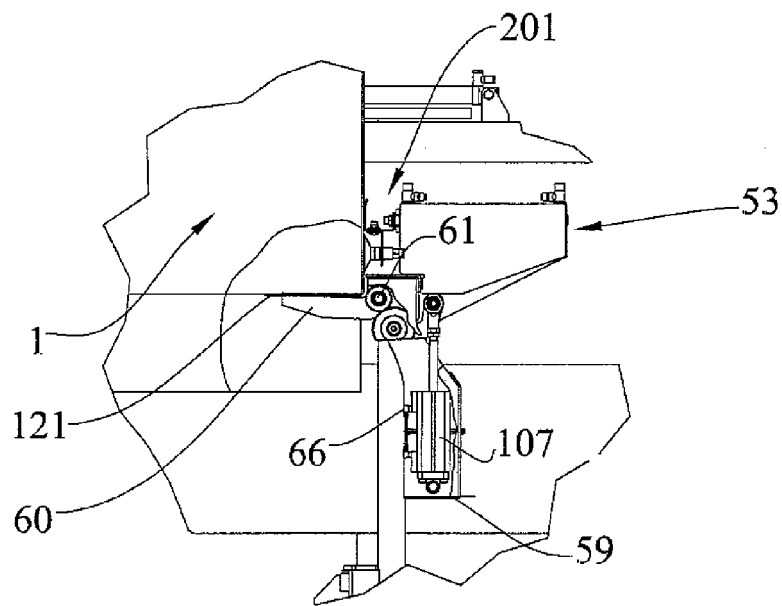


FIG.11

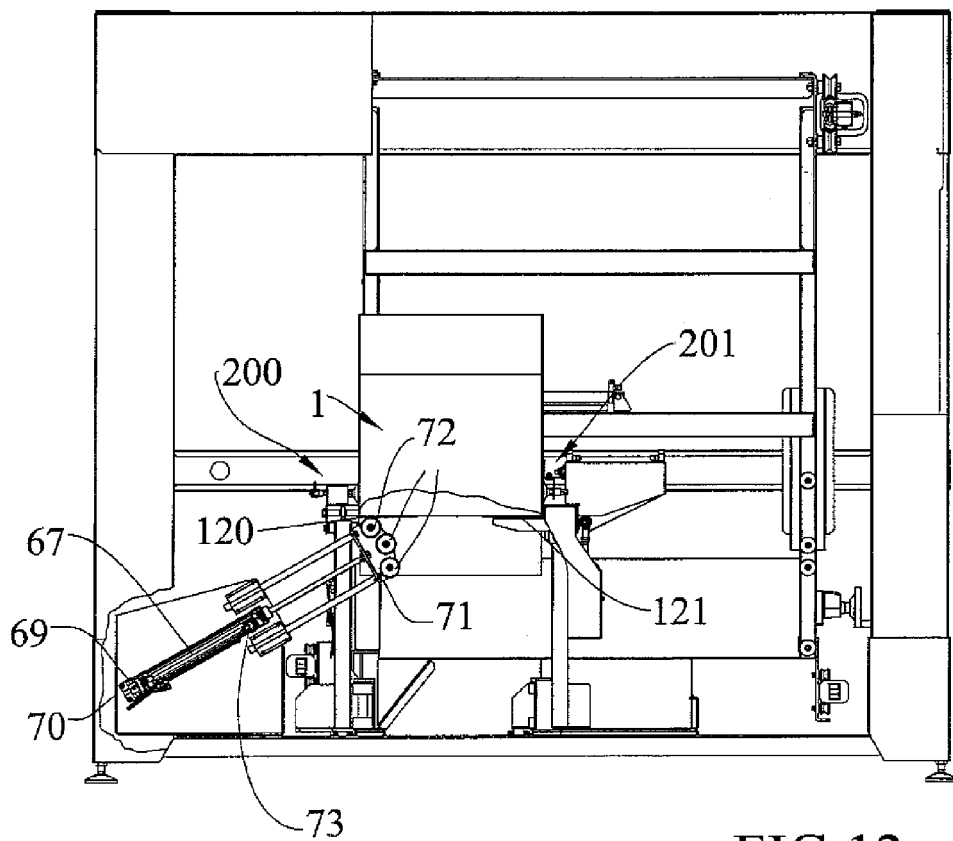


FIG.12

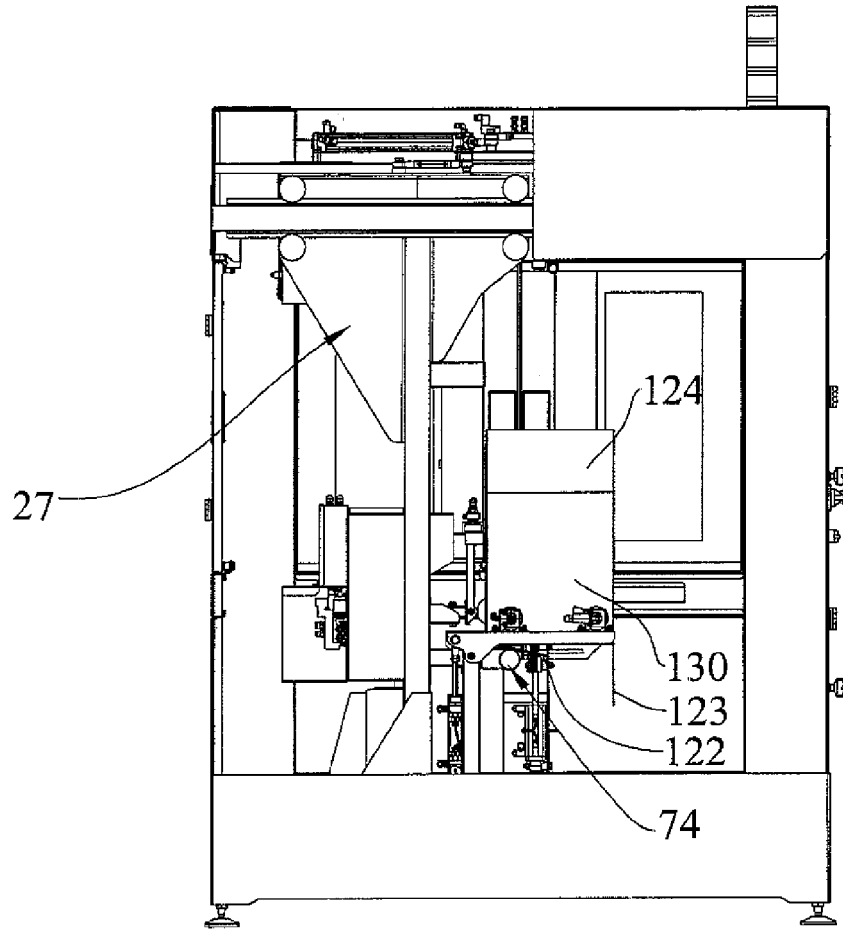


FIG. 13

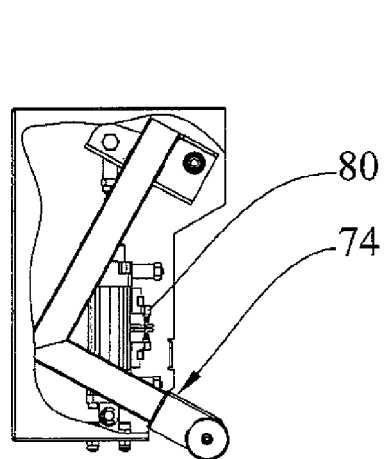


FIG. 14

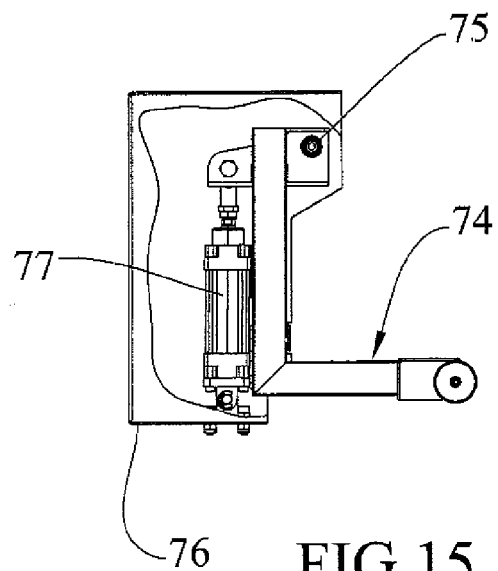


FIG. 15

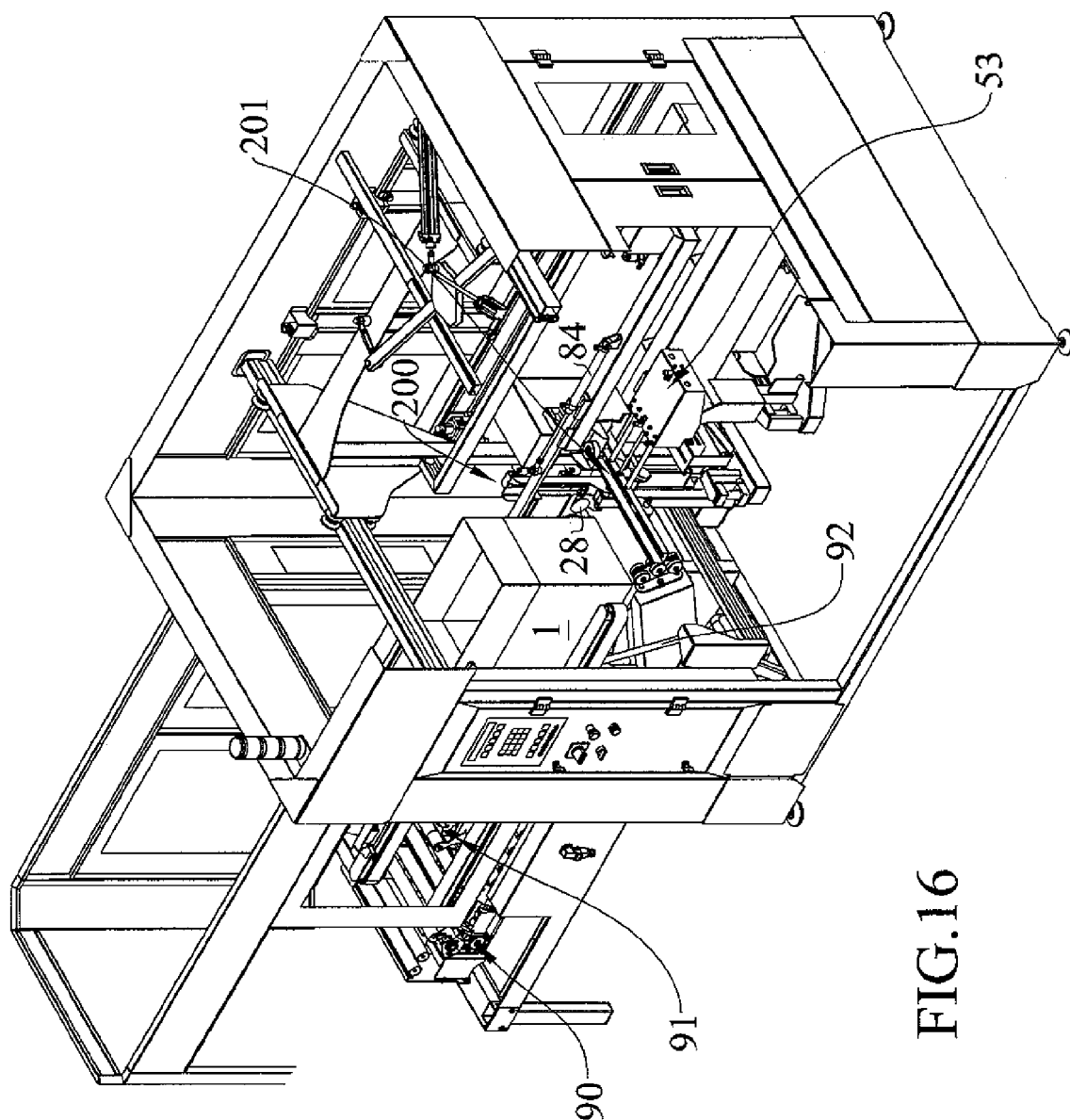


FIG.16

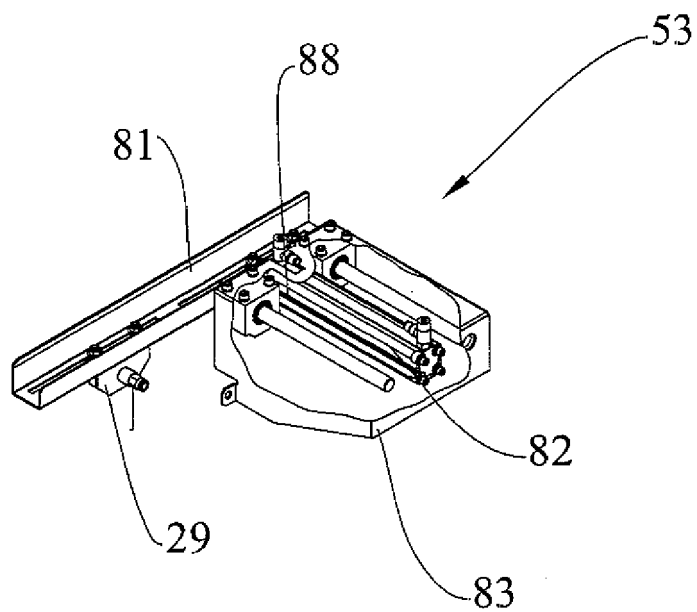


FIG.17

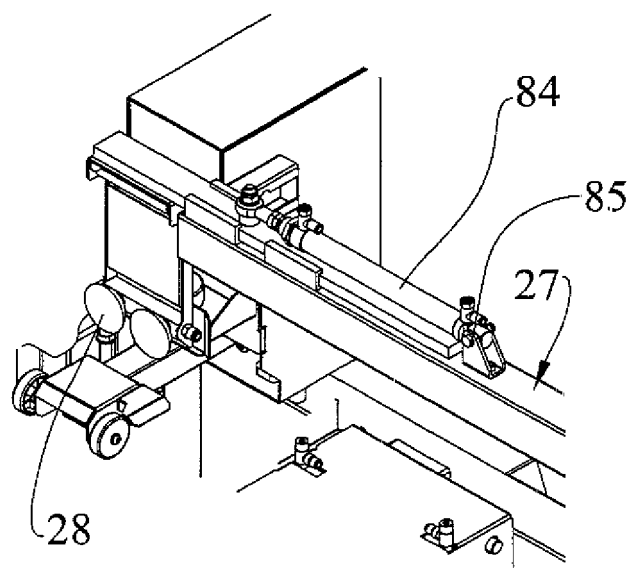


FIG.18

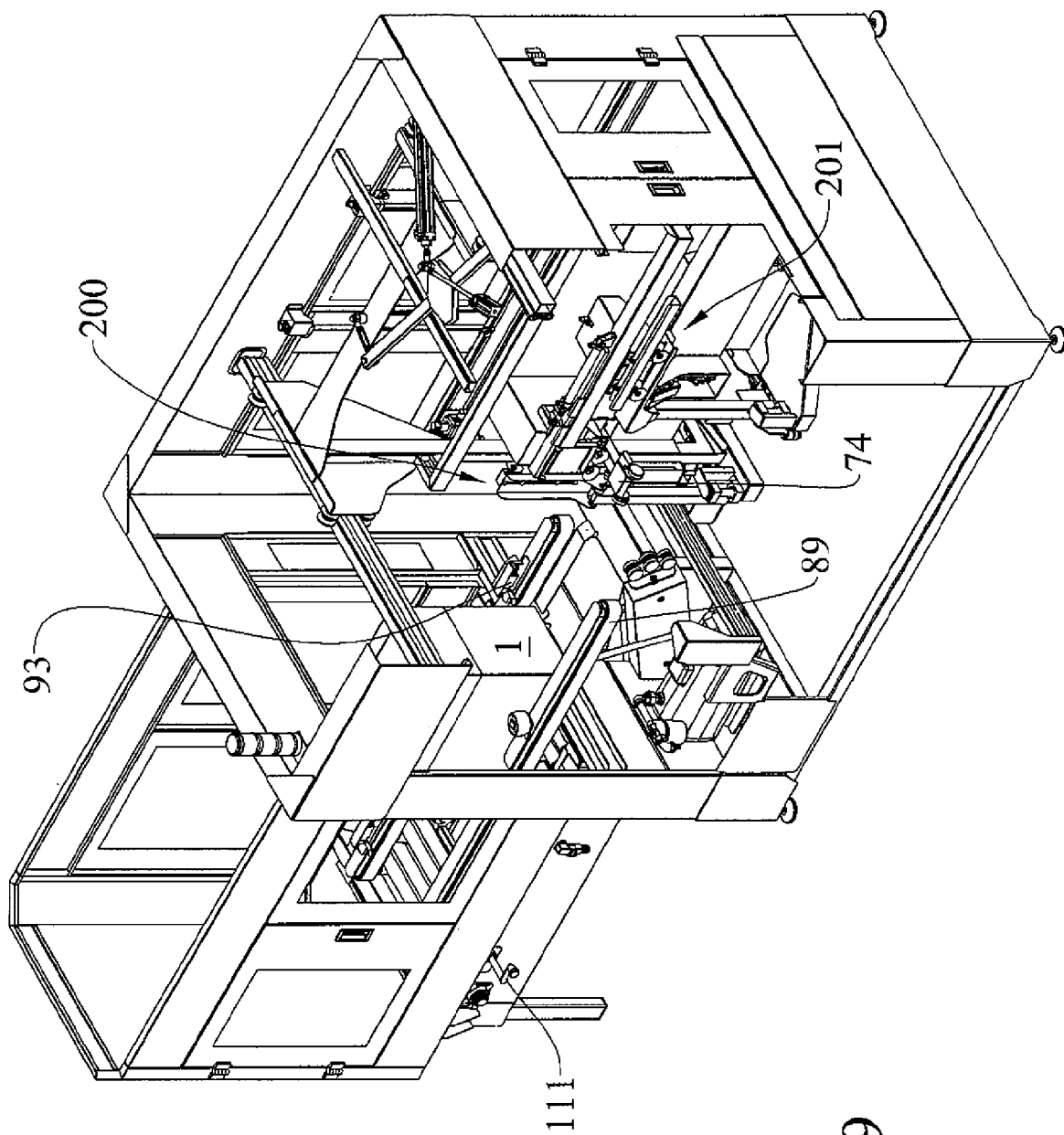
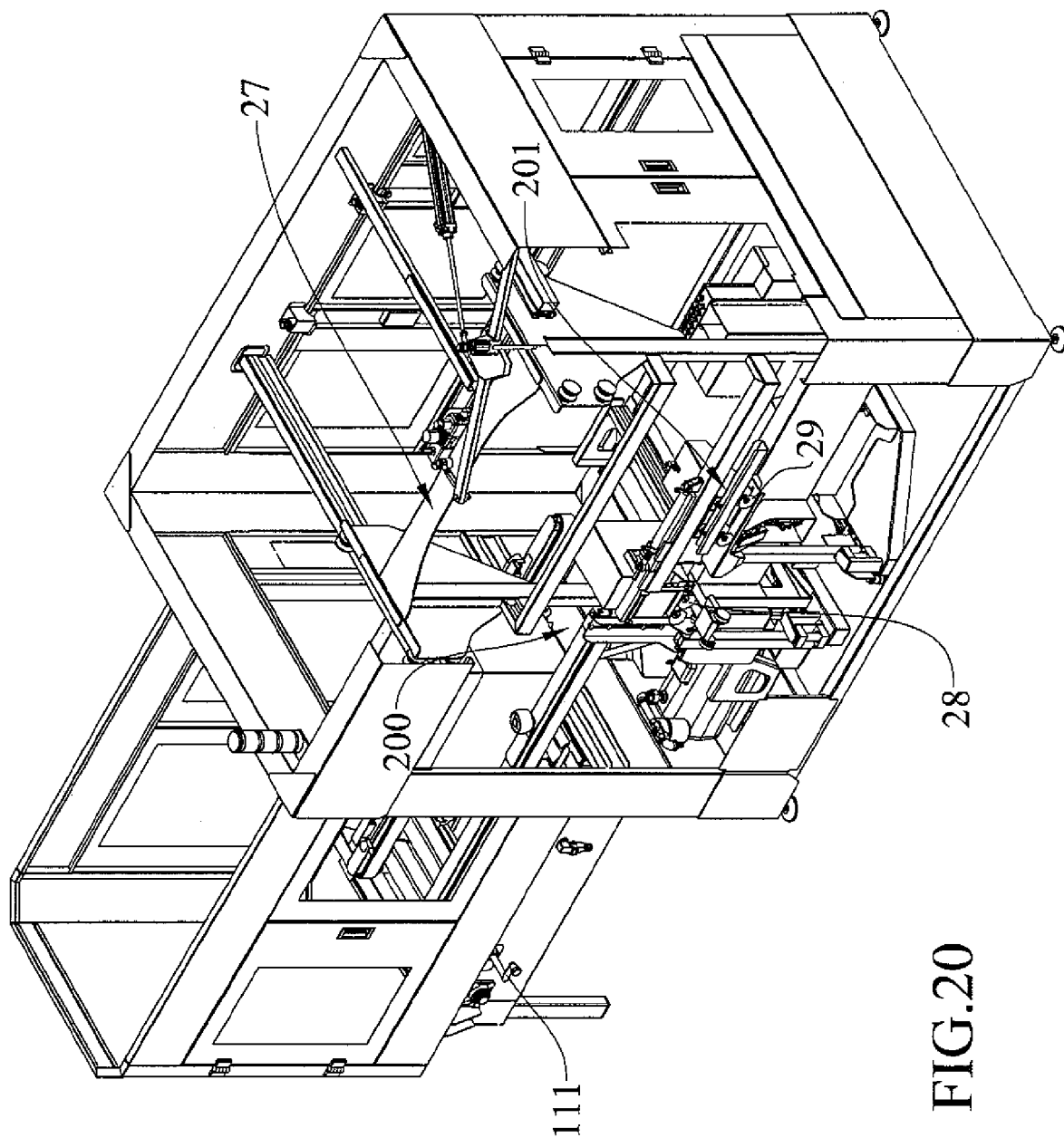


FIG.19





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 07 10 2172

DOCUMENTS CONSIDERED TO BE RELEVANT			
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 24 May 2007	Examiner Johne, Olaf
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 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 07 10 2172

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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