

(19)



(11)

EP 3 909 869 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

17.11.2021 Bulletin 2021/46

(51) Int Cl.:

B65B 5/02 (2006.01)

B31B 50/00 (2017.01)

B65B 7/20 (2006.01)

B65B 7/28 (2006.01)

B65B 35/58 (2006.01)

B65G 47/252 (2006.01)

(21) Application number: **21173199.7**

(22) Date of filing: **11.05.2021**

(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**

Designated Extension States:

BA ME

Designated Validation States:

KH MA MD TN

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(30) Priority: **12.05.2020 IT 202000010645**

(54) MACHINE FOR CLOSING AND OVERTURNING BOXES MADE OF CARDBOARD

(57) A machine (1) is described, for closing boxes (2) made of cardboard, comprising a warehouse (3) of lids (4) in the form of a cutting die, a conveyor (7) for the horizontal translation of already formed boxes (2), and a

device (5) for forming and laying the lid (4). Said machine (1) further comprises an overturning device (6) of boxes (2) closed with the lid (4) so that the lid (4) becomes the base of the box (2) on the conveyor (7).

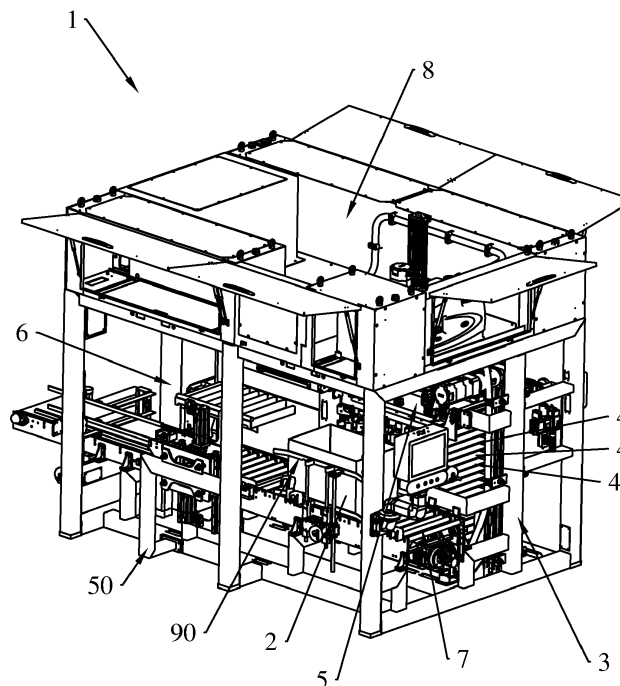


FIG.1

EP 3 909 869 A1

Description

[0001] The present invention relates to a machine for closing and overturning boxes made of cardboard.

[0002] The need is felt in the pasta packaging and boxing sector to completely automate the processes, from the making of the pasta to the boxing, limiting the operator's intervention if not eliminating it altogether.

[0003] More particularly, the case in which the box is closed by a lid, made separately with respect to the box, is addressed.

[0004] WO-2019/0817773 describes a machine having means for forming and laying a lid on a formed box, means for applying glue and means for rotating the box by 180° about a vertical axis to align the lid with the box when the coupling occurs.

[0005] US-6962271 describes a device for overturning a container by 180° about a horizontal axis so that the head becomes the base and vice versa.

[0006] Said device is suitable for overturning a container after it has been emptied so that it is ready to be returned for a new filling.

[0007] Said device is described for an isolated use and operates on a closed container without a lid and which may be positioned by means of two pallets, above and below.

[0008] It is the object of the present invention to provide a machine for closing and overturning boxes made of cardboard about a horizontal axis so that the lid becomes the base of the box.

[0009] It is a further object of the present invention that the lid is able to directly become a tray for offering the contents in an exhibition place.

[0010] It is a still further object of the present invention that the machine operates on boxes containing pasta packages.

[0011] According to the invention, said and further objects are achieved by means of a machine for closing boxes made of cardboard, comprising a warehouse of lids in the form of a cutting die, a conveyor for the horizontal translation of already formed boxes, and a device for forming and laying the lid, characterized in that it further comprises an overturning device of boxes closed with the lid so that the lid becomes the base of the box on the conveyor.

[0012] Advantageously, the overturning of the box occurs with a continuous movement.

[0013] In output from the machine, the box is closed with the lid acting as a base.

[0014] Advantageously, the closed and overturned box may subsequently be positioned on a shelf and its contents made directly available by simply removing the body of the box which, during the step of filling, constituted the base and the containing element of the inserted products.

[0015] These and other features of the present invention will become more apparent from the following detailed description of a practical exemplary embodiment

thereof, shown by way of non-limiting example in the accompanying drawings, in which:

Figure 1 shows a first perspective view of a machine according to the present invention;

Figure 2 shows a second perspective view of the machine;

Figure 3 shows a perspective view of a device for forming and laying a lid;

Figure 4 shows a top plan view of the device;

Figure 5 shows a side view of the device;

Figure 6 shows a front view of the device;

Figure 7 shows a front perspective view of an overturning device of a box closed by the lid;

Figure 8 shows a rear perspective view of the overturning device;

Figure 9 shows a front view of the overturning device;

Figure 10 shows a sectional view according to line X-X in Figure 9;

Figure 11 shows a front view of the overturning device in a first position;

Figure 12 shows a front view of the overturning device in a second position;

Figure 13 shows a front view of the overturning device in a third position;

Figure 14 shows a front view of a portion of the device for forming and laying, in a first position;

Figure 15 shows a front view of said portion in a second position;

Figure 16 shows a front view of said portion in a third position;

Figure 17 shows a front view of said portion in a fourth position;

Figure 18 shows a front view of said portion in a fifth position;

Figure 19 shows a front view of said portion in a sixth position.

[0016] A machine 1 for closing and overturning boxes 2 made of cardboard comprises a warehouse 3 of lids 4 in the form of a cutting die (i.e., flat), a device 5 for forming and laying the lid 4, and an overturning device 6 of boxes 2 closed with the lid 4 (Figures 1 and 2).

[0017] The machine 1 further comprises a roller conveyor 7 for horizontally translating already formed boxes 2, and upper casings 8 for housing the wiring.

[0018] The lids 4 in the form of a cutting die are stacked in the warehouse 3.

[0019] The device 5 for forming and laying the lid 4 (Figures 3-6) is able to remove one lid 4 at a time from the warehouse 3, take it over a box 2 open on top, form the lid 4 after laying it over the box 2 so as to close it completely.

[0020] The lid 4 is thus formed after resting it on the box 2 by exploiting the contrast of the latter as will be clarified in greater detail below.

[0021] The machine 1 further comprises gluing means able to dose glue dots onto the lid 4 before its formation

over the box 2 so that after the formation of the lid 4, the lid 4 is blocked onto the box 2 for a final closure.

[0022] The warehouse 3 is of a vertical type and comprises (Figure 2) a first zone 301, in which the operator inserts stacks of lids 4 in the form of a cutting die referring to the side and rear walls, and a second zone 302, in which the lids 4 in the form of a cutting die are lifted and removed by the device 5 one at a time. A roller conveyor allows the lids 4 to slide from the first zone 301 to the second zone 302 at a speed controlled by photocells. The second zone 302 comprises an elevator 303 able to take the lid 4 into the removing position, a pneumatic size equalizer 304, and a horizontal bar retractable support 305 to guarantee a minimum plenum of lids 4 in the form of a cutting die in the steps of reloading of the warehouse 3 itself.

[0023] Advantageously, the elevator 303 of the warehouse 3 allows to have the lid 4 to be grasped as high as possible, i.e., just below the device 5 so as to optimize the work.

[0024] The device 5 comprises an attachment plate 9 to a two-axis manipulator, and a supporting frame 10 integral with the plate 9.

[0025] The supporting frame 10 comprises two side bars 11, 12, and a central bar 13 comprised between said side bars 11, 12. Said bars 11-13 are parallel and support a plate 14 fixed to ends of said bars 11-13 (Figure 4). The plate 14 is orthogonal to the bars 11-13 and comprises a guide 15 along which two runners 16 are able to slide (Figure 6).

[0026] Each runner 16 supports a group 17 able to take the lid 4 and to fold flaps 41 of the lid 4 for forming it on the box 2.

[0027] The side bar 12 and the central bar 13 rotatably support a rotating bar 18 orthogonal to said bars 12, 13 (Figures 3, 4). A first wheel 19 is keyed to said rotating bar 18 and is able to rotate a second wheel 20 keyed to a first screw 21 orthogonal to said rotating bar 18.

[0028] The first screw 21 is rotatably supported by a movable frame 22 comprising two guides 23 parallel to the bars 11-13. Two runners 24 integral with the lower part of the plate 9 slide along each guide 23. The first screw 21 is associated with a plate 25 parallel to the plate 14 by means of a nut 211 integral with the plate 25 (Figures 3, 4, and 5). The plate 25 supports a guide 26 along which two runners 27 slide, each runner 27 being fixed to a respective group 17.

[0029] As apparent by observing Figure 4, the device 5 thus comprises four groups 17 able to take the lid 4 and to fold flaps 41 of the lid 4.

[0030] The movable frame 22 supports said guides 23 on the top and two guides 28 (Figure 3), orthogonal to said guides 23, on the bottom. A pair of runners 29, with which a respective bar 30, orthogonal to said guides 28, is integral, slides along each of said guides 28 (Figures 4 and 6). Each bar 30 supports a guide 31 along which runners 32, which support respective groups 17, slide.

[0031] Each group 17 is thus able to slide along a first

guide 31 and a second guide 15, 26.

[0032] The plate 25 translates with respect to the plate 14 but it does not rotate with respect to the bars 30 by virtue of the constraint with the bars 30 made by means of two groups 17.

[0033] A second screw 32 (Figure 4), parallel to the rotating bar 18, is rotatably supported by the bars 30. In particular, one of the two bars 30 comprises a nut 322 which allows the mutual approach/removal of the bars 30, thereby determining the approach/removal of the groups 17 associated with each bar 30.

[0034] The rotating bar 18 and the second screw 32 are controlled in rotation by respective wheels 181, 321.

[0035] Advantageously, the device 5 thus comprises means able to vary the mutual position of the groups 17, such as the rotating bar 18, the first screw 21 and the second screw 32.

[0036] Each group 17 (Figures 3-6) comprises a body 33 able to be fixed to pairs of runners 16, 27, 32, and which provides two arms 34 at the ends of which two pneumatic cylinders, able to control two pistons 35, 36, are rotatably associated. Each group 17 further comprises two plates 37, the ends of which are rotatably fixed to the respective arm 34 and to one free end of the respective piston 35, 36.

[0037] The body 33 further comprises a through hole, inside which a cylinder 38 which supports a suction cup 78, vertically slides. Air may be aspirated through the cylinder 38, with appropriate pneumatic commands, to create a vacuum so as to keep the suction cup 78 gripping the lid 4. The plates 37 support runners 39 able to fold flaps 41 of the lid 4.

[0038] The movable frame 22 comprises two through holes through which respective cylinders 92 (Figures 4 and 5), which support a plate 91 able to press the lid 4, are able to slide vertically.

[0039] In addition to the four groups 17, the device 5 further comprises two further groups 42 able to fold flaps of the lid 4. Similarly to the groups 17, each group 42 provides a body 43 fixed to the respective bar 30, between two groups 17 associated with the same bar 30. The body 43 comprises an arm 44 at the end of which a piston 45 is rotatably fixed. A plate 46 is rotatably fixed at its ends to the body 43 and to the end of the piston 45, and supports a runner 47 able to fold flaps of the lid 4.

[0040] The groups 17 thus comprise both means for gripping the lid 4 in the form of a cutting die, such as the suction cups 78, as well as means for forming the lid 4 on the box 2, such as the plates 37, the runners 39, and the pistons 35, 36. On the other hand, the groups 42 comprise only means for forming the lid 4 on the box 2, such as the plates 46, the runners 47 and the pistons 45.

[0041] The overturning device 6 of boxes 2 (Figures 7-10) already closed with the lid 4 by means of the device 5, comprises a fixed frame 50 to which it is integral a pneumatic cylinder 51 which is able to control the vertical movement of a stem 511.

[0042] A first plate 81 moves integrally with the stem

511 and rotatably supports two gear wheels 52, 53 connected by means of a belt 54, a first motor 55 and a second motor 56. The first motor 55 is able to control the first gear wheel 52, while the second motor 56 is able to control the rotation of a shaft 57 on which a wheel 58 is keyed.

[0043] A second plate 59, preferably H-shaped, is integral with the second gear wheel 53. The shaft 57 is in axis with the second gear wheel 53 and supports the wheel 58 at its end so that the wheel 58 is positioned beyond the second plate 59. The wheel 58 is thus rotatable with respect to the second plate 59, and comprises two arms 60 at the ends of which cranks 61 are rotatably mounted at their first ends.

[0044] The second ends of the cranks 61 are rotatably fixed to respective combs 62 at respective edges 63. Each comb 62 comprises prongs 64 able to grasp the box 2, and is slidably associated with the second plate 59 by means of runners 65 sliding along guides 70.

[0045] The rotation of the wheel 58 thus determines the approach or removal of the combs 62, with respect to one another. Differently, the actuation of the gear wheels 52, 53 determines the rotation of the second plate 59 and therefore of the combs 62. On the other hand, the cylinder 51 determines the vertical movement of the second plate 59 and therefore of both combs 62.

[0046] The device 6 thus comprises means for raising/lowering the combs 62 in an integral manner, including the cylinder 51 and the stem 511, means for rotating the combs 62 in an integral manner, including the gear wheels 52, 53, the first motor 55 and the belt 54, and means for approaching/removing the combs 62 with respect to one another, including the wheel 58, the second motor 56, the cranks 61, the guides 70, the shaft 57.

[0047] Operationally, the conveyor 7 moves the box 2, which is already formed and open at the top, to a closing station of the box 2, in which blocking means 90 hold the box 2 stationary (Figure 1).

[0048] The device 5, configured for a given size of lid 4 and moved by the two-axis manipulator, takes a lid 4 in the form of a cutting die from the warehouse 3. The lid 4 in the form of a flat cutting die lies horizontally so that the suction cups 78 grip the lid 4 by virtue of suction means which create the vacuum.

[0049] After taking the lid 4, the manipulator translates the device 5 from the warehouse 3 until it is arranged over the box 2. During said movement, the device 5 transits near gluing means comprising guns able to apply glue dots on flaps 41 of the lid 4 for blocking it on the box 2 at the end of the forming of the lid 4.

[0050] Once the lid 4 in the form of a cutting die is positioned on the vertical of the carton 2, the device 5 is lowered by the manipulator until the lid 4, still in the form of a cutting die, rests on the box 2, more precisely on the top edge which defines the perimeter of the opening of the box 2.

[0051] Advantageously, the box 2 acts as a contrast for the forming operations of the lid 4.

[0052] Look at the Figures 14-19 in which the steps of forming the lid 4 are represented starting from the flat shape of the cutting die, at a single group 17.

[0053] The manipulator lowers the plate 9 and the four groups 17 integrally therewith. The suction cups 18 do not move due to the contrast applied by the box 2 and the presence of the through hole in the bodies 33 of the groups 17; in practice, the bodies 33 move downwards sliding on the cylinders 38 which substantially act as guides for the bodies 33.

[0054] Observing a single group 17, the body 33 moves down integrally dragging the runner 39 which at a given point (Figure 15) touches and starts folding a flap 41; in Figure 16, the runner 39 integral with the piston 36 has folded said flap 41 further; in Figure 17 the runner 39 integral with the piston 36 continues the folding of said flap 41, while a different runner 39 integral with the piston 35 has started to fold a different flap 41; in Figure 18, the folding of the two flaps 41 continues until, almost in a final position, the body 33 is blocked and the pistons 35, 36 are actuated so as to give a final pressure to the flaps 41 which guarantees the gripping of the glue on the box 2, reaching the final configuration of the group 17 in Figure 19.

[0055] What described with reference to Figures 14-19 for a single group 17 is repeated simultaneously for the other groups 17. Similarly, the groups 42 cooperate in the folding of the flaps 41 and the gripping of the glue by means of the pistons 45.

[0056] The plate 91 helps to keep the central part of the lid 4 horizontal, the action of the groups 17 tending to make said central part bulge.

[0057] Advantageously, the lid 4 is formed and laid gripping the box 2, which is thus definitively closed.

[0058] The conveyor 7 moves the closed box 2 towards an overturning station on which the device 6 is situated. As already mentioned, the conveyor 7 is a roller conveyor, i.e., it is provided with a series of horizontal rollers spaced apart from one another so as to allow the prongs 64 of the comb 62 to descend (each between two rollers) below the sliding level of the box 2: when the box 2 is over said prongs 64, the device 6 is started. The conveyor 7 is provided with a side frame with notches so that the prongs 64 may go below the level of the rollers of the conveyor 7.

[0059] Observing Figure 7, it may be noticed that each comb 62 has the two end prongs 64 offset with respect to the central prongs 64. In particular, the distance between the two combs 62 at the end prongs 64 is smaller with respect to the zone of the central prongs 64: during the gripping, the box 2 thus always tends to position itself in the central zone without any risk of falling during the overturning.

[0060] The second motor 56 actuates the wheel 58 which approaches the combs 62 so as to lift the box 2, clamping it between the combs 62 themselves (Figure 11); then, the pneumatic cylinder 51 actuates the stem 511 by lifting the second plate 59 and thus both combs

62 gripping the box 2 (Figure 12); once an adequate height has been reached, the first motor 55 actuates the belt 54 by rotating the box 2 integral with the second plate 59 by 180° about a horizontal axis (Figure 13).

[0061] The repositioning of the overturned box 2 on the conveyor 7 occurs first by actuating in the opposite direction the pneumatic cylinder 51 which retracts the stem 511 lowering the box 2 until it rests again on the conveyor 7, then by operating the second motor 56 which rotates the wheel 58 in the opposite direction, moving away the combs 62 which leave the overturned box 2 free to continue its sliding along the conveyor 7 up to an exit zone of the machine 1.

[0062] Advantageously, the overturning of the box 2 occurs with a continuous movement.

[0063] Upon exiting the machine 1, the box 2 is closed with the lid acting as a base.

[0064] Advantageously, the closed and overturned box 2 may subsequently be positioned on a shelf and its contents made directly available by simply removing the body of the box 2 which, during the step of filling, constituted the base and the containing element of the inserted products.

[0065] The machine 1 adapts to different sizes of boxes 2; the device 5 is suitable for working with different sizes of lids 4 compatible with the different sizes of boxes 2.

[0066] The size of the device 5 is changed by actuating the wheels 181, 321.

[0067] Observing in particular Figure 4, it is apparent that the actuation of the wheel 181 rotates the rotating bar 18 which, by means of the coupling of the wheels 18, 19, rotates the first screw 21, which may only rotate with respect to the plate 9; consequently, the nut 211 allows the translation of the plate 25 towards the plate 14 thus approaching the groups 17 associated with the plate 25 and the plate 14. The groups 17 associated with the plate 25 slide along the guides 31 of the bars 30.

[0068] On the other hand, the actuation of the wheel 321 rotates the second screw 32 which, engaged with the nut 322, moves one of the two bars 30 towards the other bar 30, thus approaching the groups 17, 42 associated with the bars 30. In particular, the groups 17 associated with the plate 14 slide along the guide 15, while the groups 17 associated with the plate 25 slide along the guide 26.

[0069] Advantageously, it is possible to adapt the position of the groups 17 according to the size of the lid 4 still flat in the form of a cutting die simply by actuating two wheels 181, 321.

Claims

1. Machine (1) for closing boxes (2) made of cardboard, comprising a warehouse (3) of lids (4) in the form of a cutting die, a conveyor (7) for the horizontal translation of already formed boxes (2), and a device (5) for forming and laying the lid (4), **characterized in**

that it further comprises a overturning device (6) of boxes (2) closed with the lid (4) so that the lid (4) becomes the base of the box (2) on the conveyor (7).

2. Machine (1) according to claim 1, **characterized in that** the overturning device (6) comprises a fixed frame (50), two combs (62) able to take the box (2), approaching/removing means of the combs (62) with respect to each other, raising/lowering means of the combs (62) and rotation means of the combs (62), the raising/lowering means and the rotating means moving the combs (62) integral with each other.

3. Machine (1) according to claim 2, **characterized in that** the approaching/removing means of the combs (62) comprise a wheel (58) which is provided with two arms (60) at the ends of which cranks (61) are rotatably mounted at their first ends, the second ends of the cranks (61) being rotatably fixed to respective combs (62) slidably associated with a movable plate (59) of the overturning device (6) by means of runners (65) sliding along guides (70), wherein the movable plate (59) is rotatable.

4. Machine (1) according to claim 3, **characterized in that** the rotation means comprise two gear wheels (52, 53) connected by a belt (54), wherein a first motor (55) is able to control the first gear wheel (52) to which said movable plate (59) is integral, while a second motor (56) is able to control the rotation of the wheel (58) independently of the rotation of said movable plate (59).

5. Machine (1) according to claim 4, **characterized in that** the overturning device (6) comprises a first movable plate (81) which rotatably supports the two gear wheels (52, 53), the first motor (55) and a second motor (56), a second movable plate (59) integral with the second gear wheel (53), a fixed frame (50) to which it is integral a pneumatic cylinder (51) able to control the vertical movement of a stem (511) to which the first plate (81) is integral, the rotation of the wheel (58) determining the approach/removal of the combs (62) with respect to each other, the actuation of the gear wheels (52, 53) determining the rotation of the second plate (59) and therefore of the combs (62), the cylinder (51) determining the vertical movement of the second plate (59) and therefore of both combs (62).

6. Machine (1) according to any one of claims 2-5, **characterized in that** each comb (62) comprises two end prongs (64) and central prongs (64) between said two end prongs (64), wherein the two end prongs (64) are offset with respect to the central prongs (64), the distance between the two combs (62) at the end prongs (64) being smaller than the distance at the

central prongs (64).

7. Machine (1) according to any one of the preceding claims, **characterized in that** the device (5) for forming and laying the lid (4) comprises removing means of one lid (4) at a time from the warehouse (3), forming groups (17) of the lid (4) by contrast with the box (2) so as to close it directly during the formation of the lid (4), and means able to vary the mutual position of the forming groups (17) according to the size of the lid (4).
8. Machine (1) according to claim 7, **characterized in that** each forming group (17) is able to slide along a first guide (31) and a second guide (15, 26) orthogonal to each other.
9. Machine (1) according to claim 8, **characterized in that** it comprises means (181, 321) able to selectively control the approaching or removing of guides (15, 26, 31) parallel to each other slidably supporting the forming groups (17).
10. Machine (1) according to claim 9, **characterized in that** the device (5) for forming and laying the lid (4) comprises a supporting frame (10) to which it is fixed a first plate (14) to which it is fixed a guide (15) along which two runners (16) are able to slide, each of which is integral with a forming group (17), the supporting frame (10) rotatably supports a rotating bar (18) parallel to said guide (15) and able to rotate a first screw (21) orthogonal to said rotating bar (18), the first screw (21) is rotatably supported by a movable frame (22) with respect to the supporting frame (10), and is associated with a second plate (25) parallel to the first plate (14) by means of a nut (211) integral with the plate (25) which allows the mutual approach/removal of the plates (14, 25), the second plate (25) supports a guide (26) along which two sliding runners (27) slide, to each of which a respective forming group (17) is fixed, the movable frame (22) supports two guides (28) parallel to the guides (15, 26) of the plates (14, 25), along each of said guides (28) slides a pair of runners (29) to which it is integral a respective bar (30) orthogonal to said guides (28), each bar (30) supports a guide (31) along which slide runners (32) which support respective forming groups (17), a second screw (32), parallel to the rotating bar (18), is rotatably supported by the bars (30), one of the two bars (30) comprising a nut (322) which allows the mutual approach/removal of the bars (30), wheels (181, 321) being able to selectively control the rotating bar (18) and the second screw (32).
11. Machine (1) according to claim 10, **characterized in that** the mobile frame (22) comprises at least one

through hole through which it is able to vertically slide a cylinder (40) which supports a plate (41) able to press the lid (4).

12. Machine (1) according to any one of claims 7-11, **characterized in that** each forming group (17) comprises a body (33) which provides arms (34) at the ends of which pneumatic cylinders able to control respective pistons (35, 36) are rotatably associated, plates (37) whose ends are rotatably fixed to the respective arm (34) and to one end of the respective piston (35, 36), a through hole inside which a cylinder (38) which supports a suction cup (78) vertically slides, wherein the plates (37) support runners (39) able to fold flaps (41) of the lid (4).

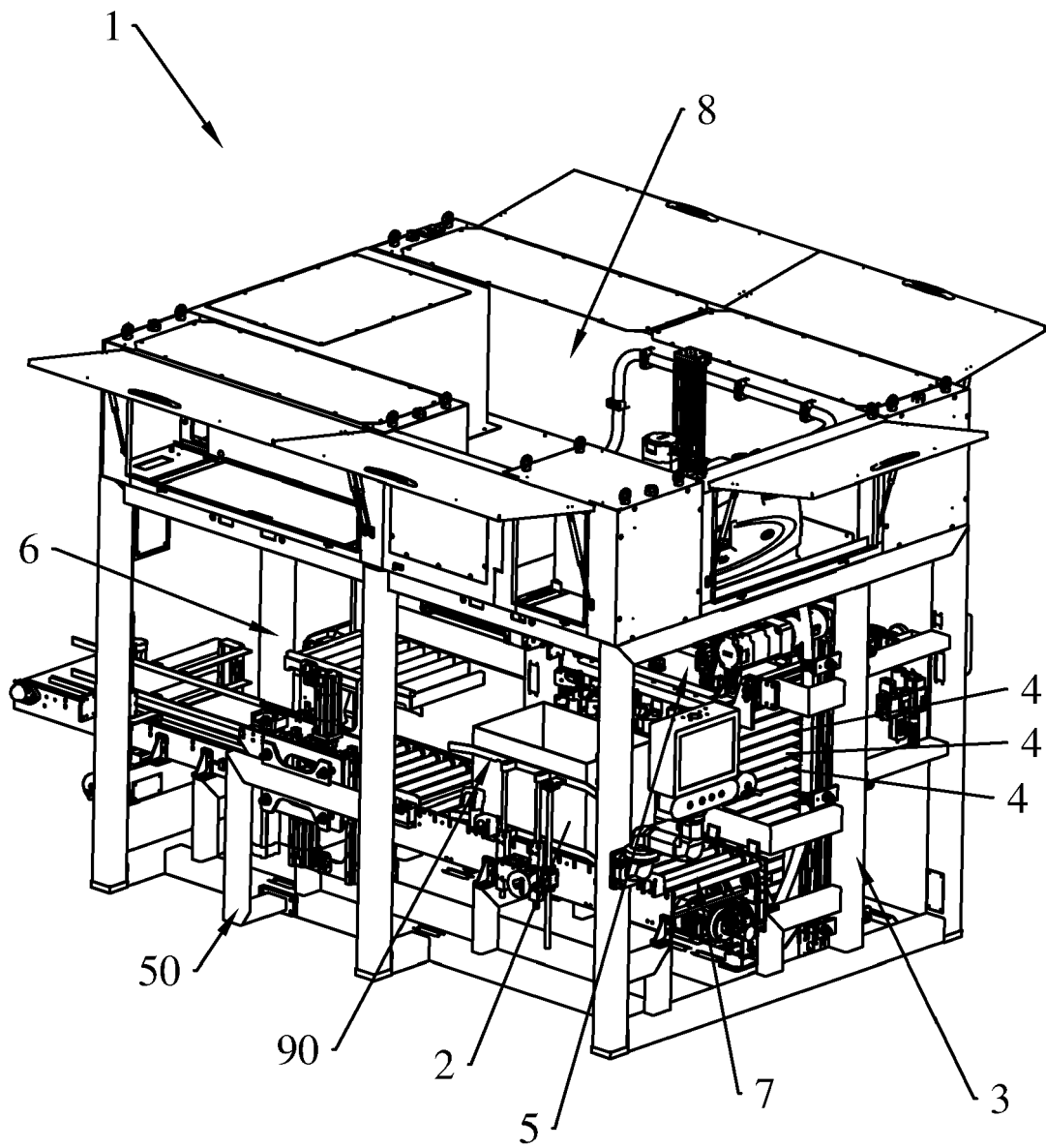


FIG.1

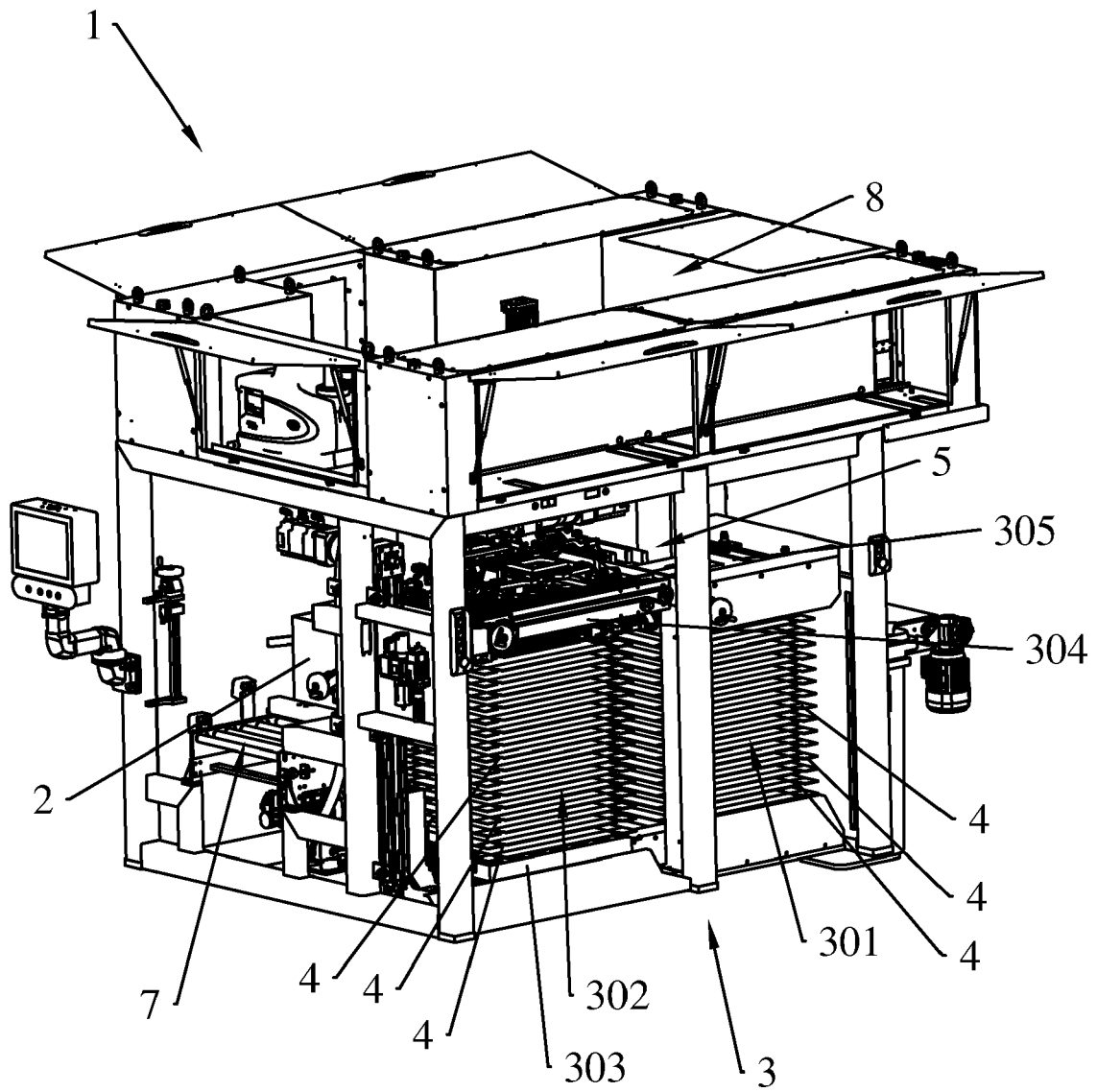
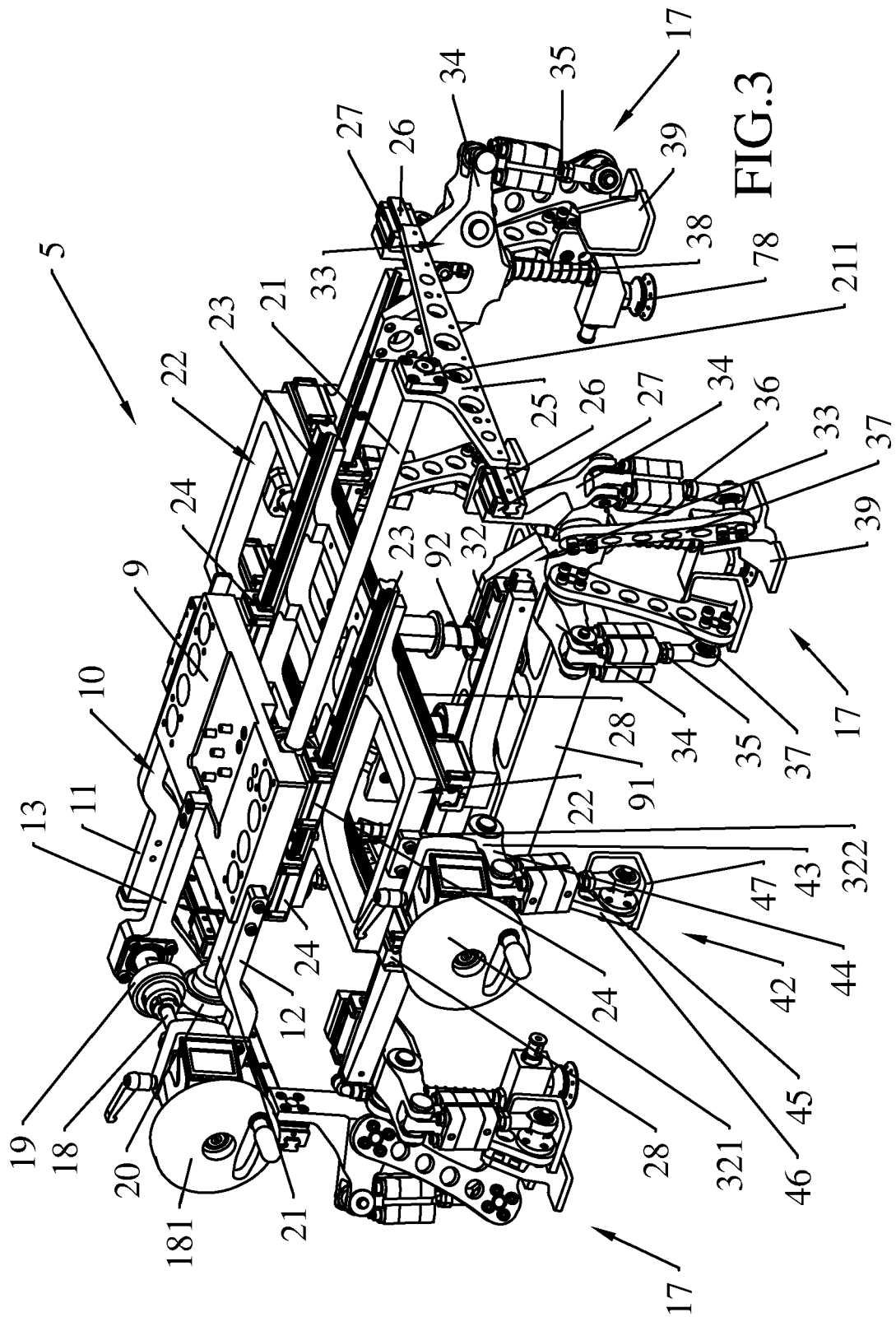
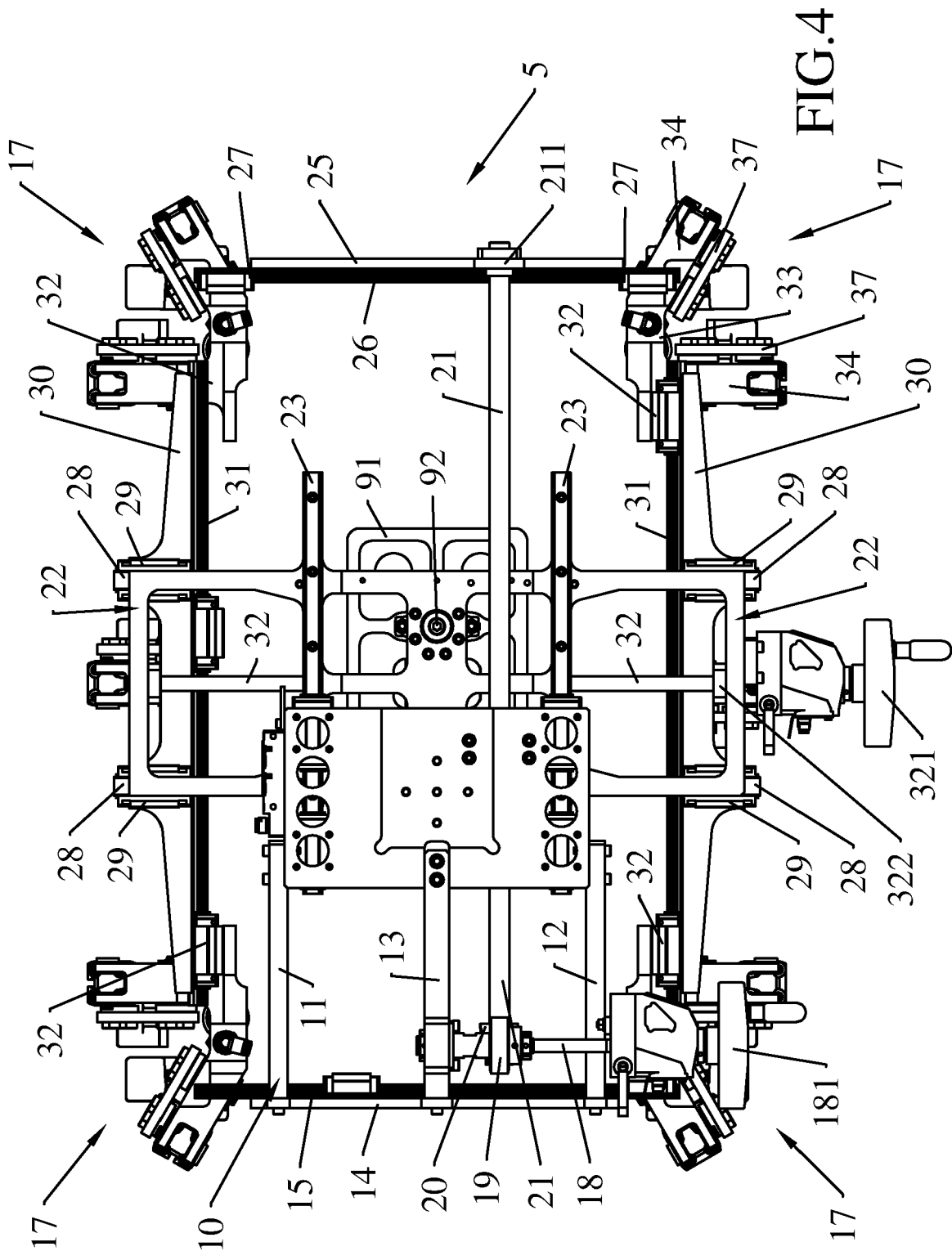


FIG.2





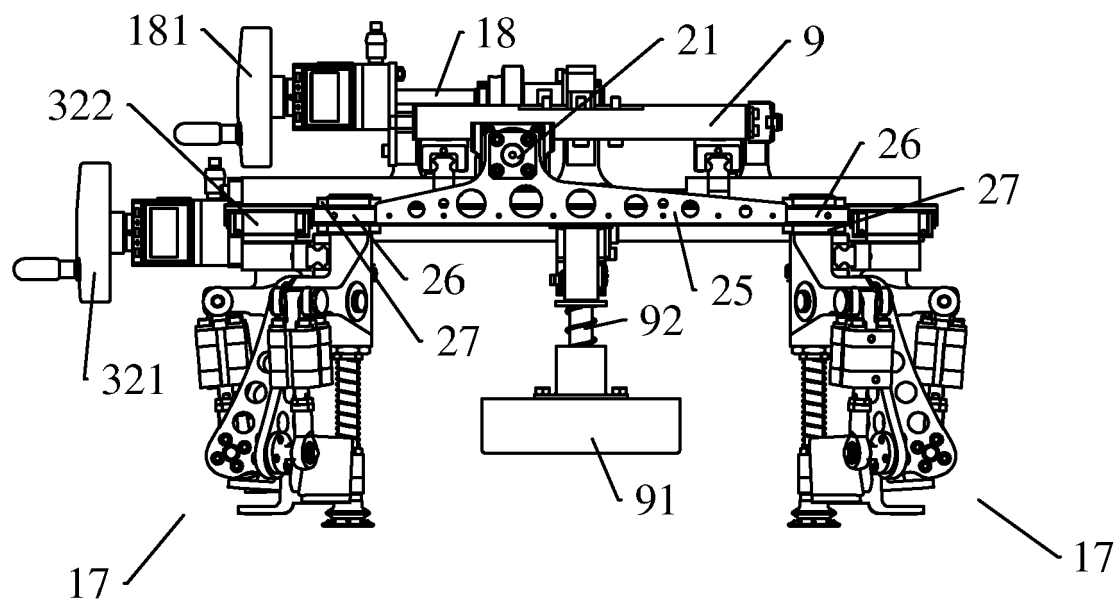


FIG. 5

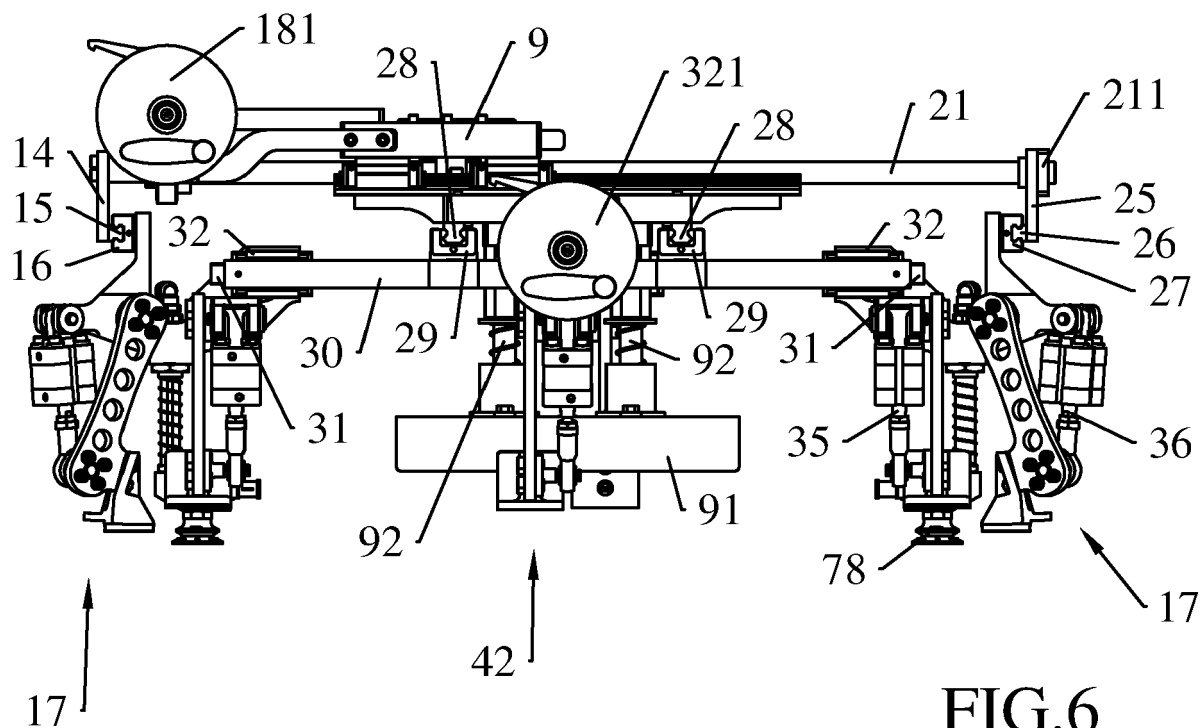
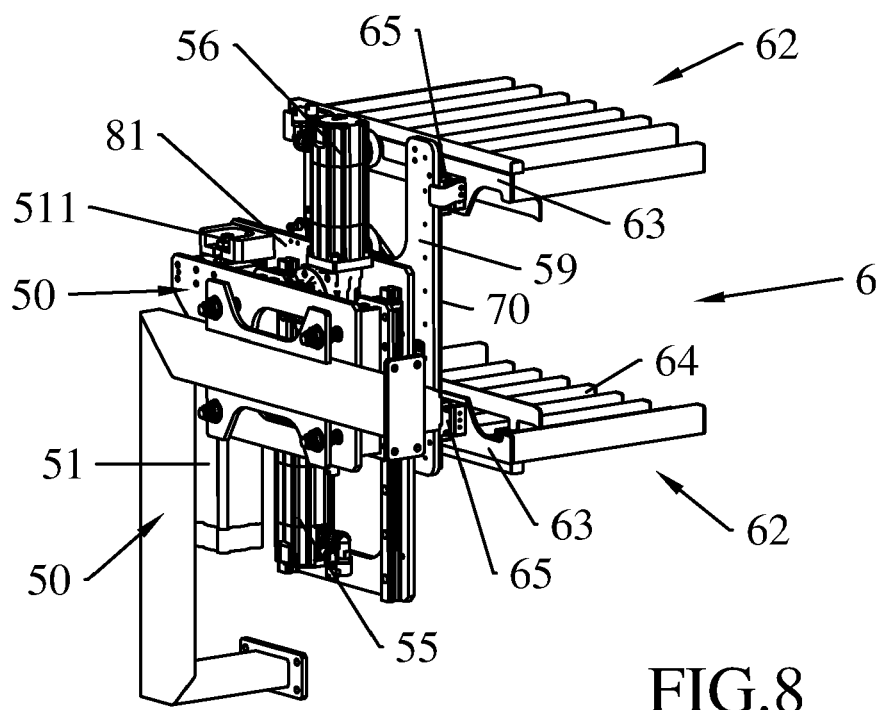
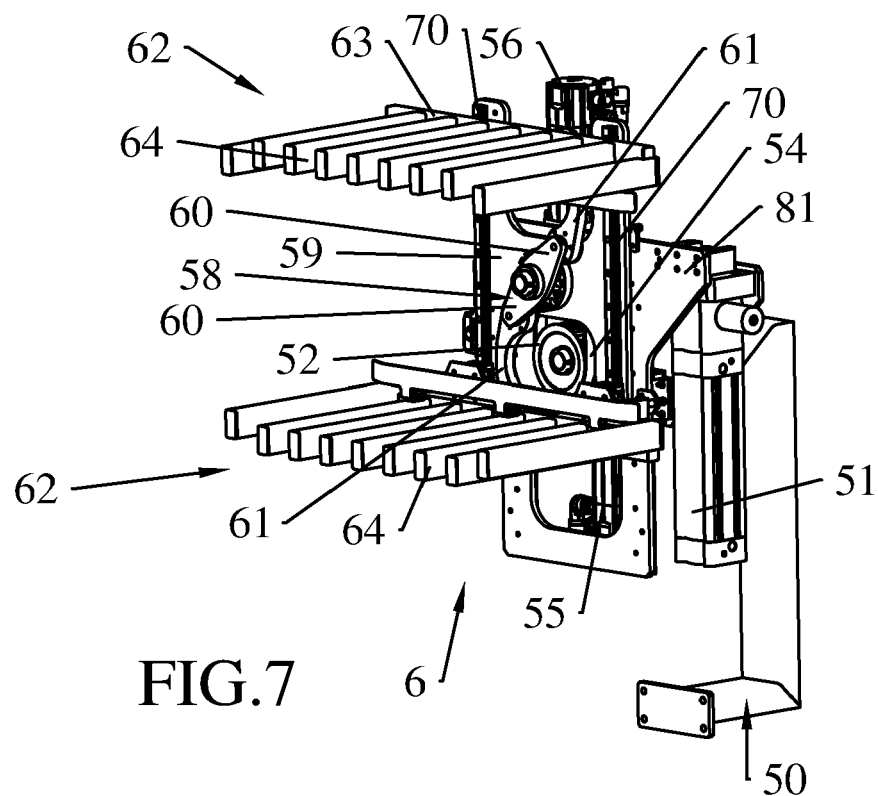
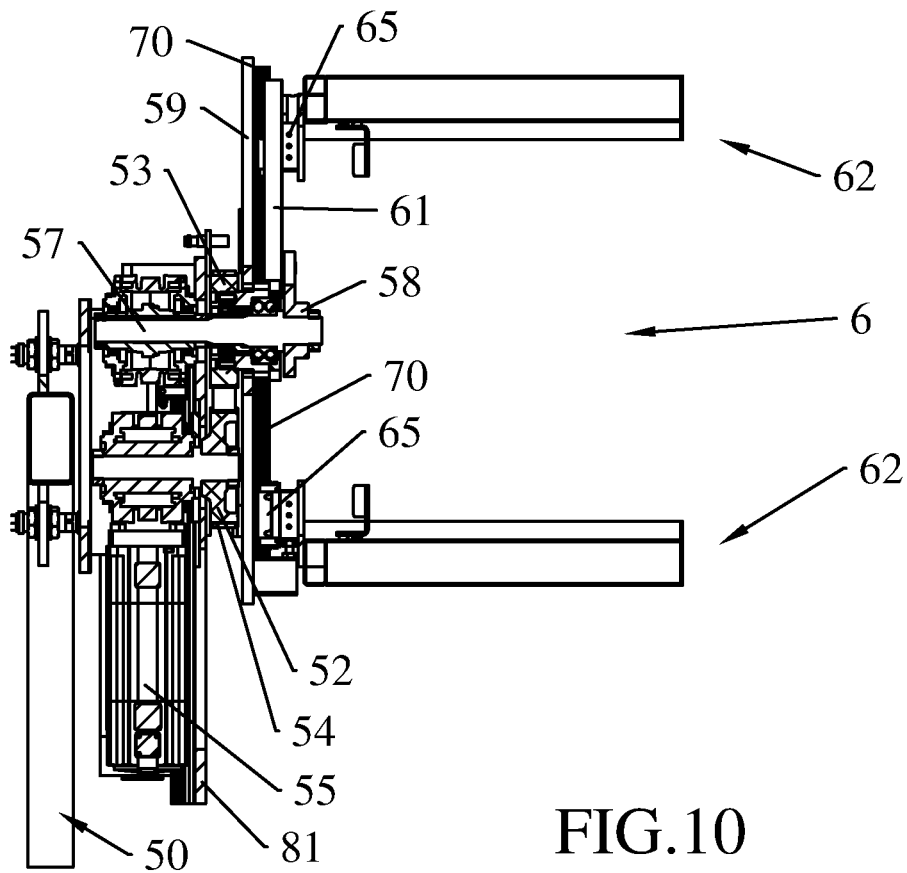
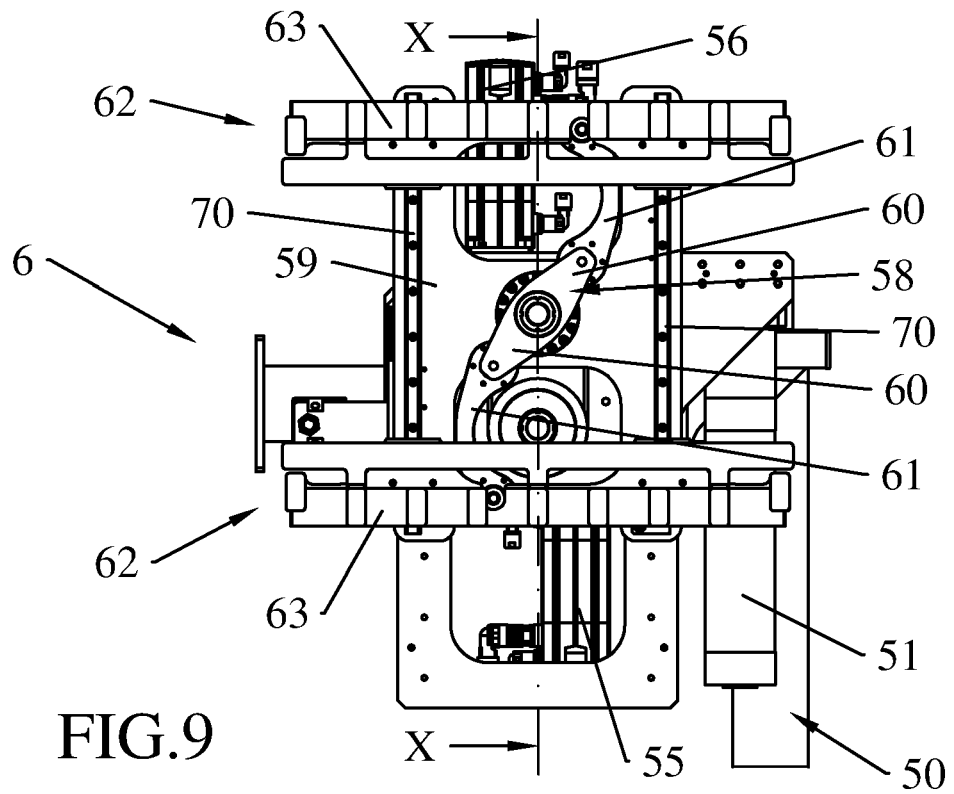


FIG. 6





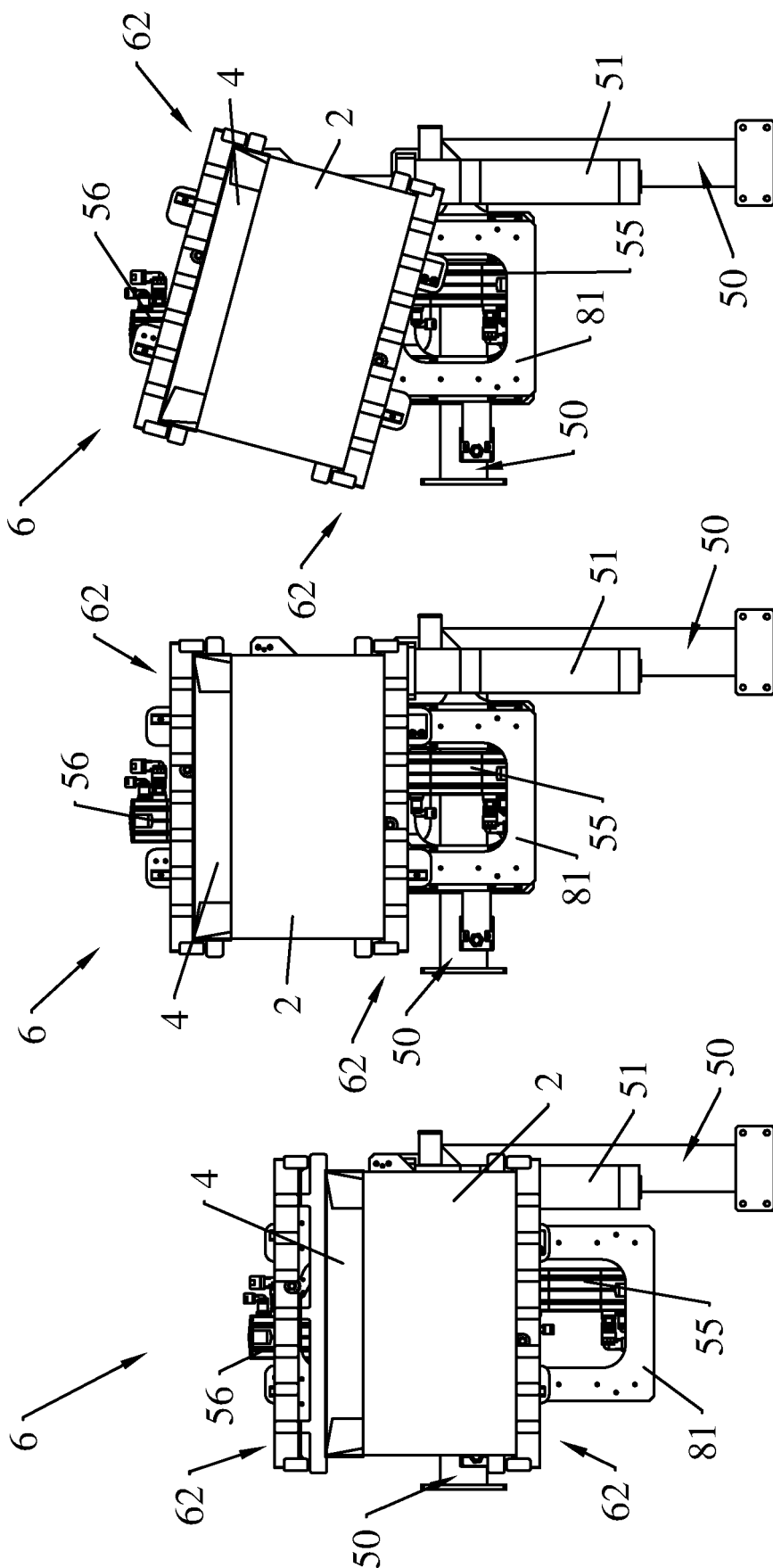


FIG.11

FIG.12

FIG.13

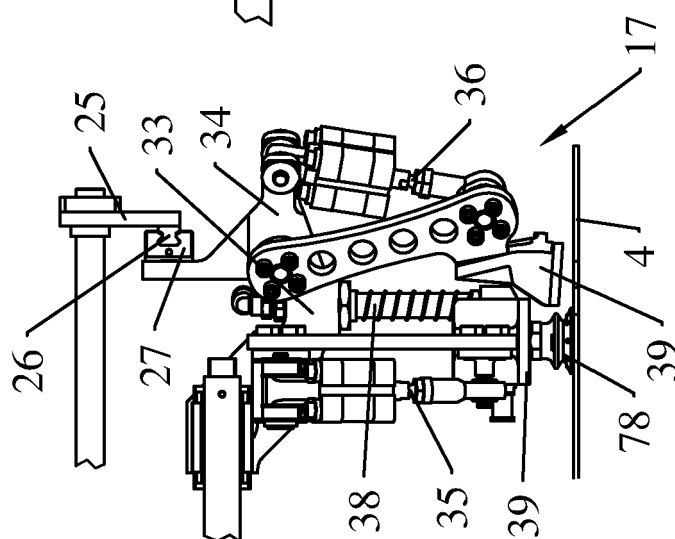


FIG. 14

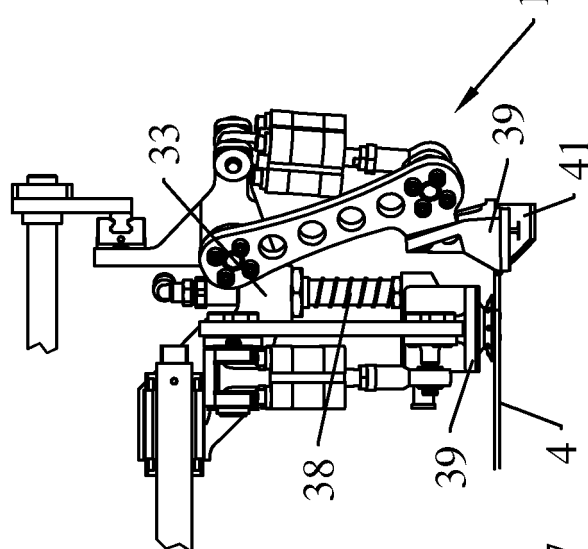


FIG. 15

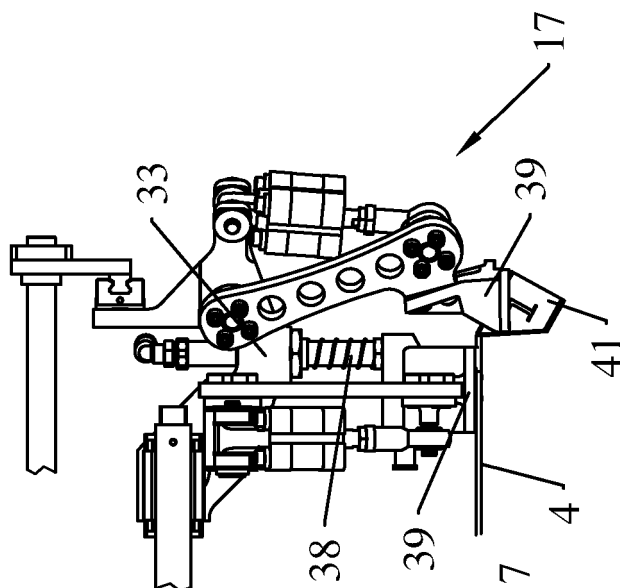


FIG. 16

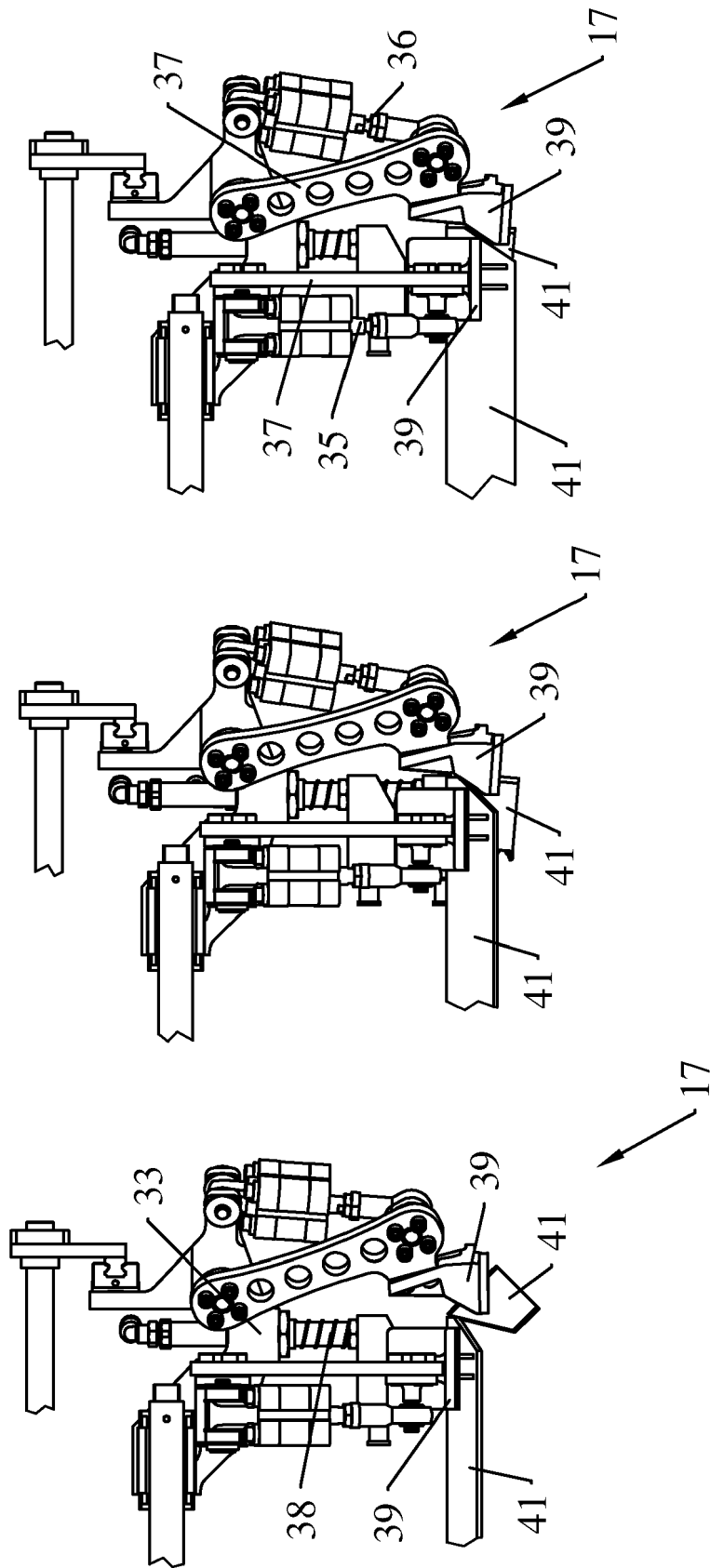


FIG.19

FIG.18

FIG.17



EUROPEAN SEARCH REPORT

Application Number
EP 21 17 3199

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