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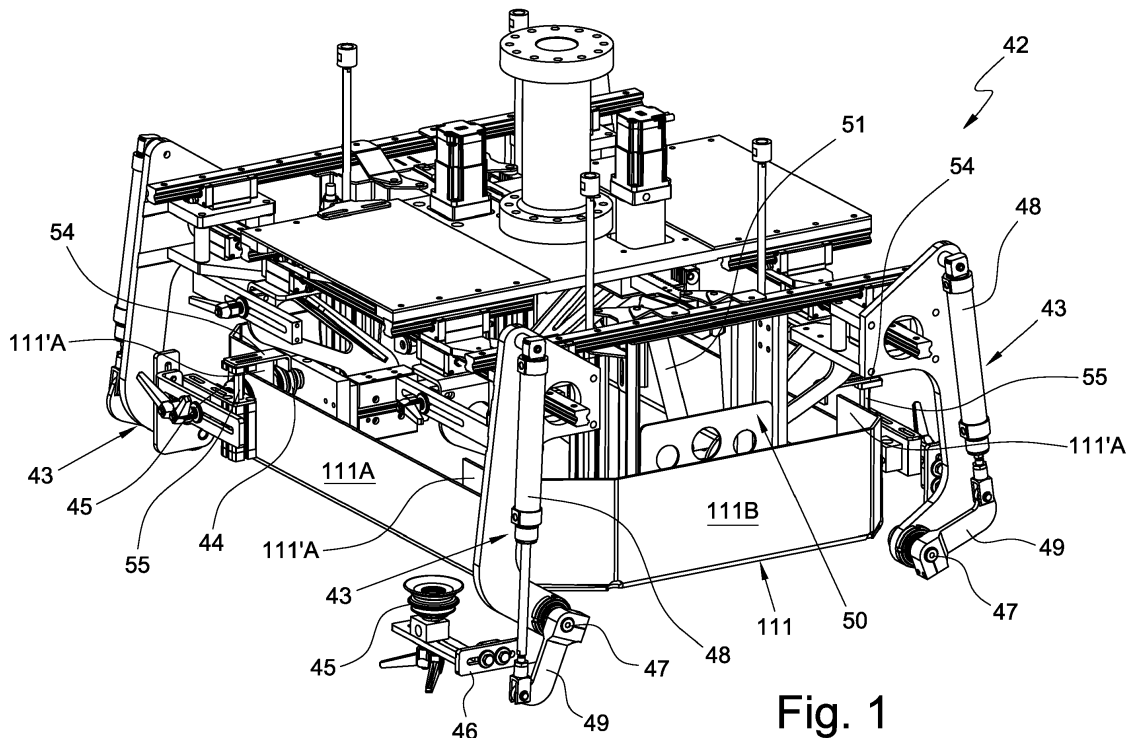
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(54) **SUCTION CUP GRIPPING HEAD FOR THE OPENING OF A PAPER OR CARDBOARD TRAY AND RELATIVE METHOD OF OPENING A TRAY**

(57) A suction cup gripping head for the opening of a paper or cardboard tray identifying a quadrilateral perimeter of adjustable size comprises four gripper elements (43) placed in pairs at the ends of two opposite sides of the perimeter, associable with pairs of opposite glued flaps, outer and inner, (111A, 111'A) of the tray (111), in which each gripper element (43) is equipped with a first set of inner suction cups (44) that are engage-

able from the inside against the inner glued flap (111'A) of the tray, and a tear device that is engageable from the outside against the outer glued flap (111A) of the tray, in which the tear device is applied to an arm (46) tilting about a fulcrum (47) adapted to detach the outer glued flap (111A) of the tray with its own rotary movement.

The relative method for opening a paper or cardboard tray is also part of the invention.



**Fig. 1**

## Description

**[0001]** The present invention relates to a suction cup gripping head for the opening of a paper or cardboard tray and to a relative method of opening a tray.

**[0002]** Increasing attention in the packaging field is paid to minimizing waste materials both in terms of savings and in terms of respecting the environment, and has led to the need to recover empty paper or cardboard trays which formed the resting base of pallets of primary products. The recycling of empty trays may be understood as reusing them as inserts or possibly also as new trays.

**[0003]** Tray means a sheet of paper or cardboard turned up at the four sides to form two glued opposite outer sides and two sides orthogonal to the outer sides provided at their ends with attachments forming inner flaps glued to outer flaps glued to the other sides.

**[0004]** The use of paper or cardboard trays is for example frequent in the case of primary containers consisting of bottles, which require a containment edge for stabilizing the pallets.

**[0005]** The need may occur to palletize primary containers or sales units in order to store them and depalletize them at a later time in order to feed them to a packaging machine for the successive secondary packaging. In this case, at the packaging location there is an increased quantity of empty trays exiting from the depalletization, which require disposal.

**[0006]** This situation is common to packaging plants of mixed lots of different primary products in which pallets of single-flavour products contained on paper or cardboard trays are fed, which are depalletized, combined with each other and fed towards a packaging machine which packages them in bundles, trays or closed boxes.

**[0007]** Indeed, an increasingly felt need in the world of packaging is the one of producing mixed sales units containing individual primary products which may be bottles, containers or cans, having different features.

**[0008]** Typically, a sales unit means a bundle, a tray or a closed box. The primary products introduced into this mixed sales unit may differ from one another for content, colour, labelling, and in the more complex cases, for the shape of the bottle or the container. To simplify the description, we say that the primary products are of different "types" to define all these possible differences.

**[0009]** Primary products similarly means units closed in primary packages to be introduced into a packaging machine to produce secondary packages.

**[0010]** Currently, the trays used are open, that is flattened, thus causing the tear at the corners through a mechanical thrust action exerted from the inside outwards. The trays thus torn can no longer be reused, not even as inserts, and they represent a significant waste of material.

**[0011]** The aim of the present invention is to provide a suction cup gripping head for the opening of a paper or cardboard tray and a relative method of opening a tray which allows resolving the drawbacks of the prior art.

**[0012]** Another aim of the present invention is to provide a suction cup gripping head for the opening of a paper or cardboard tray and a relative method capable of efficiently detaching the glued flaps of the tray without tearing the cardboard and thus minimizing the deformations thereof.

**[0013]** Another aim of the present invention is to provide a suction cup gripping head for the opening of a paper or cardboard tray and a particularly simple and functional relative method, with contained costs and compact size.

**[0014]** These aims according to the present invention are achieved by providing a suction cup gripping head for the opening of a paper or cardboard tray and a relative method, as disclosed in the independent claims.

**[0015]** Further characteristics are provided in the dependent claims.

**[0016]** The characteristics and advantages of a suction cup gripping head for the opening of a paper or cardboard tray and a relative method according to the present invention will be more apparent from the following description, which is to be understood as exemplifying and not limiting, referring to the accompanying drawings in which:

figure 1 shows a suction cup gripping head for a paper or cardboard tray according to the invention; figures 2A-2D show the opening sequence of a glued flap of a paper tray with a suction cup gripping head of figure 1;

figure 3 shows the successive opening of a side orthogonal to the glued flap of the tray through the suction cup gripping head of figure 1;

figure 4 shows the final extraction of the tray from the suction cup head of figure 1.

**[0017]** With reference to the figures, there is shown a suction cup gripping head 42 for the opening of a paper or cardboard tray 111 according to the invention.

**[0018]** The gripping head 42 is for example applied to a robot of a tray transformation unit (not shown) belonging to a tray recycling system of a mixed palletization plant. Indeed, in a mixed palletization plant pallets of single-flavoured products contained in paper or cardboard trays 111 are supplied, which are depalletized for the creation of mixed lots of primary products, that is to say lots consisting of different primary products supplied towards a packaging machine which packages them in bundles, trays or closed boxes. The trays 111, emptied of the primary products, are conveyed towards the tray transformation unit which picks them, opens them and stacks them to make them available for a new use.

**[0019]** The suction cup gripping head 42 identifies a quadrilateral perimeter of adjustable size according to the size of the trays 111. The suction cup gripping head 42 comprises four gripper elements 43 placed in pairs at ends of two opposite sides of the perimeter and associable with pairs of opposite glued flaps, outer 111A and inner 111'A, of the tray 111. Each gripper element 43 is

provided with a first set of inner suction cups 44 engageable in translation by means of linear actuators 56 against the inner flap 111'A of the gluing of the tray, and with a tear device engageable to the outer flap 111A of the gluing of the tray by means of a tilting arm 46 adapted to detach the flap 111A of the tray 111 with its rotary movement. The tear device causes the detachment of the two outer 111A and inner 111A' glued flaps following the detachment of the glue, and not the breakage of the cardboard. The tear device according to a preferred embodiment may comprise a second set of outer suction cups 45 engageable against the outer glued flap 111A of the tray, associated with a hook 54 that can be activated by means of a linear actuator 55 for the engagement in a hooking manner with the glued side of the tray 111 from the inside thereof. The hook 54, which may be associated also only with one of the two gripper elements 43 in a gripping manner on a pair of glued flaps 111A, 111'A, as shown for example in figure 1, is positioned along the side of the tray 111 so as not to get in touch with the glued inner flap 111'A. It is indeed positioned more centrally with respect to the second set of suction cups 45. According to a further embodiment (not shown), the hook 54 could be absent or associated with all the gripper elements.

**[0020]** According to the preferred embodiment, as schematically shown in the sequence of figure 8A-8D, the outer 45 and inner 44 suction cups are closed in sequence against the glued flaps 111A and 111'A, while the hook 54 is in an extracted resting position. The generation of vacuum inside the suction cups ensures the gripping on the relative glued flaps 111A and 111'A. The hook 54 is then moved by means of translation into its engagement position with the inside of the glued side of the tray. The outer suction cups 45 and the hook 54 are caused to rotate about a fulcrum 47 placed at about the fold of the outer glued flap 111A, through the engagement of a linear actuator 48 on a tilting arm 49 rigidly connected in parallel to the arm 46. During the rotation step, the hook 54 helps to pull the glued flap 111A, thus avoiding the detachment of the outer suction cup 45, thus creating a synergetic action for obtaining the detachment of the glued flaps 111A and 111'A with the minimum deformation of the tray 111. The hook 54 is then brought back to an extracted resting position.

**[0021]** According to the simplified embodiment without hook 54, the closing and tearing cycle of the pair of suction cups 44, 45 is performed identically to the one described above. Once the vacuum is generated inside the suction cups 44 and 45, the outer suction cups 45 are caused to rotate about the fulcrum 47 placed at about the fold of the outer glued flap 111A, through the engagement of the linear actuator 48 on the tilting arm 49 rigidly connected in parallel to the arm 46.

**[0022]** Different tear devices replacing or integrating the outer suction cups 45 and the hook 54 described may also be part of the invention.

**[0023]** The suction cup gripping head 42 also comprises

a pair of presser elements 50 respectively placed at the two remaining sides 111B of the tray 111, which are orthogonal to the glued flaps 111A and 111'A. Each presser element 50, preferably provided with a wide flat thrusting surface, is hinged at the fold of the side 111B of the tray 111, orthogonal to the glued flaps 111A and 111'A and connected to a linear actuator 51. The presser elements 50 rotate orthogonal to the tear direction of the outer glued flap 111A to act each on a side orthogonal to the gluing side of the tray, to complete the opening of the orthogonal sides 111B and the flattening of the tray, according to what shown in figure 9.

**[0024]** The suction cup gripping head 42 also comprises, in a position internal to the quadrilateral perimeter, a plurality of vertical linear actuators 52 arranged orthogonal to the plane of the tray, provided at the lower ends with suction cups 53 adapted to keep the open tray 111 raised and to facilitate its extraction from the suction cup gripping head 42 for depositing it onto a stack of open trays by pushing the open tray downwards (figure 10).

**[0025]** The method of opening a paper or cardboard tray according to the present invention comprises the steps of:

- 25 - engaging glued flaps 111A of the tray on opposite sides with a plurality of inner suction cups 44 and with a tear device, such as a plurality of outer suction cups 45 opposed to the inner suction cups 44 and/or a hook 54;
- 30 - detaching each outer glued flap 111A with a rotary action of the tear device and aligning it with such a rotary action to the plane of the tray 111;
- flattening the two remaining sides 111B of the tray 111, orthogonal to the glued flaps 111A, 111'A, with a rotary action orthogonal to the first one through a pair of hinged presser elements 50;
- 35 - depositing the tray thus opened onto a stack of trays.

**[0026]** The suction cup gripping head for the opening of a paper or cardboard tray and the relative method according to the present invention advantageously allow detaching the glued flaps without tearing the cardboard.

**[0027]** The suction cup gripping head for the opening of a paper or cardboard tray and the relative method according to the present invention have the advantage of allowing the automated recycling of the trays.

**[0028]** The suction cup gripping head for the opening of a paper or cardboard tray and the relative method thus conceived are susceptible to numerous modifications and variants, all falling within the invention; moreover, all the details may be replaced with technically equivalent elements. In practice, the materials used, as well as the dimensions, may be any according to technical requirements.

**Claims**

1. Suction cup gripping head for the opening of a paper or cardboard tray, identifying a quadrilateral perimeter of adjustable size, **characterized in that** it comprises four gripper elements (43), placed in pairs at the ends of two opposite sides of the perimeter, associable with pairs of opposite glued flaps, outer and inner, (111A, 111'A) of the tray (111), wherein each gripper element (43) is equipped with a first set of inner suction cups (44) that are engageable from the inside against said inner glued flap (111'A) of the tray, and a tear device that is engageable from the outside against said outer glued flap (111A) of the tray, said tear device being applied to an arm (46) tilting about a fulcrum (47) adapted to detach said outer glued flap (111A) of the tray with its own rotary movement.
2. Suction cup head according to claim 1, **characterized in that** said tear device comprises a second set of suction cups (45) applied to said tilting arm (46).
3. Suction cup head according to claim 1 or 2, **characterized in that** said tear device comprises a hook (54) movable for the engagement from the inside with the glued side of the tray (111), said hook (54) being applied to said tilting arm (46).
4. Suction cup head according to any of the preceding claims, **characterized in that** it also comprises a pair of hinged presser elements (50), respectively placed at the two remaining sides (111B) of the tray (111), orthogonal to the glued flaps (111A, 111'A), adapted to act each on one side orthogonal to the gluing side of the tray, that complete the opening and the flattening of the tray.
5. Suction cup head according to any of the preceding claims, **characterized in that** it comprises in a position internal to said quadrilateral perimeter a plurality of linear actuators (52) arranged orthogonal with respect to the plane of the tray, equipped at the lower ends with suction cups (53), adapted to keep the open tray raised and to facilitate its extraction from the suction cup head (42) for depositing it onto a stack of open trays.
6. Method for opening a paper or cardboard tray, **characterized in that** it comprises the steps of:
  - engaging pairs of glued flaps (111A, 111'A) of the tray on opposite glued sides with a plurality of inner suction cups (44) and with a tear device;
  - detaching each outer glued flap (111A) and aligning it to the plane of the tray (111) with a rotary action of the tear device.
7. Method according to claim 6, **characterized in that** a second set of outer suction cups (45) leans in a gripping manner onto said outer glued flap (111A).
8. Method according to claims 6 or 7, **characterized in that** a hook (54) engages in a hooking manner on each of said opposite glued sides.
9. Method according to any of the preceding claims, **characterized in that** it comprises the successive steps of:
  - flattening the remaining two sides (111B) of the tray (111), orthogonal to the glued flaps (111A, 111'A), with a rotary action orthogonal to the first one through a pair of hinged presser elements (50);
  - depositing the tray thus open onto a stack of trays.
10. Method according to claim 9, **characterized in that** it comprises the step of pushing downwards the open tray for the extraction from said suction cup head (42) prior to its deposit onto said stack of trays.

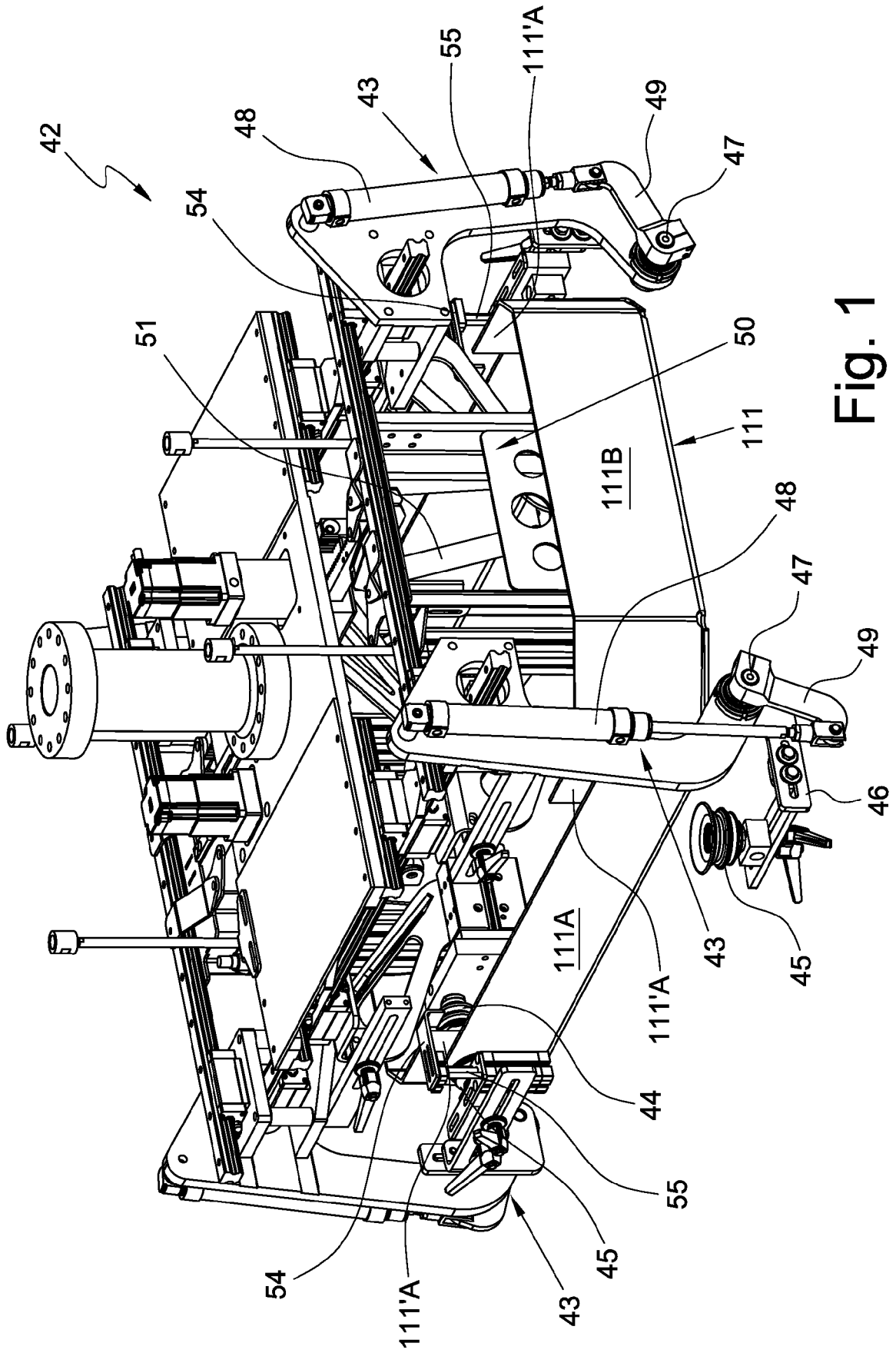


Fig. 1

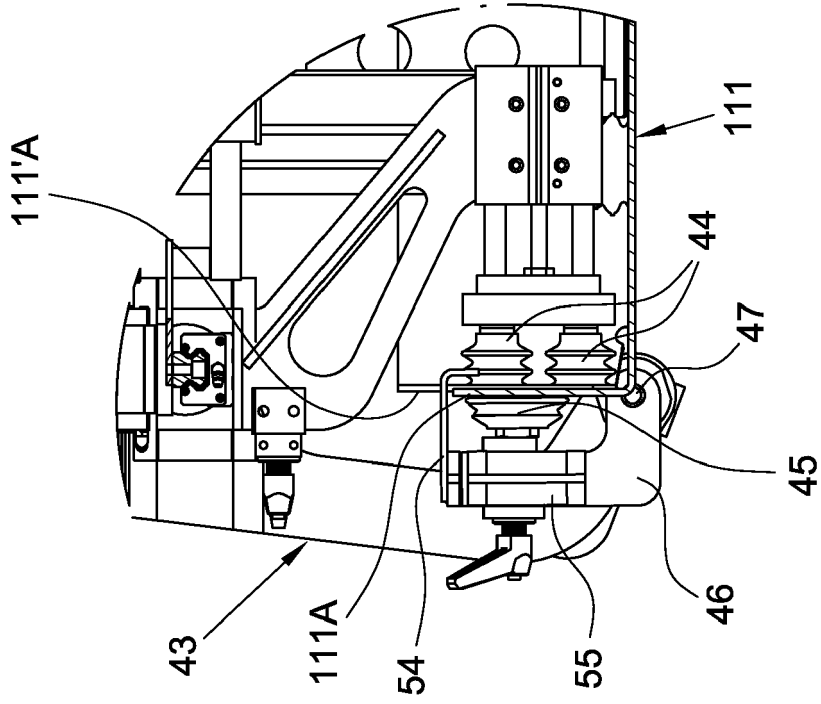


Fig. 2B

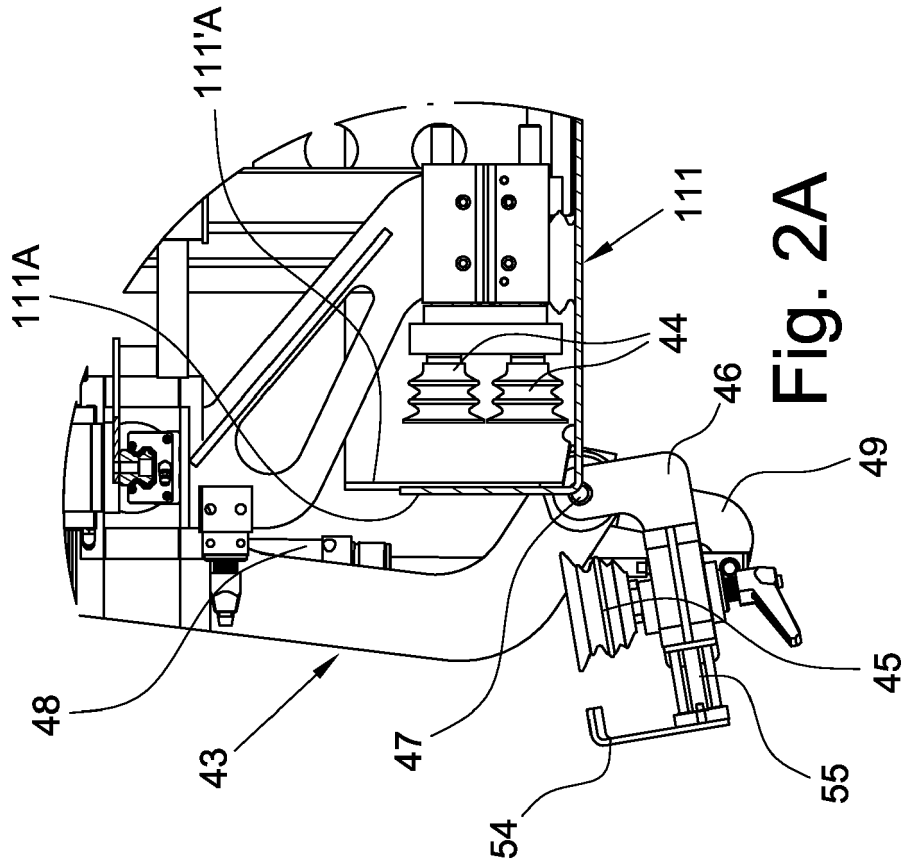


Fig. 2A

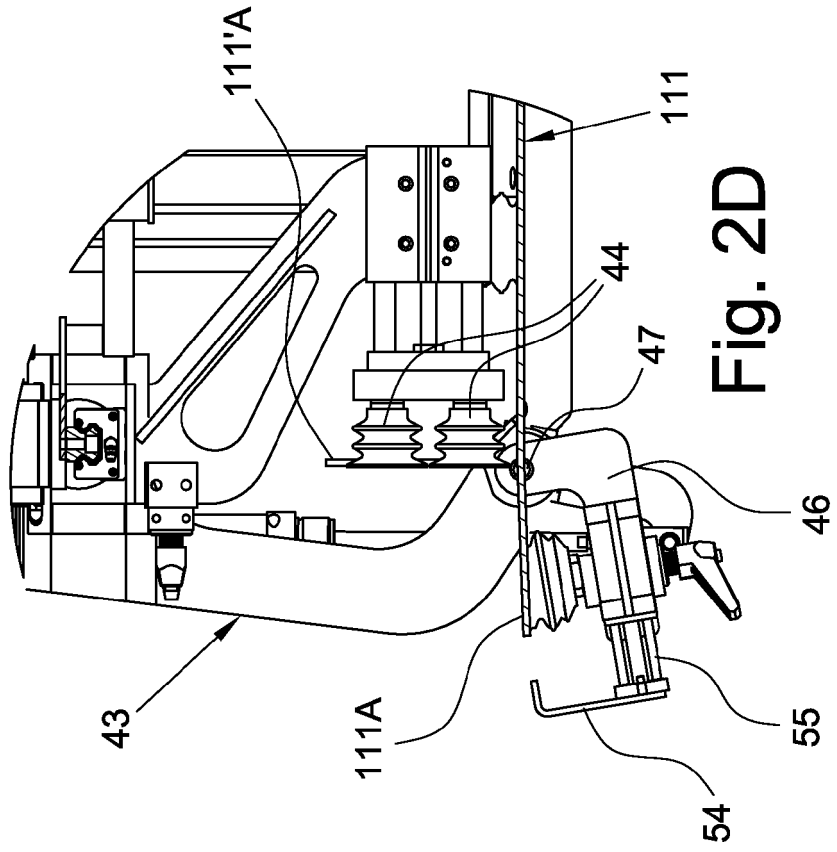


Fig. 2D

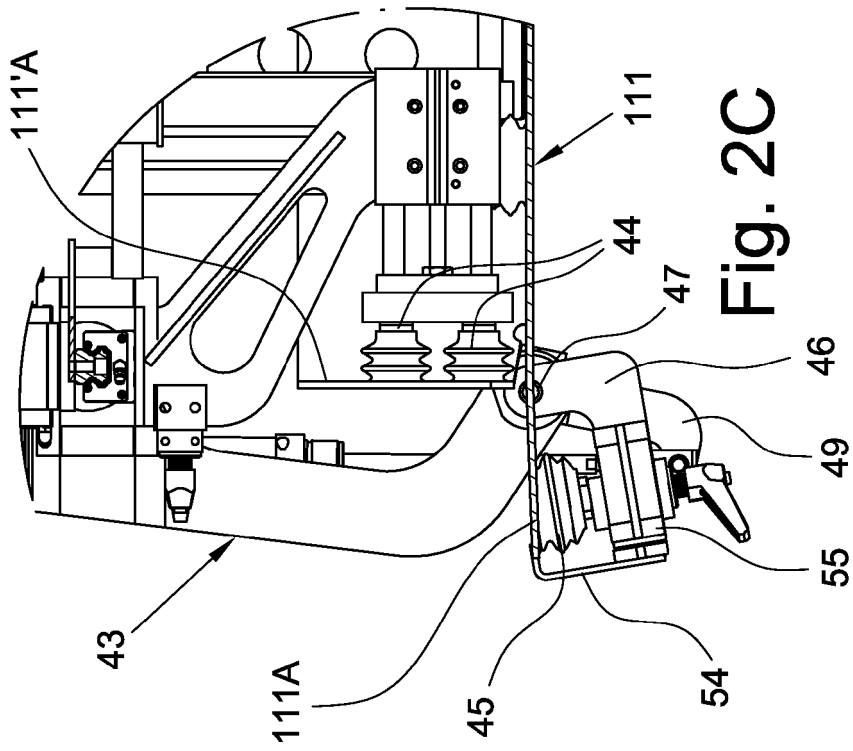


Fig. 2C

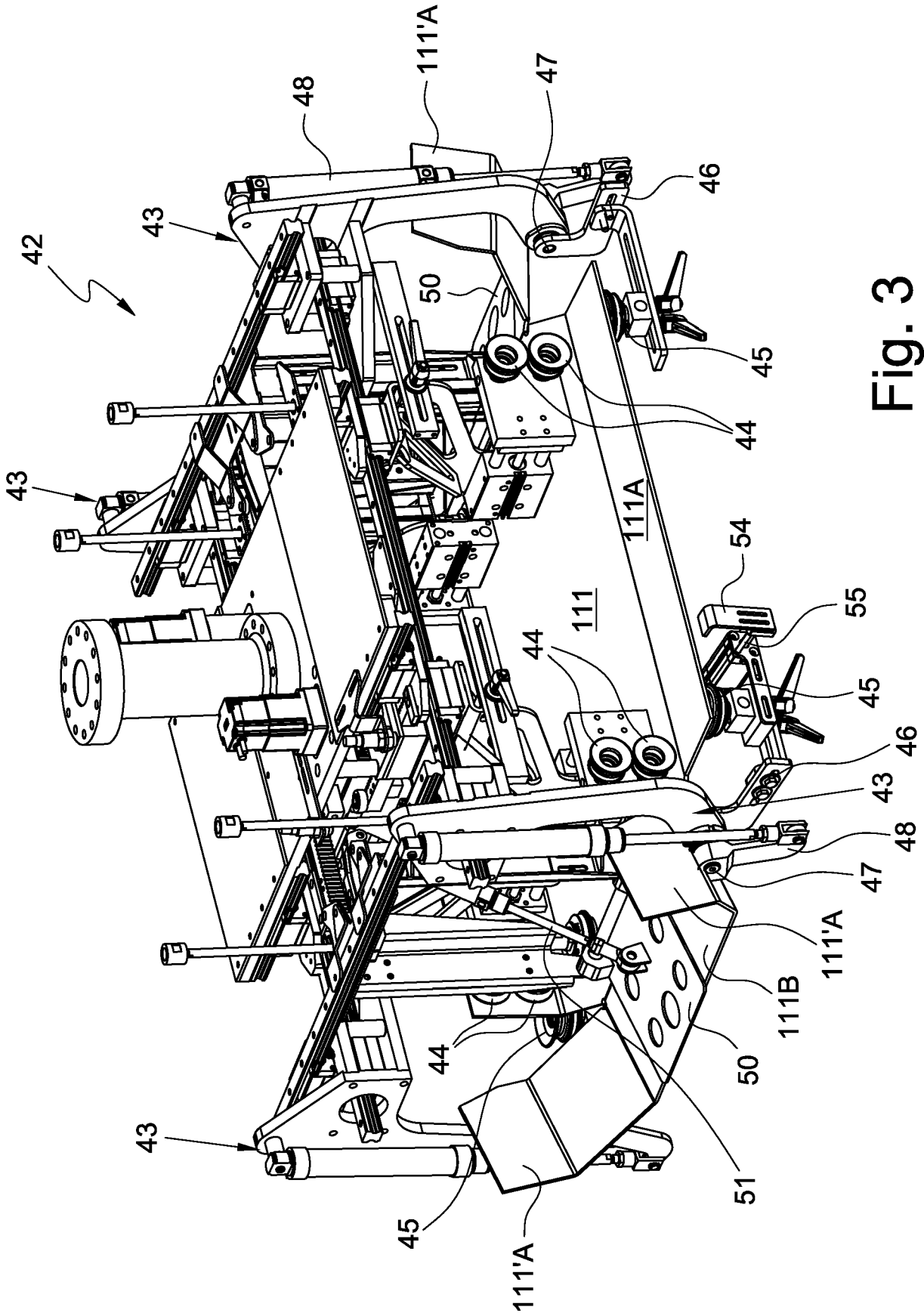


Fig. 3

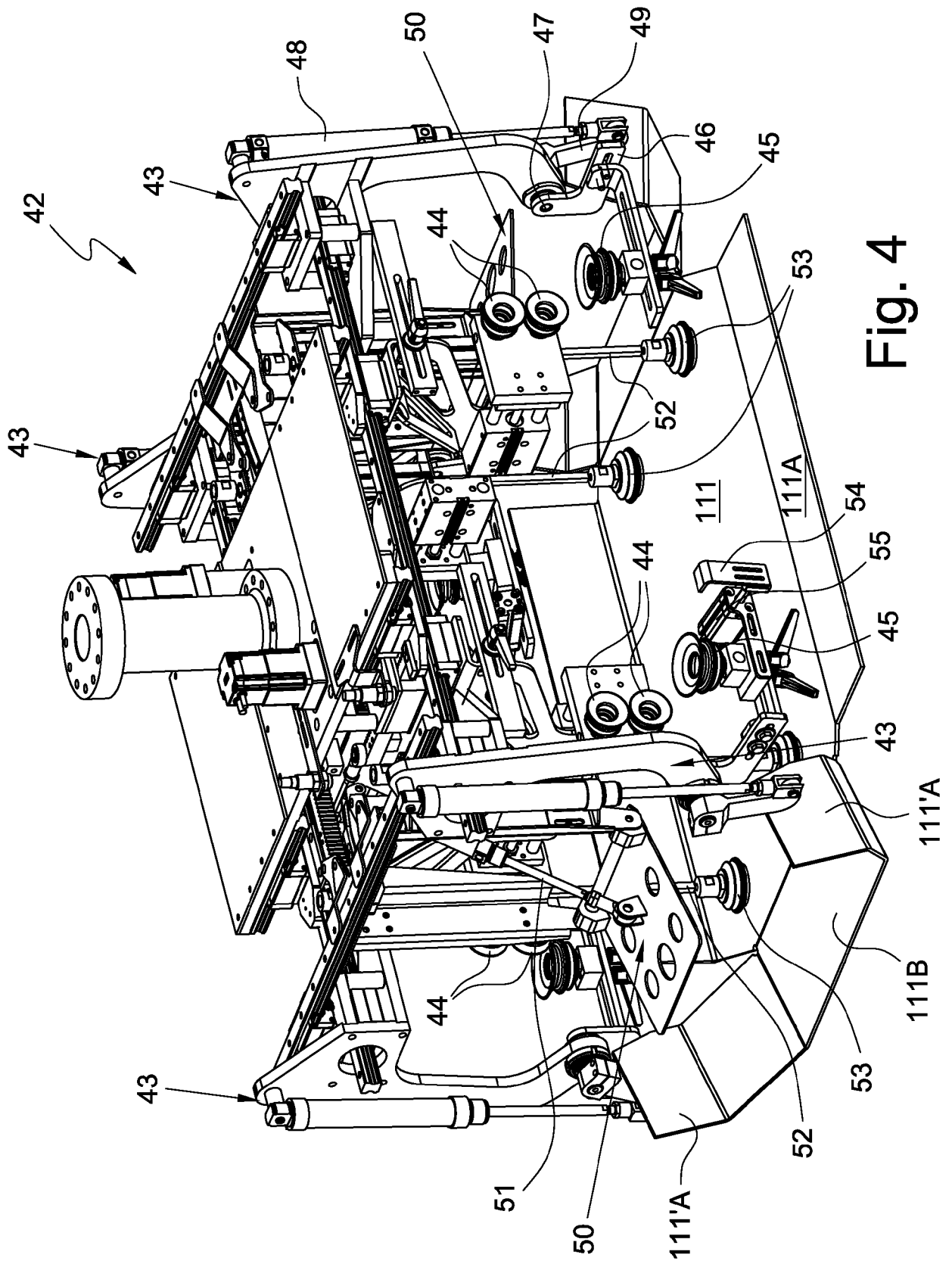


Fig. 4



EUROPEAN SEARCH REPORT

Application Number  
EP 17 16 7236

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|  |   |  | B65B                                    |
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| Place of search<br><b>Munich</b>   |   | Date of completion of the search<br><b>20 July 2017</b>  | Examiner<br><b>Grondin, David</b>       |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |   | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |   |

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