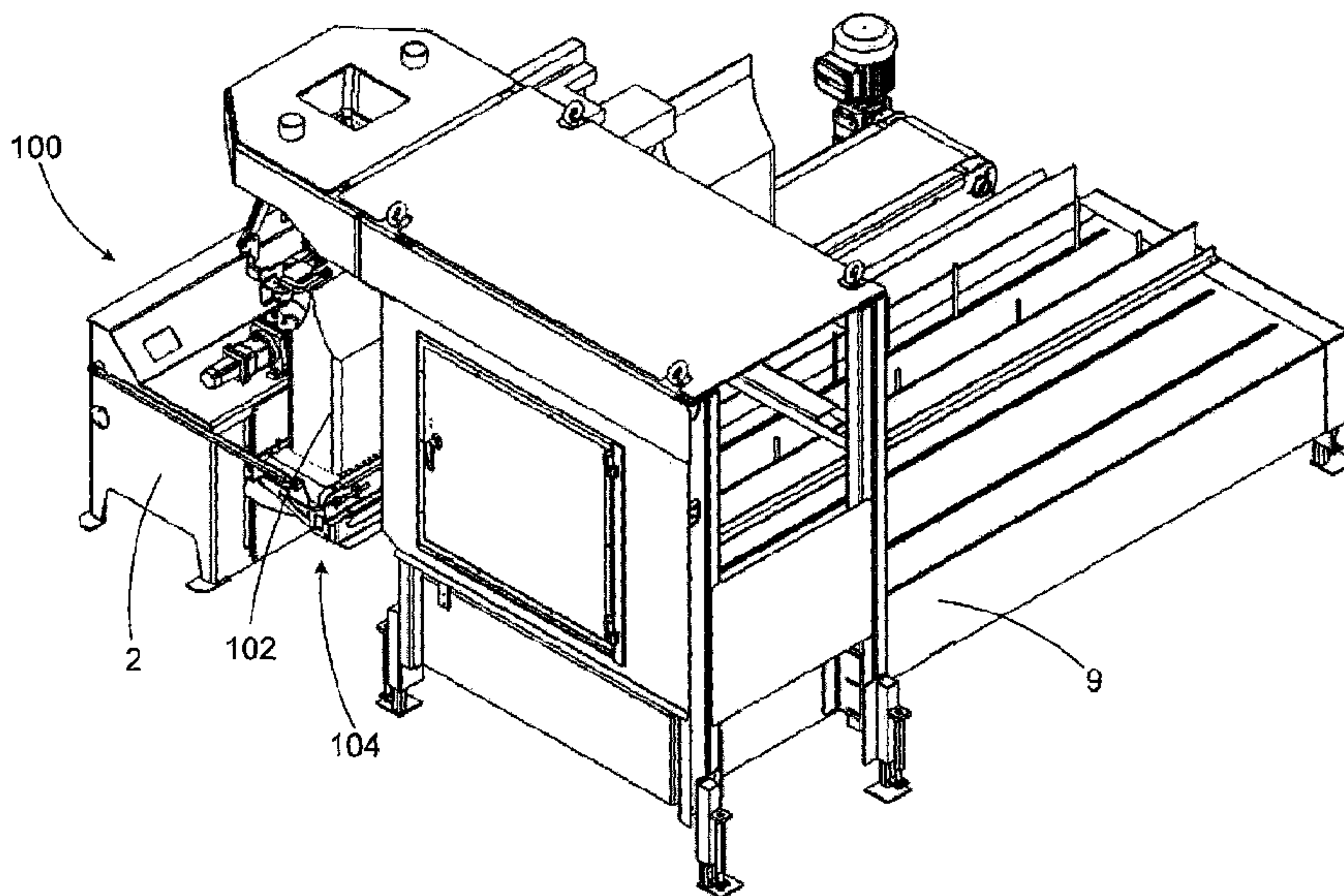




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(57) Abrégé/Abstract:

A system and a method for maintaining, transferring and transporting a flexible package. The system includes a manipulating system, preferably a five axis robot, for transferring and displacing the flexible package and a lift-assist platform positioned within a reach of the manipulating system for transporting the package and for supporting a weight of the flexible package. The system may be used more specifically for the transport and transfer of upright flexible packages. The system simplifies the tool supported by the robot, thus allowing use of a smaller robot.

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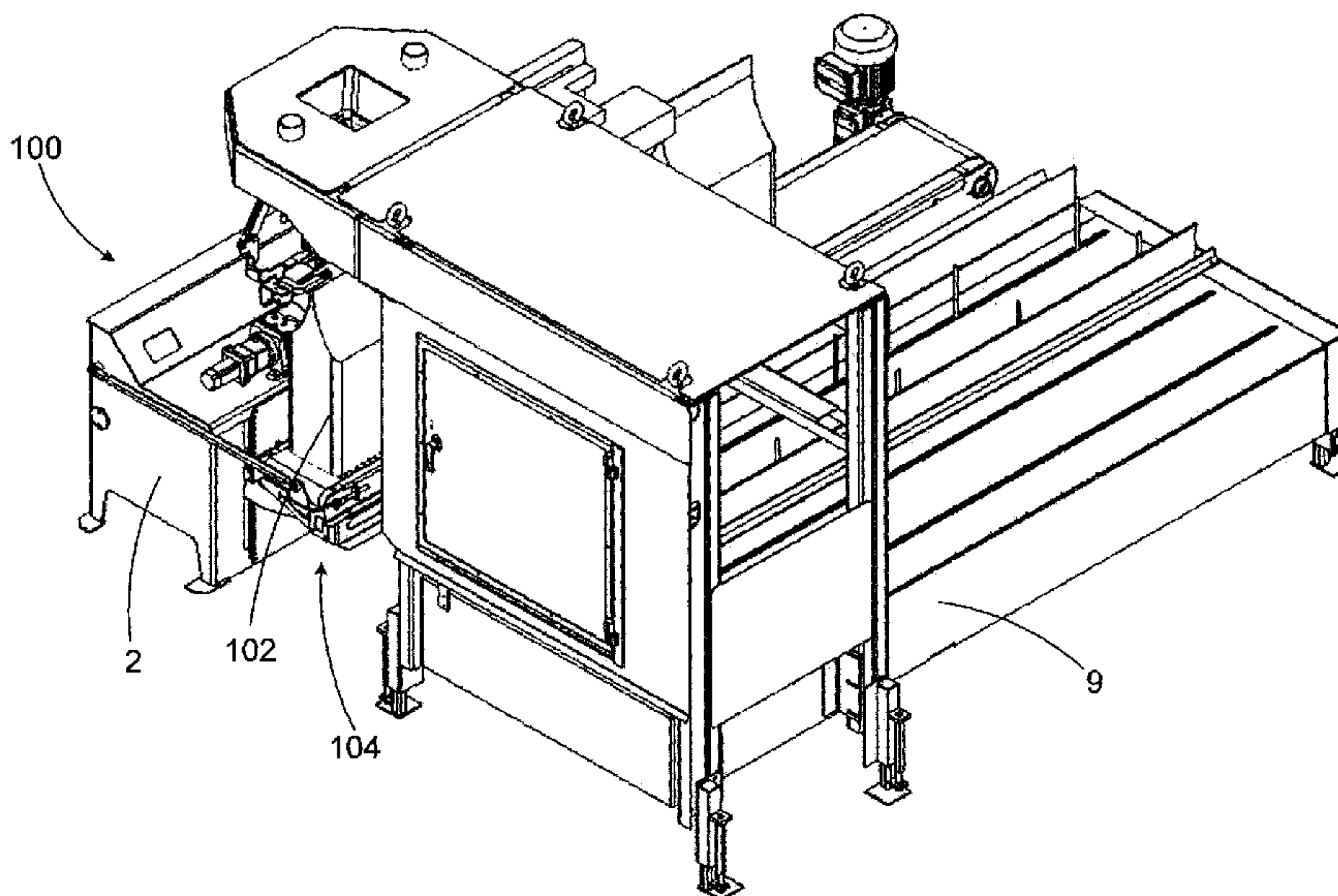


FIG. 1

(57) Abstract: A system and a method for maintaining, transferring and transporting a flexible package. The system includes a manipulating system, preferably a five axis robot, for transferring and displacing the flexible package and a lift-assist platform positioned within a reach of the manipulating system for transporting the package and for supporting a weight of the flexible package. The system may be used more specifically for the transport and transfer of upright flexible packages. The system simplifies the tool supported by the robot, thus allowing use of a smaller robot.

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ROBOTIZED TRANSPORT AND TRANSFER SYSTEM

FIELD OF THE INVENTION

5 The present invention generally relates to packaging systems. More particularly, the present invention relates to a system for transporting and transferring items, including among others, upright flexible packages.

BACKGROUND OF THE INVENTION

10

In many fields of the packaging industry, such as pet food, stock feed, seeds, etc., multi-wall gusseted paper bags are heavily used. Producers can choose from manual baggers, semi-automatic baggers or fully automated baggers. Baggers are understood to comprise at least some of the following subsystems: a bag magazine,
15 a bag dispenser, a bag placer, a filling spout, an exit unit, a bag reshaper and a sealer. A bagger may or may not include a closing system.

No matter the type of bagger used, the bagging operation for the previously mentioned types of product is similar. On semi-automatic and fully automatic
20 baggers, the bag dispenser places the bag on the filling spout, whereas manual baggers require the action of an operator to place a bag on the spout.

On automatic baggers, the gussets or the side folds of the bag are preferably maintained closed (in their original shape when the bag is empty and flat) while the
25 bag is on the spout. Otherwise, a system has to reshape them. Reshaping is understood to be the action of bringing the flaps of the top of the bag together and re-folding the gussets or the side folds of the bag. While the shape of the top portion of the bag is being maintained thoroughly, the bag is then removed from the spout and transferred to the closing system. For manual and semi-automatic baggers,
30 reshaping systems on the spout would be useless since they release the bag from

the spout and let it fall on a conveyor, losing control of the bag shape. Therefore, the use of a system reshaping the gussets or side folds while the bag travels towards the closing system (called in-line reshaping system) is necessary, otherwise an operator needs to reshape the top of the bag and transfer it to the closing system.

5 Correctly shaped gussets or side folds improve closing quality, bag appearance and produce bags that are easier to palletize.

Several criteria must be taken into account when searching for the more suitable bagger for the very precise needs of a typical application. Undoubtedly, any factory manager will opt for the best solution at the lowest price. The most important criteria are certainly the cost of the machine, its reliability, productivity, complexity, footprint and modularity (retrofitable), the safety related to the machine and the quality of the result (finished bag).

15 Manual baggers are the least expensive to purchase; however they are often associated with recurring costs such as operator salaries and insurance. The quality of the finished product is average to good, but it can be affected by different factors, such as operator exhaustion and lack of time to readjust the fold since the machine keeps running at a fixed pace. Manual baggers are more suitable for production rates around 15 to 20 bags per minute. As for manual baggers safety issues, operators' safety and ergonomics must be taken into account. On the other hand, they use minimal floor space.

25 Semi-automatic baggers are more expensive to purchase (around 2 to 3 times more expensive than the manual baggers). The bag reshaping quality is average to low since the spout is fixed and the bag falls from the spout, resulting in no bag control and hand-reformed bags. As with the manual baggers, the bag is reshaped by an operator who can be subject to the same factors expressed for manual baggers. Semi-automatic baggers can also reach an average productivity rate of 15 to 20 bags per minute. They can be retrofitted with in-line reshaping systems which

automate the reshaping of the bag while it travels toward the closing system. In-line reshaping systems are quite expensive (it can cost the amount of the semi-automatic bagger itself) and give low quality results. As for reliability issues, due to their complex mechanical construction, these systems have an average to low
5 mechanical reliability.

Fully automated baggers are the most expensive systems to purchase (around 4 to 6 times more expensive than the manual baggers). Large producers can afford this kind of machine which offers even more benefits to producers bagging large batches
10 and high value end product. Automatic systems can reach an average productivity rate of 20 to 30 bags per minute. These fully automated baggers have quite complex mechanical systems and use more floor space than manual or semi-automatic baggers.

15 The most effective solution is obviously the completely automated bagger, but this option is also the most expensive and, for that reason, is not affordable and suitable for the majority of producers which must turn towards manual or semi-automatic systems. The manual and semi-automatic baggers are cheaper to purchase and can be retrofitted with an in-line reshaping system, but still, they will operate with limited
20 productivity and quality. Considering the proportion of producers who use manual and semi-automatic baggers and those who increment their system with additional automation, it represents a large potential for machine sales.

The critical point is the system transferring the bag from the bagger to the closing
25 system since it influences the bagger productivity and the quality of the finished product. The use of dedicated in-line reshaping systems increase bagger productivity, but decrease the quality of the product. Up to now, in the targeted fields such as pet food, stock feed, seeds, etc., of the packaging industry, there appears to be no small, low cost, high quality, high productivity, reliable, retrofitable system
30 available capable of maintaining the shape of the top portion of the bag, transferring

and transporting the bag from the bagger to a closing system. Hereinbelow, it is understood that the term "transport" encompasses a displacement of an item while properly supporting its weight during the displacement. The term "displacing" encompasses a displacement of an item between a point A and a point B. The term
5 "transferring" encompasses a transfer and passage of an item between a first system carrying out operations on the item and a second system carrying out operations on the item

Some references show reshaping systems positioned on the machine spout. It
10 would be possible for someone, well educated in this technical field and aware of prior art, to logically think of a system capable of taking the bag while it is being closed and maintaining its state until the closing of the bag is completed. A dedicated mechanical system would be quite easy to develop but would be cumbersome, hardly retrofitable, complex and expensive. The final solution would be
15 very close to the existing automated baggers but with the disadvantages of having two machines not well integrated and almost as much expensive.

Another way of transferring the bag once it has been reshaped on the spout would be to use a robot to maintain the bag reshaped and transport it to the closing
20 system. A robot capable of supporting the filled bag weight and moving it at the requested speed to achieve acceptable production rates (20 bags per minute minimum) would be too large to be well integrated on an existing bagger and would cost as much as an automated bagger. There are existing applications, frequently used in valve bagging applications, where a robot manipulates a filled bag from the
25 bagger to the closing system, but this has never been done to be suitable for gusseted open mouth bags and sewing systems. These applications typically use a big six-axis robot.

Therefore, there is still a need for a system to automate manual and semi-automatic
30 baggers, thereby improving their productivity and the quality of the finished bags.

The preferable solution would be a small, low cost, high quality, high productivity, reliable, retrofittable system to maintain the shape of the the top of the bag, while transporting and transferring the bag from the bagger to a closing system.

5

SUMMARY OF THE INVENTION

10 An object of the present invention is to provide a system that addresses at least one of the above-mentioned needs.

According to the present invention, there is provided a system for transferring and transporting a flexible package, the system comprising:

- 15 -a multi-axis robot for transferring and displacing the flexible package between a first position and a second position; and
- a lift-assist platform for transporting the flexible package, said lift-assist platform substantially supporting a weight of the flexible package, said lift-assist platform comprising a displacing system for displacing and supporting the flexible package upright between the first and second positions, the
20 platform being positioned within reach of the multi-axis robot.

Preferably, the multi-axis robot, in certain configurations, maintains the flexible package between the first position and the second position.

25 Preferably, the system further comprises a single central controller for synchronizing motion of the multi-axis robot and the lift-assist platform.

Preferably, the multi-axis robot is a five axis robot.

Preferably, the multi-axis robot comprises a gripper continuously maintaining a shape of at least a portion of a top of the flexible package between the first and second positions.

- 5 Preferably, the gripper comprises opposite side clamps for grasping the flexible package.

Preferably, the system further comprises a semi-automatic bagger proximate the first position for filling the upright flexible package and shaping a top portion of the
10 package, and a closing system positioned proximate the second position for closing the package received from the multi-axis robot.

Preferably, the displacing system is a conveyor system.

- 15 According to the present invention, there is also provided a method for transferring and transporting a flexible package, comprising the steps of:

a) providing a system comprising:

-a multi-axis robot for transferring and displacing the flexible package between a first position and a second position;

20 -a lift-assist platform for transporting the flexible package, said lift-assist platform substantially supporting a weight of the flexible package, said lift-assist platform comprising a displacing system for displacing and supporting the flexible package upright between the first and second positions, the platform being positioned within reach of the multi-axis robot;

25 -a semi-automatic bagger proximate the first position for filling the upright flexible package; and

-a closing system positioned proximate the second position;

b) filling the flexible package with a substance, using the semi-automatic bagger;

30 c) bringing together sidewalls of a top of the filled flexible package in a package-closing configuration with the semi-automatic bagger;

- d) raising the lift-assist platform to substantially support the weight of the filled flexible package;
- e) grasping and maintaining a shape of the top of the filled flexible package in said package-closing configuration with the multi-axis robot;
- 5 f) releasing the filled flexible package from the semi-automatic bagger;
- g) displacing the filled flexible package towards an inlet of the closing system, through synchronized motion of the multi-axis robot and the lift-assist platform, the displacing system of the lift-assist platform displacing the flexible package laterally towards the closing system;
- 10 h) aligning the top of the flexible package with the inlet of the closing system; and
- i) transferring the flexible package from the multi-axis robot to the closing system.

Preferably, the present invention is a system capable of transferring a filled bag, maintaining it in a package-closing configuration and vertical, supporting its weight
15 and transporting it from the bagger to a closing system.

According to a general aspect, there is provided a system for transporting and transferring a filled flexible package, having a top with an open mouth and a bottom, towards a flexible package closing system. The system comprises: a lift-assist
20 platform receiving the bottom of the flexible package in a filled state at a first position and supporting a substantial portion of a weight of the filled flexible package from the first position to a second position, vertically spaced-apart from the first position, the lift-assist platform comprising a displacing system to displace and support the filled flexible package in an upright configuration from the first position to the second
25 position; a multi-axis robot having a gripper configured to grasp the top of the filled flexible package in the first position and maintain the top of the filled flexible package during displacement and transfer to the second position; and a controller operatively connected to the lift-assist platform and the multi-axis robot and synchronizing motion of the lift-assist platform and the multi-axis robot.

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According to another general aspect, there is provided a system for filling, transferring, transporting, and closing a flexible package having a top and a bottom. The system comprises: a flexible package filling unit; a flexible package closing system, spaced-apart from the flexible package filling unit; a lift-assist platform receiving the bottom of the flexible package in a filled state and supporting a substantial portion of a weight of the filled flexible package during vertical displacement from the flexible package filling unit to the flexible package closing system and comprising a displacing system to displace and support the filled flexible package in an upright configuration towards the flexible package closing system; a multi-axis robot having a gripper grasping the top of the filled flexible package from the flexible package filling unit and maintaining the top of the filled flexible package during displacement and transfer towards the flexible package closing system; and a controller operatively connected to the lift-assist platform and the multi-axis robot and synchronizing motion of the lift-assist platform and the multi-axis robot.

According to a further general aspect, there is provided a method for filling, transferring, and transporting a flexible package having a top and a bottom. The method comprises:

Providing a system comprising:

- 20 a flexible package filling unit;
- a flexible package closing system, spaced-apart from the flexible package filling unit;
- a lift-assist platform receiving the bottom of the flexible package in a filled state and supporting a substantial portion of a weight of the filled flexible package during vertical displacement from the flexible package filling unit to the flexible package closing system and comprising a displacing system to displace and support the

7b

filled flexible package in an upright configuration towards the flexible package closing system;

5 a multi-axis robot having a gripper grasping the top of the filled flexible package from the flexible package filling unit and maintaining the top of the filled flexible package during displacement and transfer towards the flexible package closing system; and

a controller operatively connected to the lift-assist platform and the multi-axis robot and synchronizing motion of the lift-assist platform and the multi-axis robot;

10 Filling the flexible package with the flexible package filling unit;

Displacing the lift assist platform to receive the bottom of the filled flexible package thereon and support the substantial portion of the weight of the filled flexible package;

15 Grasping and maintaining the top of the filled flexible package with the gripper of the multi-axis robot;

Releasing the filled flexible package from the flexible package filling unit;

20 Displacing the filled flexible package from the flexible package filling unit to the flexible package closing system in an upright position with a synchronized motion of the lift-assist platform and the multi-axis robot; and

Transferring the filled flexible package from the multi-axis robot to the flexible package closing system.

25 These actions require force and dexterity. Since these actions cannot be carried out by a system other than a big, strong and complex robot, the solution is to separate the actions requiring force from those requiring dexterity. The present invention uses the robot dexterity, but not its strength, thereby allowing the use of a smaller robot

7c

which is not strong enough to support the bag weight on its own. Thus, the robot is used to perform dexterous actions such as maintaining the gusset or side folds closed, maintaining the bag verticality and guiding the bag into the closing system. The use of a small robot is achievable since the weight of the bag is supported by
5 the platform which preferably comprises a conveyor, so the robot arm does not have to support the weight of the bag. The support actions which require force, such as bag weight support and bag transfer to the closing system, are performed separately by the conveyor. The bag is transferred to the closing system by synchronous motion of the conveyor belt, vertical motion of the conveyor and 3-D motion of the
10 robot. No load from the bag weight is supported by the robot. Vertical motion and

belt driving of the conveyor (powered by servomotors) are controlled by the robot, enabling synchronization of movements.

5 The reshaping action is performed by the bagger, on the spout, which provides a high quality gusset or side fold and simplifies the tool supported by the robot, thus allowing use of a small robot.

10 The present invention combines many interesting advantages: use of a small robot, small required footprint (almost a smaller footprint than for manual applications), and easily retrofittable. Furthermore, robots are well known in the industry for their exceptional reliability and safety of operation.

BRIEF DESCRIPTION OF THE DRAWINGS

15 These and other objects and advantages of the invention will become apparent upon reading the detailed description, provided merely by way of non-limitative examples, and upon referring to the drawings in which:

Figure 1 is a perspective view of the system according to a preferred embodiment of the present invention;

20

Figure 2 is another perspective view of the system shown in Figure 1;

Figure 3 is another perspective view of the system shown in Figure 1;

25 Figure 4 is another perspective view of the system shown in Figure 1;

Figure 5 is a front view of the system shown in Figure 1;

Figure 6 is a back view of the system shown in Figure 1;

Figure 7 is a left side view of the system shown in Figure 1; and

Figure 8 is a right side view of the system shown in Figure 1.

5

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

As shown in Figures 1 to 8, the present invention provides a system (100) for transferring and transporting a flexible package (102). The system (100) includes a
10 multi-axis robot (101) for transferring and displacing the flexible package (102) between a first position (namely a filling point) and a second position (namely a closing point). The system also includes a lift-assist platform (104) for transporting the flexible package (102). The lift-assist platform (104) substantially supports a weight of the flexible package (102). The lift-assist platform (104) comprises a
15 displacing system (4) for displacing and supporting the flexible package (102) upright between the first and second positions. The platform (104) is positioned within reach of the multi-axis robot (101).

Preferably, the multi-axis robot (101), in certain configurations, maintains the flexible
20 package (102) between the first position and the second position.

Preferably, the system (100) comprises a central controller (3) for synchronizing motion of the multi-axis robot (101) and the lift-assist platform (104).

25 Preferably, the multi-axis robot (101) is a five axis robot (1).

Preferably, the multi-axis robot (101) comprises a gripper (8) continuously maintaining a shape of at least a portion of a top of the flexible package (102) between the first and second positions.

30

Preferably, the gripper (8) comprises opposite side clamps (108) for grasping the flexible package (102). One of the opposite side clamps acts like an opposable thumb simulating the movement of a human hand for better manipulation of the flexible package.

5

Preferably, the displacing system (4) is a conveyor system (4).

According to the present invention, there is also provided a method for transferring and transporting a flexible package (102), comprising the steps of:

10 a) providing a system (100) comprising:

-a multi-axis robot (101) for transferring and displacing the flexible package (102) between a first position and a second position;

15

-a lift-assist platform (104) for transporting the flexible package (102), the lift-assist platform substantially supporting a weight of the flexible package (102), the lift-assist platform (104) comprising a displacing system (4) for displacing and supporting the flexible package (102) upright between the first and second positions, the platform (104) being positioned within reach of the multi-axis robot;

20

-a semi-automatic bagger (9) proximate the first position for filling the upright flexible package (102); and

-a closing system (7) positioned proximate the second position;

b) filling the flexible package (102) with a substance, using the semi-automatic bagger (9);

25

c) bringing together sidewalls of a top of the filled flexible package (102) in a package-closing configuration with the semi-automatic bagger (9);

d) raising the lift-assist platform (104) to substantially support the weight of the filled flexible package (102);

e) grasping and maintaining a shape of the top of the filled flexible package (102) in the package-closing configuration with the multi-axis robot (101);

30

f) releasing the filled flexible package (102) from the semi-automatic bagger (9);

- g) displacing the filled flexible package (102) towards an inlet of the closing system (7), through synchronized motion of the multi-axis robot (101) and the lift-assist platform (104), the displacing system (4) of the lift-assist platform (104) displacing the flexible package (102) laterally towards the closing system (7);
- 5 h) aligning the top of the flexible package (102) with the inlet of the closing system (7); and
- i) transferring the flexible package (102) from the multi-axis robot (101) to the closing system (7).
- 10 Preferably, the flexible package (102) is a bag (10) and the robot (1) continuously maintains an upper part of the bag (10).

As better shown in Figure 3, in a preferred embodiment of the invention, a robot (1) with a gripper (8) is placed on a support (2) which holds the controller (3). The platform (102) is preferably a support conveyor (4) (also referred to technically as a peripheral axis) mounted on the support (2). A servomotor (5) drives the up/down movement of the support conveyor (4). An exit conveyor (6) is located next to the support conveyor (4). A closing system (7) (preferably a sewing machine) is located over the exit conveyor (6). A semi-automatic bagger (9) is placed in front of the support conveyor (4).

15

20

Description of an operational cycle:

The system preferably operates according to the following steps:

- 25 -A filled bag (10) is ready at the spout (11) of the semi-automatic bagger (9);
- Sidewalls of the top of the filled bag are brought together in a package-closing configuration and the gussets are shaped by the spout of the bagger;
- The support conveyor (4) raises to support the weight of the filled bag (10) while the robot (1) moves to grab the top of the filled bag (10);
- 30 -The spout (11) releases the filled bag;

-Using its gripper (8), the robot (1) maintains the shape of the top of the filled bag (10) and keeps it vertical;

-In a synchronous motion, the support conveyor (4) moves down, the belt (12) of the support conveyor (4) starts moving to transfer laterally the bag to the closing system (7) and the robot (1), using its gripper (8), aligns the top of the bag (10) and transfers it to the closing system (7).

In one preferred embodiment of the present invention, the closing system (7) is a sewing machine which is an assembly of driving belts and a sewing head. The driving belts are used to support the top of the bag closed and drive the top of the bag at the correct speed to perform a good stitching. However, the closing system may use any number of different closing methods including adhesives, stitching, stapling, sealing, or adding a closure member, among others.

Preferably, when the bag (10) is being transferred to the closing system (7), the robot (1) and the belt (12) of the support conveyor (4) move at the same speed as the driving belts of the closing system.

Preferably, when the bag is transferred to the closing system, the bottom of the filled bag rests on an exit conveyor (6) adjacent to the support conveyor (4). The belt (13) of the exit conveyor (6) also moves at the same speed of the driving belts of the closing system (7).

The addition of the platform with a support conveyor in combination with the five axis robot results in a reduction in the required capabilities of the robot as it no longer has to be designed to support the weight of the items or bags being manipulated. The robot simply has to be designed for the specific manipulation operations it has carried out. This reduction in the required capabilities of the robot through the addition of the platform results in cost savings since a simpler robot may be used for the application.

As mentioned above, the system according to the present invention can be provided as a module that can then be retrofitted to an existing bagger and closing systems.

- 5 Although preferred embodiments of the present invention have been described in detail herein and illustrated in the accompanying drawings, it is to be understood that the invention is not limited to these precise embodiments and that various changes and modifications may be effected therein without departing from the scope or spirit of the present invention.

CLAIMS

1. A system for transporting and transferring a filled flexible package, having a top with an open mouth and a bottom, towards a flexible package closing system, the system comprising:
 - a lift-assist platform receiving the bottom of the flexible package in a filled state at a first position and supporting a substantial portion of a weight of the filled flexible package from the first position to a second position, vertically spaced-apart from the first position, the lift-assist platform comprising a displacing system to displace and support the filled flexible package in an upright configuration from the first position to the second position;
 - a multi-axis robot having a gripper configured to grasp the top of the filled flexible package in the first position and maintain the top of the filled flexible package during displacement and transfer to the second position; and
 - a controller operatively connected to the lift-assist platform and the multi-axis robot and synchronizing motion of the lift-assist platform and the multi-axis robot.
2. The system as claimed in claim 1, wherein the displacing system of the lift-assist platform further comprises a flexible package receiving surface and a vertical motion assembly to selectively raise and move down the flexible package receiving surface, the flexible package receiving surface receiving the bottom of the filled flexible package at the first position and supporting the substantial portion of the filled flexible package weight.
3. The system as claimed in one of claims 1 and 2, wherein the displacing system of the lift-assist platform comprises a support conveyor to displace laterally the filled flexible package supported thereon in an upright position.
4. The system as claimed in claim 3, wherein the displacing system of the lift-assist platform further comprises a vertical motion assembly to selectively raise and move down the support conveyor.

5. The system as claimed in any one of claims 1 to 4, wherein the controller synchronizes the multi-axis robot with a displacement of the lift-assist platform.
6. The system as claimed in any one of claims 1 to 5, wherein the first position is proximate to a flexible package filling unit configured to fill the flexible package.
7. The system as claimed in any one of claims 1 to 6, wherein the gripper comprises opposite side clamps configured to continuously maintain a shape of at least a portion of the top of the filled flexible package.
8. The system as claimed in any one of claims 1 to 7, wherein the gripper is mounted above the lift-assist platform and holds the top of the filled flexible package during displacement and transfer to the second position.
9. The system as claimed in any one of claims 1 to 6, wherein the gripper maintains a shape of the top of the filled flexible package between the first position and the second position.
10. A system for filling, transferring, transporting, and closing a flexible package having a top and a bottom, the system comprising:
 - a flexible package filling unit;
 - a flexible package closing system, spaced-apart from the flexible package filling unit;
 - a lift-assist platform receiving the bottom of the flexible package in a filled state and supporting a substantial portion of a weight of the filled flexible package during vertical displacement from the flexible package filling unit to the flexible package closing system and comprising a displacing system to displace and support the filled flexible package in an upright configuration towards the flexible package closing system;
 - a multi-axis robot having a gripper grasping the top of the filled flexible package from the flexible package filling unit and maintaining the top of the filled

flexible package during displacement and transfer towards the flexible package closing system; and

a controller operatively connected to the lift-assist platform and the multi-axis robot and synchronizing motion of the lift-assist platform and the multi-axis robot.

11. The system as claimed in claim 10, wherein the displacing system of the lift-assist platform further comprises a flexible package receiving surface and a vertical motion assembly to selectively raise and move down the flexible package receiving surface, the flexible package receiving surface receiving the bottom of the filled flexible package at the flexible package filling unit and supporting the substantial portion of the filled flexible package weight.
12. The system as claimed in one of claims 10 and 11, wherein the displacing system of the lift-assist platform comprises a support conveyor to displace laterally the filled flexible package supported thereon in the upright configuration.
13. The system as claimed in claim 12, wherein the displacing system of the lift-assist platform further comprises a vertical motion assembly to selectively raise and move down the support conveyor.
14. The system as claimed in any one of claims 10 to 13, wherein the controller synchronizes motion of the multi-axis robot with a displacement of the lift-assist platform.
15. The system as claimed in any one of claims 10 to 14, wherein the gripper comprises opposite side clamps with one of the side clamps being pivotally mounted and configurable between a flexible package engaged configuration and a disengaged configuration, with the opposite side clamps being configured to grasp the top of the filled flexible package in the flexible package engaged configuration.

16. The system as claimed in any one of claims 10 to 15, wherein the gripper is mounted above the lift-assist platform and holds the top of the filled flexible package during displacement and transfer to the flexible package closing system.
17. The system as claimed in any one of claims 10 to 16, wherein the gripper continuously maintains a shape of the top of the filled flexible package between the flexible package filling unit and the flexible package closing system.
18. A method for filling, transferring, and transporting a flexible package having a top and a bottom, the method comprising:
 - Providing a system comprising:
 - a flexible package filling unit;
 - a flexible package closing system, spaced-apart from the flexible package filling unit;
 - a lift-assist platform receiving the bottom of the flexible package in a filled state and supporting a substantial portion of a weight of the filled flexible package during vertical displacement from the flexible package filling unit to the flexible package closing system and comprising a displacing system to displace and support the filled flexible package in an upright configuration towards the flexible package closing system;
 - a multi-axis robot having a gripper grasping the top of the filled flexible package from the flexible package filling unit and maintaining the top of the filled flexible package during displacement and transfer towards the flexible package closing system; and
 - a controller operatively connected to the lift-assist platform and the multi-axis robot and synchronizing motion of the lift-assist platform and the multi-axis robot;
 - Filling the flexible package with the flexible package filling unit;

Displacing the lift assist platform to receive the bottom of the filled flexible package thereon and support the substantial portion of the weight of the filled flexible package;

Grasping and maintaining the top of the filled flexible package with the gripper of the multi-axis robot;

Releasing the filled flexible package from the flexible package filling unit;

Displacing the filled flexible package from the flexible package filling unit to the flexible package closing system in an upright position with a synchronized motion of the lift-assist platform and the multi-axis robot; and

Transferring the filled flexible package from the multi-axis robot to the flexible package closing system.

19. The method as claimed in claim 18, wherein displacing the lift assist platform to receive the bottom of the filled flexible package comprises raising the lift assist platform.
20. The method as claimed in one of claims 18 and 19, wherein grasping the top of the filled flexible package comprises grasping the top of the filled flexible package with opposite side clamps of the gripper of the multi-axis robot.
21. The method as claimed in any one of claims 18 to 20, wherein displacing the filled flexible package comprises moving down the lift assist platform and driving a belt of a support conveyor of the lift assist platform.
22. The method as claimed in claim 21, wherein displacing the filled flexible package further comprises displacing the gripper of the multi-axis robot in a synchronized motion with a displacement of the lift assist platform to displace laterally the filled flexible package.
23. The method as claimed in any one of claims 18 to 22, wherein transferring the filled flexible package comprises releasing the top of the filled flexible package from the

gripper of the multi-axis robot to the flexible package closing system and transferring the bottom of the filled flexible package from the lift assist platform to an exit conveyor, extending below the flexible package closing system.

24. The method as claimed in any one of claims 18 to 23, wherein displacing the filled flexible package further comprises maintaining the gripper above the lift-assist platform between the flexible package filling unit and the flexible package closing system and maintaining a shape of at least a portion of the top of the filled flexible package.
25. The method as claimed in any one of claims 18 to 24, further comprising bringing together sidewalls of the top of the filled flexible package in a package-closing configuration with the flexible package filling unit following filling the flexible package with the flexible package filling unit; and aligning the top of the filled flexible package with an inlet of the flexible package closing system before transferring the filled flexible package to the flexible package closing system.

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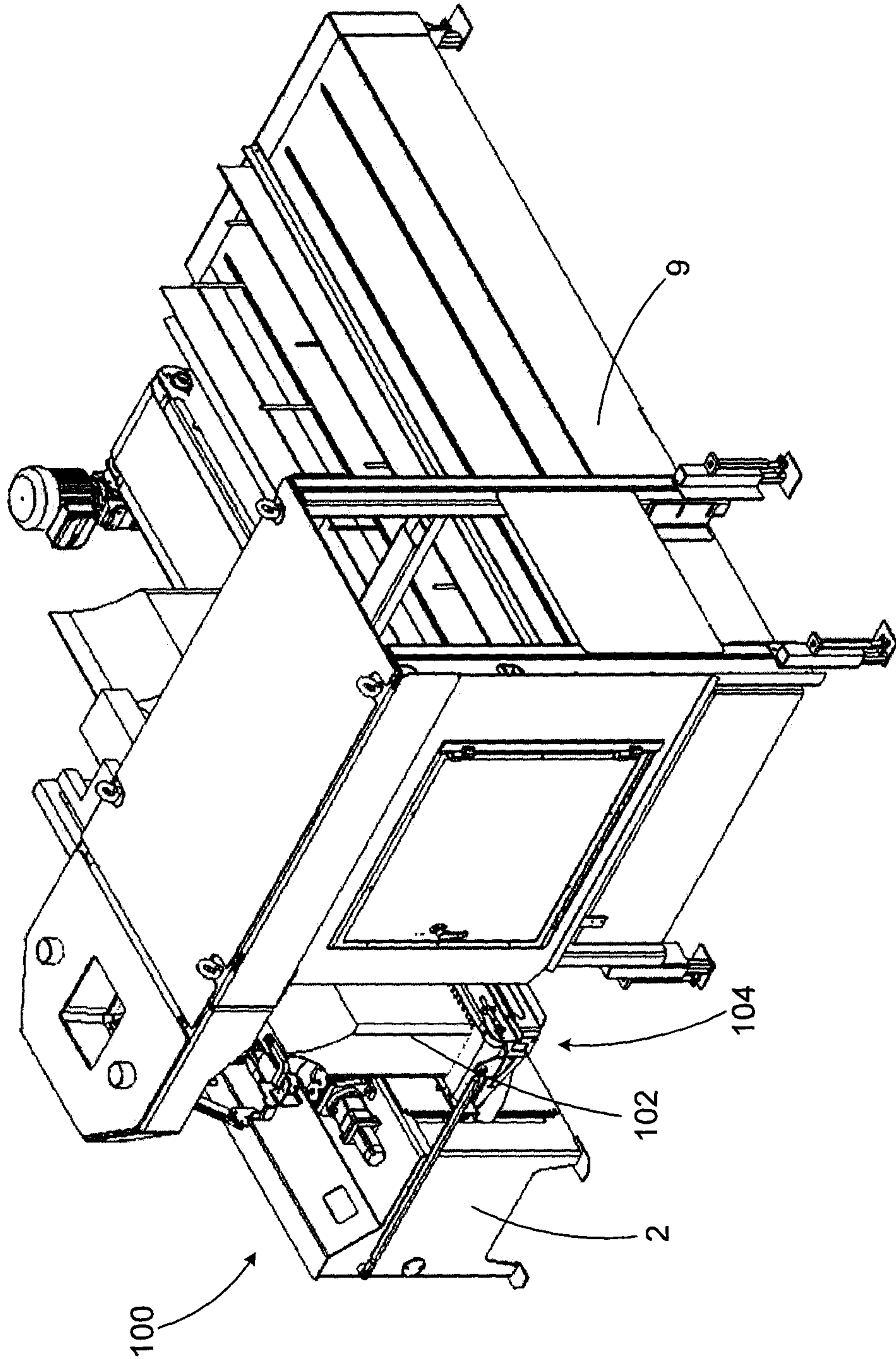


FIG. 1

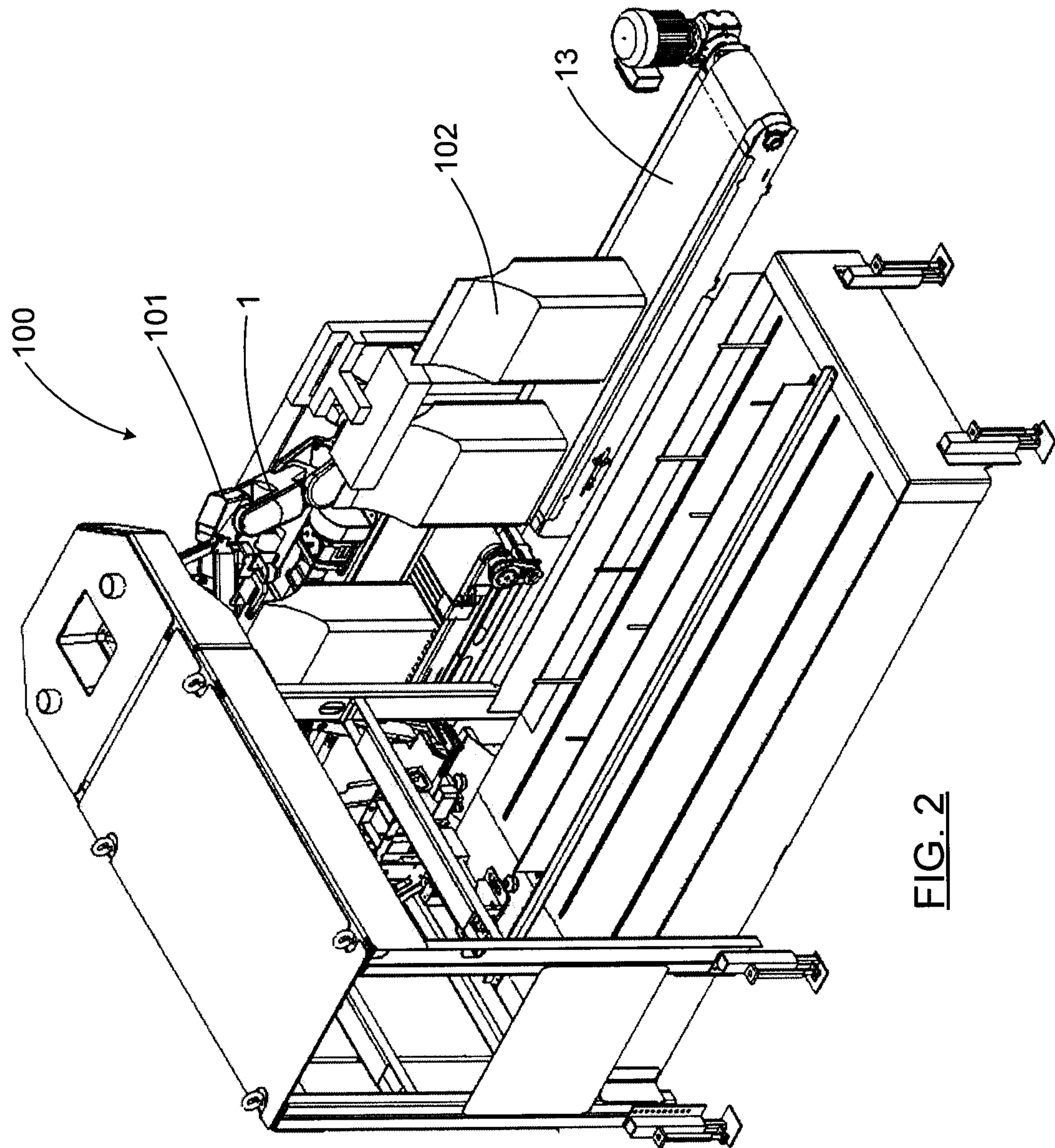


FIG. 2

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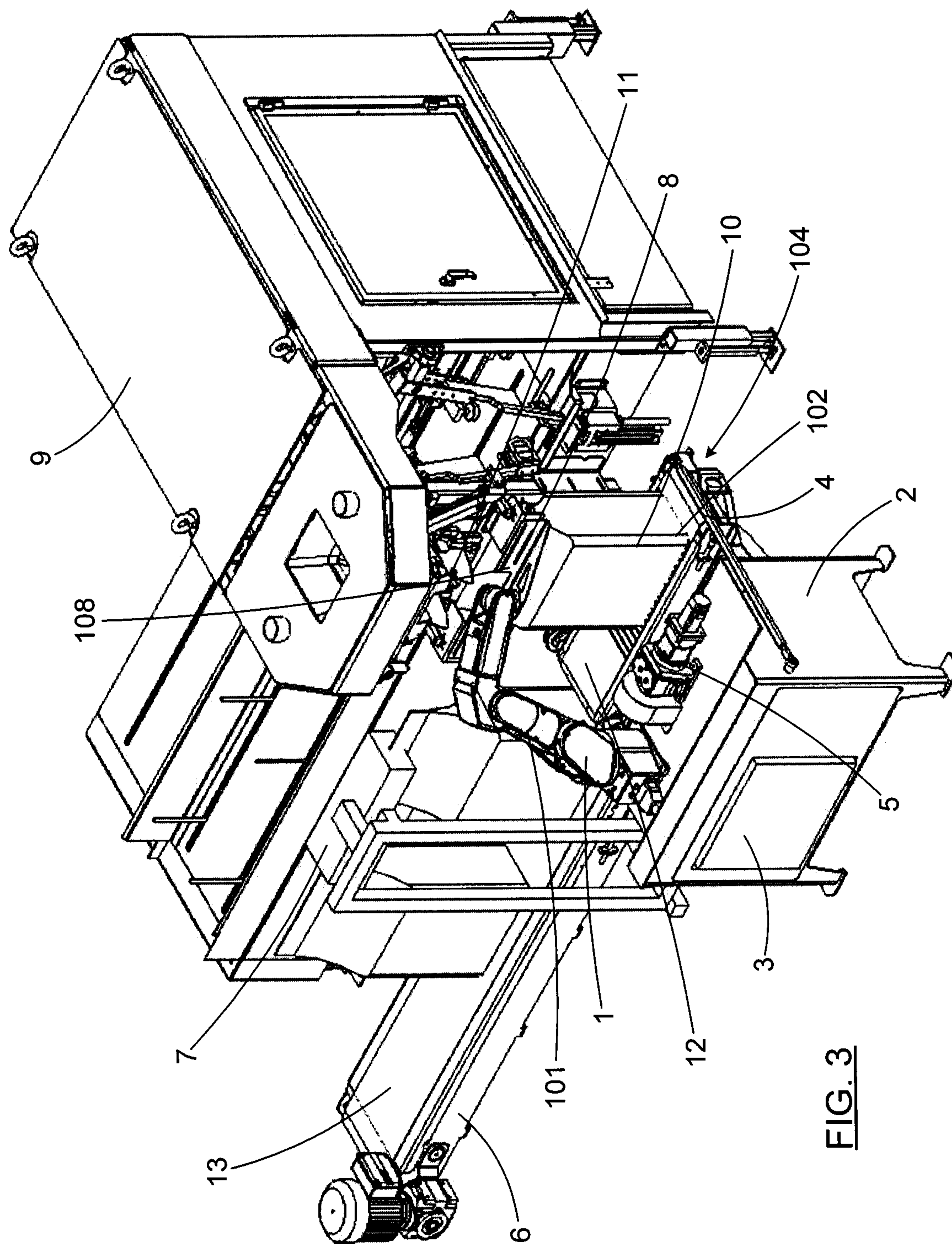


FIG. 3

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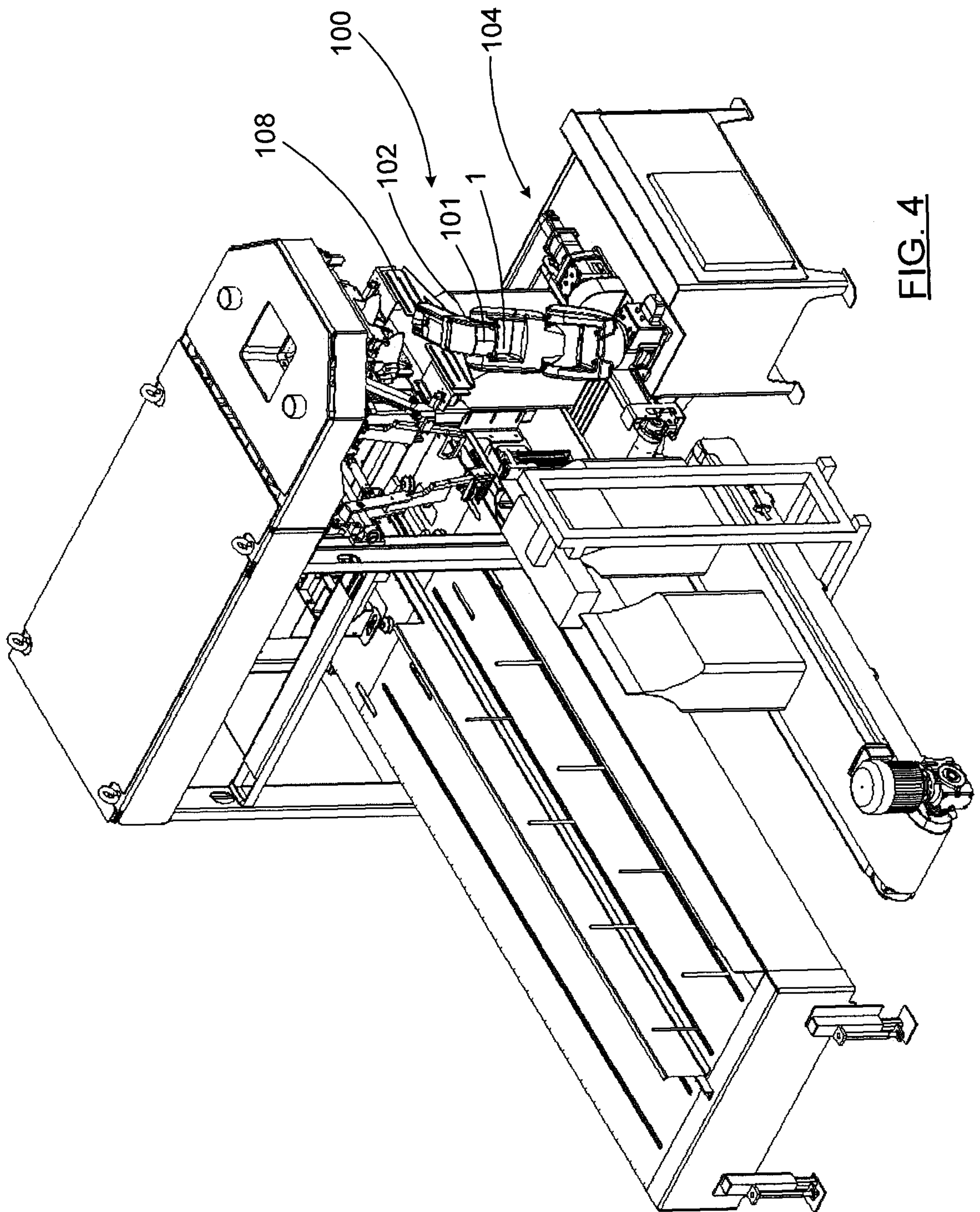


FIG. 4

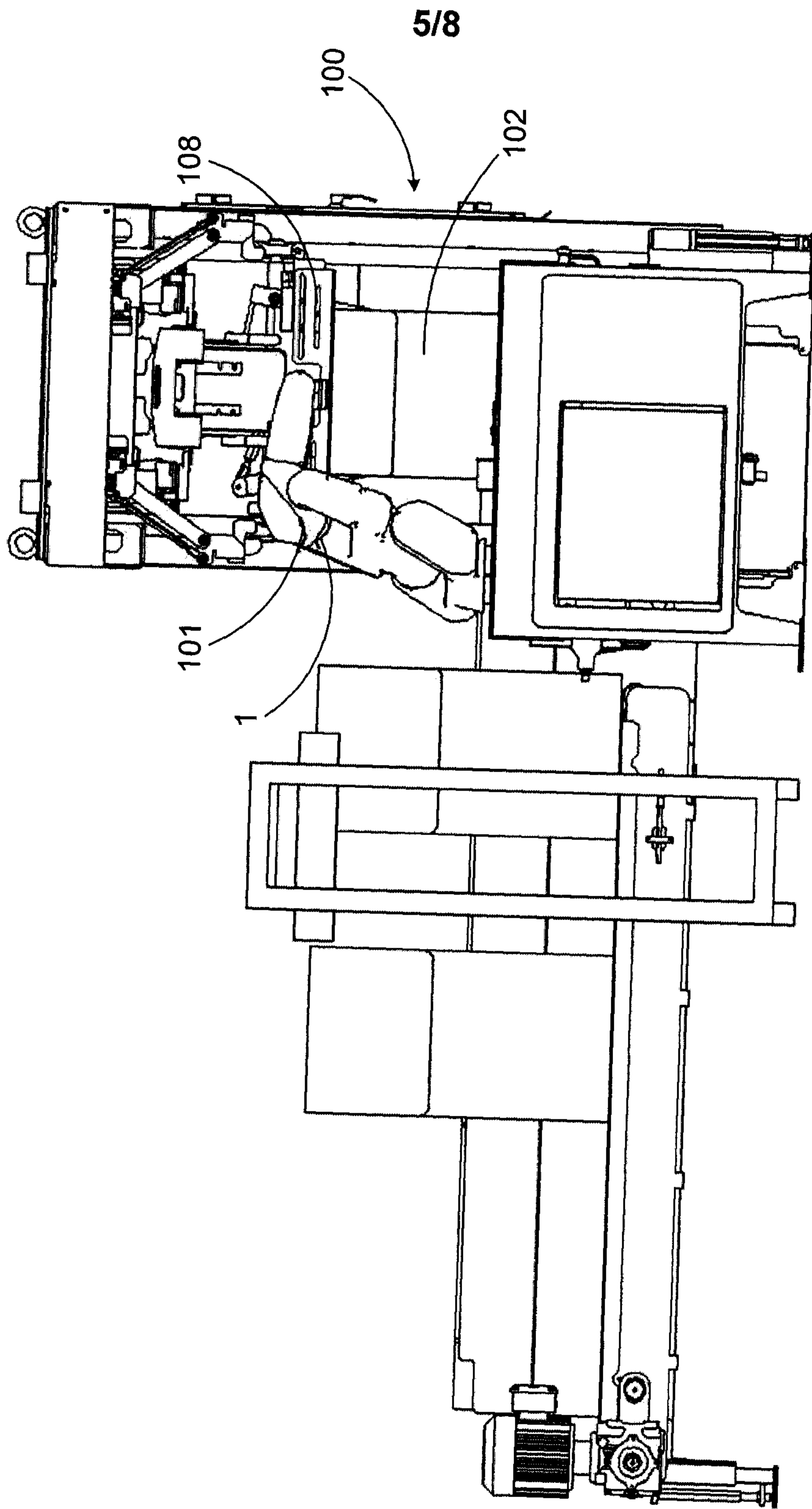


FIG. 5

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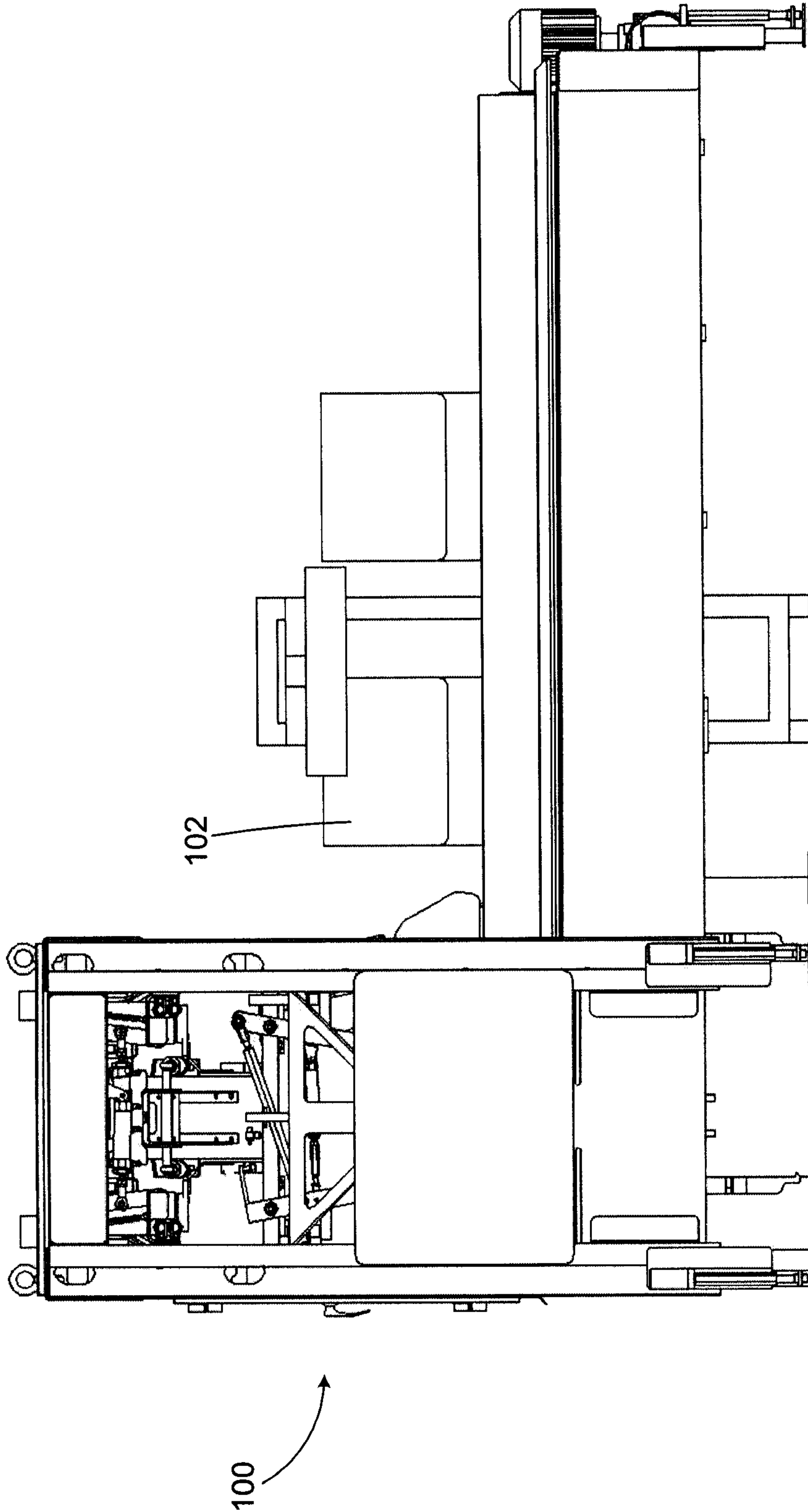


FIG. 6

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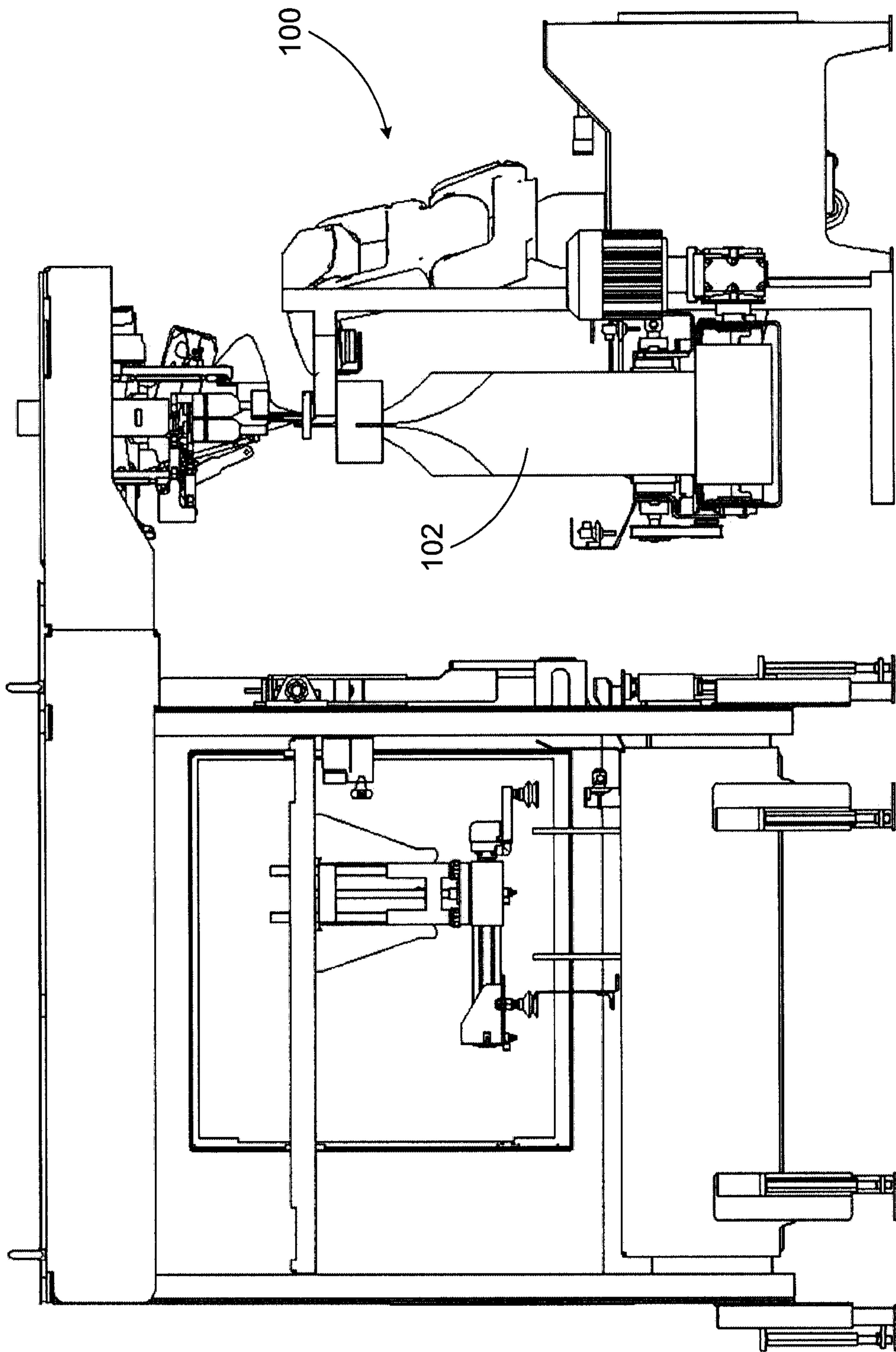


FIG. 7

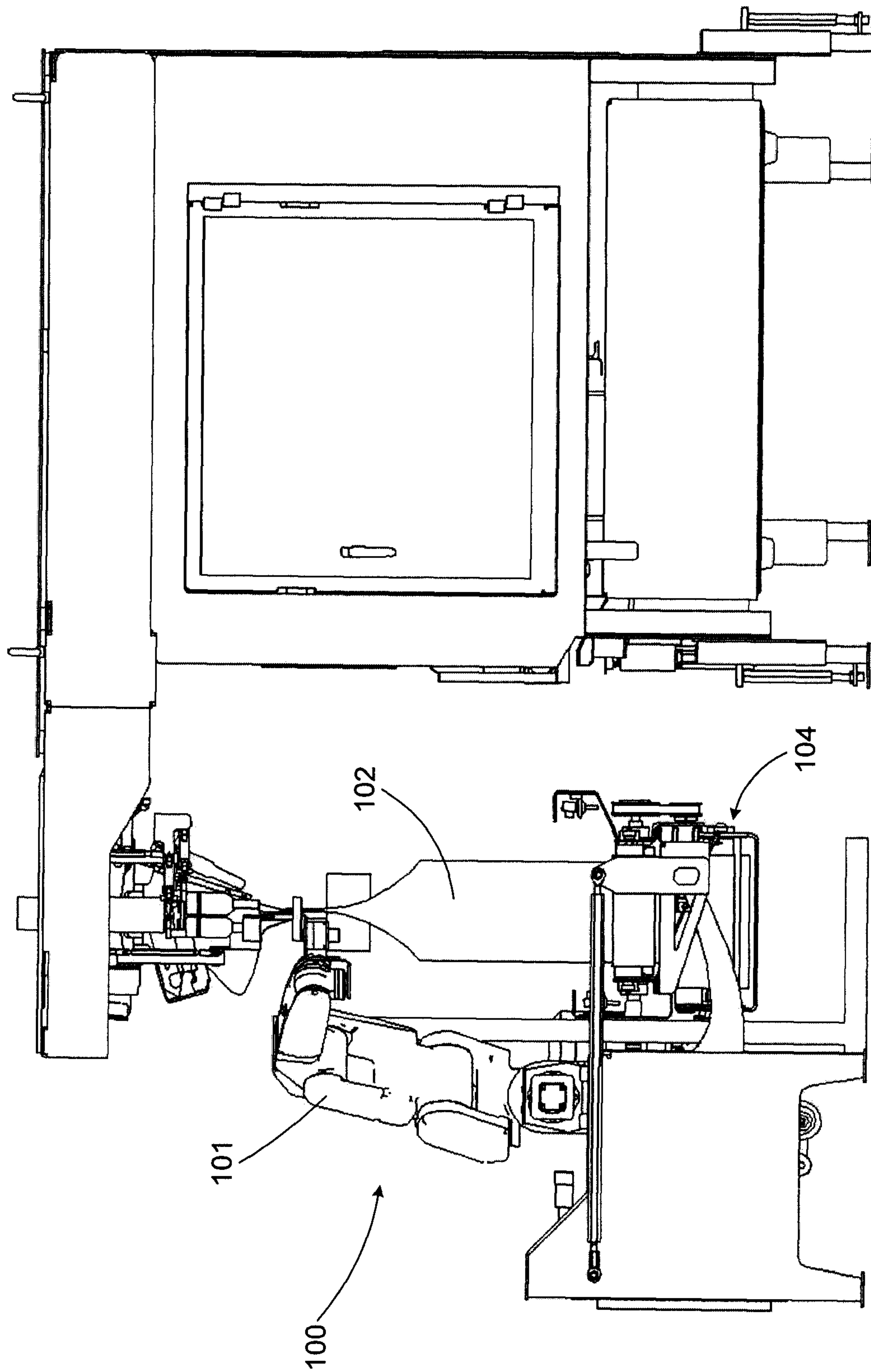


FIG. 8

