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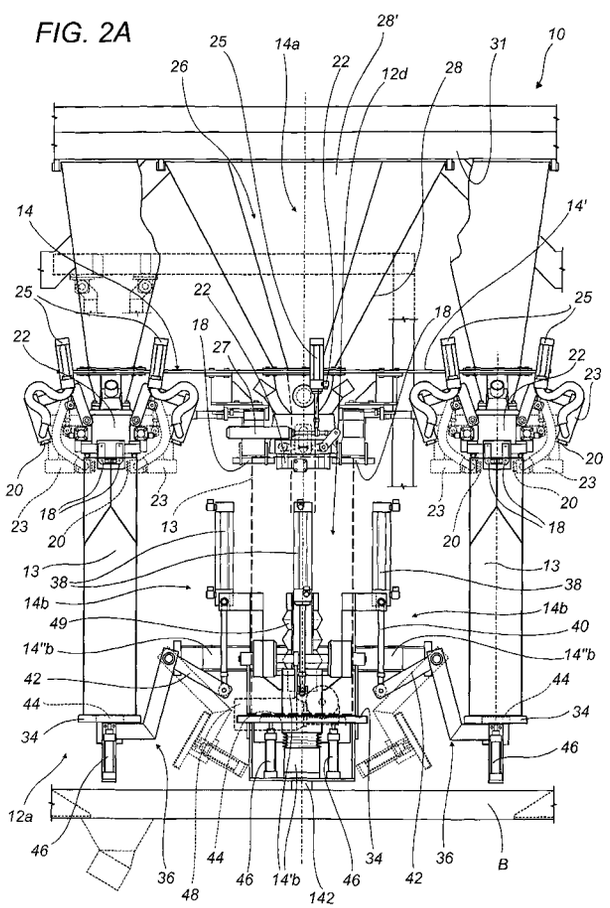
(54) A sack filling method and apparatus.

(57) A method and apparatus for filling sacks (13) with a predetermined quantity of product. The apparatus comprises at least one mobile sack feed and filling unit which carries each sack (13) along the process line and at the same time fills the product into it. In the method according to the invention, the empty sacks (13) are fed at the same speed as the mobile filling unit before they are transferred to the mobile filling unit itself.

FIG. 2A



EP 1 279 601 A2

Description

[0001] The present invention relates to a method and an apparatus for filling sacks.

[0002] The method and apparatus according to this invention are used in particular for filling sacks with a powdery or granular product such as flour or a similar type of product.

[0003] In prior art machinery used for this purpose, the sacks are stepped through the different stages in the sack filling process in stop-start fashion.

[0004] Thus, in prior art machinery, the sacks are loaded, filled and sealed at separate working stations, stopping at each station to allow a particular operation to be carried out before moving on to the next station. For each sack, the process cycle includes a first stop to enable the sack to be placed on the feed line.

[0005] This is followed by another stop to allow the sack to be filled with the granular product, after which the sack moves on to the sealing station where it stops again so that it can be sealed.

[0006] Although modern sack filling machinery is capable of performing these operations extremely quickly, the average operating speeds of the machines that adopt this type of process cycle tend to be rather low, and, as a result, the overall performance of the machinery is not entirely satisfactory.

[0007] Therefore, according to one aspect of it, the present invention provides a method for filling sacks with products of different kinds, in particular, powdery or granular products, wherein the sacks are filled while they are being fed forward.

[0008] This means that the sack filling apparatus operates continuously and can achieve average speeds that are higher than those of prior art machinery, thus improving the output and overall performance of sack filling lines.

[0009] According to another aspect of it, the present invention provides a method for transferring sacks to sack feed means in a sack filling apparatus, wherein the sacks are transferred to the feed means while they are being fed forward.

[0010] This means that the sack filling apparatus operates continuously and performs the step of transferring the sacks to the feed means without stopping, thus achieving average speeds that are higher than those of prior art machinery and improving the output and overall performance of sack filling lines.

[0011] Specifically, in the method according to the invention, the sacks are made to travel at the same speed as the feed means before they are transferred to the feed means.

[0012] According to yet another aspect of it, the present invention provides a method for transferring sacks to sack sealing means in a sack filling apparatus, where the sacks are transferred to the sealing means by the feed means without stopping the feed means.

[0013] This has the advantage of avoiding the need to stop each sack at the sealing station and of thus improving the productivity of the apparatus according to the invention.

[0014] The combination of the sack filling, transfer and outfeed steps, which are carried out continuously without stopping, also makes it possible to provide an apparatus where the sacks are not stopped during the entire process cycle and whose productivity can be maximised while at the same time reducing wear and minimising the risk of breaking machine parts due to excessive speeds to perform certain steps in the process.

[0015] Accordingly, the invention provides an advantageous apparatus for filling sacks.

[0016] The technical characteristics and advantageous aspects of the invention are apparent from the detailed description which follows, with reference to the accompanying drawings which illustrate a preferred embodiment of the invention provided merely by way of example without restricting the scope of the inventive concept, and in which:

- Figure 1 is a top view of the preferred embodiment of an apparatus according to the present invention;
- Figure 2A is an elevation view of the sack filling section of the preferred embodiment of the apparatus according to the present invention;
- Figure 2B is an elevation view of a part of the mounting frame of the apparatus according to the present invention;
- Figure 3 is a top view of a part of the preferred embodiment of the apparatus according to the present invention, showing the bottom of the mobile frame mounting the units that fill the sacks as they move;
- Figure 4A is a top view of the upper part of the carousel and shows the mobile product conveyor hoppers in the preferred embodiment of the apparatus according to the present invention;
- Figure 4B is an elevation view of the mobile hopper area;
- Figures 5A and 5B are top views showing, in two different operating conditions, the sack loading section of the apparatus where an empty sack is transferred to a mobile filling unit;
- Figure 6 is a front view showing only the unit that picks up the full sacks from the carousel in the preferred embodiment of the apparatus according to the present invention.

[0017] The accompanying drawings illustrate a preferred embodiment 10 of an apparatus according to the invention used to fill sacks with a granular or powdery product.

[0018] This apparatus advantageously enables the sacks to be filled as they move, without having to stop each sack during the filling step or during the other steps in the process, as is necessary in sack filling machines known up to now.

[0019] More specifically, in accordance with another

advantageous aspect of the invention, the sacks are transferred to the means that feed them during the filling step so that it is not necessary for the apparatus to stop to enable empty sacks to be loaded.

[0020] As shown in particular in Figures 1 and 2A, the preferred embodiment of the sack filling apparatus according to the invention advantageously comprises a plurality of mobile filling units, labelled 12a, 12b, 12c and 12d in the drawings. These are rotatably mounted on a frame 14 in such a way as to form a carousel that preferably rotates continuously.

[0021] In the preferred embodiment of the invention, there are four units for feeding and filling the sacks 13. These units are positioned at angular intervals of 90° from each other in such a way that while one of them is picking up an empty sack (in the working position shown in Figure 2A, the unit 12a), and another of them (in the working position shown in Figure 2A, the unit 12d) is dispensing a full sack to a subsequent unit 16 that seals it and unloads it full from the machine, the other two (in the working position shown in Figure 2A, the units 12b and 12c) are filling their sacks.

[0022] As illustrated, the apparatus according to the invention preferably comprises four sack feeding and filling units. The apparatus, however, might also have a different number of sack feeding and filling units. In another preferred embodiment, for example, the apparatus might have six mobile sack feeding and filling units positioned at angular intervals of 60° from each other.

[0023] As shown in particular in Figure 2A, each sack feeding and filling unit comprises grippers which hold and support the sacks by their lateral edges. In Figure 1, the grippers are labelled 18 and, being of a type well-known to experts in the trade, are not described in detail.

[0024] The grippers 18 arrive at the sack receiving position in the open or jaws-apart condition and are closed over the upper portion of the sack when the sack is transferred to them by the loading means. The loading means are described in more detail below.

[0025] The grippers 18, 18 catch hold of the sack at a level just above the where the sack is held by the loading means (described in more detail below). Thus, the upper edge of the sack is held by the loading means in a sufficiently vertical position to enable it to be easily positioned between the opposing jaws of the grippers 18, 18 of the mobile filling unit.

[0026] To engage and release the sack, the opposing jaws of the grippers 18, 18 are turned about a vertical plane, actuated by appropriate pneumatic cylinders mounted on each mobile filling unit.

[0027] As shown in more detail in Figure 2A, each sack feeding and filling unit also comprises suction cups. These suction cups, labelled 20 in Figure 1 and also of a type well known to experts in the trade, engage the upper portions of opposite faces of the sack and adhere to them thanks to a suitable vacuum so that, when the suction cups are moved apart, the upper opening of the sack is opened.

[0028] As illustrated, the suction means for opening the sack are positioned in such a way as to engage and open the opposite upper edges of the sack extending between the grippers 18, 18, in the position shown by the dashed line in Figure 2A, moving into the gap between the opposing grippers 18 that are holding the opposite lateral edges of the sack. Once the sack has been opened, the suction means release the central upper portion of the sack and move to the position shown by the continuous line in Figure 2A.

[0029] The grippers 18 hold the sack while the suction cups 20 move towards each other to engage the upper outer surface of the sack and then move apart to allow the lower end of the filler pipe, labelled 22 in the drawings, to be inserted into the sack. The filler pipe is not described in any detail since it is also of a type well known to experts in the trade.

[0030] To enable the opposite edges of the sack to be moved apart by the suction cups so that the downwardly extending end of the filler pipe can be inserted, the grippers 18, 18 slacken the upper portion of the sack by moving towards each other, actuated by pneumatic cylinders, preferably cylinders 18a, 18a, illustrated schematically in Figure 1, extending lengthways in the corresponding unit. In Figure 1, pneumatic cylinders labelled 18b, 18b impart on the jaws of the grippers 18, 18 the required gripping motion and preferably extend from a central position in the filling unit in a direction transversal to the unit.

[0031] As illustrated in the drawings, the sack filling suction means are supported by an arm 23 which is pivotally mounted on a portion of the frame of the mobile unit and which is actuated by a pneumatic actuator 25 that moves it between a first angular raised position of non-interference with the other parts of the apparatus, to the lowered angular positions mentioned above where the opposite edges of the sack are first engaged and then moved apart to permit insertion of the filler pipe.

[0032] In Figure 2A, the numeral 27 denotes a pneumatic actuator used to open and close the filler pipe.

[0033] Once the sack has been filled, the grippers 18, 18 release the full sack and transfer it to the next unit 16 (shown also in Figure 6), which, at the sack receiving zone, is equipped with a pair of opposing belts 24, 24, which - when at the sack receiving end - are moved relative to each other between a position where they are apart so that they can receive the sack and a position where they are close together so that they can engage and grip the sack.

[0034] Looking in more detail, this sack gripping movement is imparted by a pneumatic actuator 29, which engages a lever 31' attached to a supporting portion 24' of the end of one of the belts 24, the portion 24' being pivotally mounted at 24" (see Figure 6) to the frame of the apparatus in such a way as to swing the end of the belt 24 in a substantially horizontal plane so that it can receive and grip the sack, as shown in Figure

6.

[0035] Once the belts 24, 24 have caught hold of a sack, they feed it downstream in a straight line, as described in more detail below.

[0036] After transferring the full sack to the section 16, the grippers 18, 18 remain in the open or jaws-apart condition until they reach the empty sack loading zone.

[0037] The mobile mounting frame 14 comprises an upper portion 14a which, for each filling unit, mounts the sack grippers 18, 18, the sack opening suction means 20, 20 and the pipe 22 that fills the product into the sack.

[0038] The upper portion 14a of the mounting frame of the sack feed and filling units also mounts, at the top of the sack feed and filling zone, a hopper 26 for each of filling units 12a, 12b, 12c, 12d.

[0039] As better illustrated in Figures 4A and 4B, each of the hoppers 26 comprises a main hopper body which, in the direction of feed, presents an asymmetrical shape.

[0040] The body of each hopper 26 presents a longitudinal front wall 28', a longitudinal rear wall 28 opposite it, and side walls 28a, 28b converging downwardly towards a lower opening 30 that dispenses product to the filler pipe 22 below.

[0041] Looking in more detail, the rear hopper wall 28 makes a sharper angle with the horizontal than the wall 28' opposite it so as to form a large opening at the top of the hopper. More specifically, the upper opening of the hopper, formed by the upper profile 32' of the hopper itself, extends circumferentially backwards starting from a vertical position corresponding substantially to the lower opening 30, in such a way as to discharge a sufficient quantity of product to completely fill the sack.

[0042] Indeed, the product to be filled into the sacks is dispensed to the hopper 26 through a hole, which is not illustrated in the drawings, made in the fixed top cover plate T' of the apparatus and the angular length of the upper opening of the hopper is such as to enable the require quantity of product to be discharged as the hopper itself moves forward.

[0043] As illustrated in particular in Figures 2A and 3, the rotating frame comprises, in addition to the upper section 14a, a lower section 14b, which rotates together with the upper section 14a and which is adjustably mounted for height relative to the latter so that the apparatus can be adapted to different sack sizes.

[0044] The lower frame 14b mounts, for each mobile filling unit, a lower board 34 to support the sack 13, the board 34 being mounted on a pair of L-shaped brackets 36 which are connected to the lower frame section 14b in such a way that they rotate in a vertical plane and which are actuated by pneumatic cylinders 38.

[0045] The rods 40 of the cylinders 38 engage an extension 42 of each bracket 36 in such a way as to move the board 34 between a horizontal or raised position in which it supports the sack and a lowered or retracted position which enables the rotating apparatus to turn freely without interfering with other components, especially with the conveyor belt 25 of the sack outfeed unit shown in Figure 6.

[0046] The sack supporting board includes an element or strip, labelled 44 in Figure 1, designed to stop the bottom of the sack and alternately driven by pneumatic cylinders 46 in such a way that it repeatedly strikes the bottom of the sack in order to distribute the product evenly within the sack.

[0047] The raising of the lower section of the rotating apparatus is advantageously accomplished by a motor, labelled 48 in Figure 1, that drives an appropriate rack, which is not illustrated, connected to the lower frame section 14b.

[0048] Another electric motor rotates the entire frame 14 and the filling units mounted on the frame 14. This drive motor is not illustrated in Figure 2A.

[0049] The drive transmission mechanisms enabling the rotation and relative vertical motion between the upper and lower sections are well known to experts in the trade and are housed within a central zone covered by a concertinaed tubular element 49 made of a flexible material which opens and closes axially in multiple folds in such a way as to follow the movements of the lower section 14b.

[0050] As shown in particular in Figure 2B, the means for supporting the apparatus according to the invention comprise a fixed frame I including a trestle with columns C (viewed from above in Figure 1), that support a first quadrangular beam T and a second top cover plate T'.

[0051] As can be seen in particular in Figures 2A and 2B, the mobile apparatus comprises a circular plate 14', which supports the upper sections of the mobile units, that is to say, the grippers 18, 18, the suction means, the filler pipes 22 extending downwardly from the circular plate, and the hoppers 26 extending upwardly from the circular plate. The circular plate 14' is perforated at the openings through which the product passes from the hoppers 26 to the underlying filler pipes 22.

[0052] In addition, the apparatus mounting means comprise a lower fixed base B, illustrated in Figure 2A, to which the lower frame section 14b is connected in freely rotatable fashion.

[0053] In particular, as can be seen also in Figure 3, the lower mobile frame section 14b comprises a central shaft 14'b and a plurality of radial arms 14"b that support the lower sections of the mobile filling units 12a, 12b, 12c, 12d.

[0054] The plate 14' is rotatably mounted on the trestle by appropriate means extending from the central plate and slidably engaging with the quadrangular beam T.

[0055] Means for guiding the circular motion of the frame 14 are included. As shown in Figure 2B, the means for guiding the circular motion of the frame 14 comprise a circular surface 141, which is defined by a tubular portion centrally positioned on the top cover plate T' and which contacts the outer surface 143 of a central supporting column 145 of the circular plate 14'.

[0056] Further, as illustrated in Figure 2A, the means for guiding the circular motion of the frame 14 comprise a vertical rod 142 extending downwardly from the central shaft 14'b that mounts the bottom section 14b of the fixed frame.

[0057] As shown in Figures 5A and 5B, the means 50 for transferring the sack to a corresponding sack feed and filling unit comprise gripper means designed to hold the sack and being equipped with elongated opposing jaws 52, 52 actuated by pneumatic cylinders 53 mounted on a frame 54.

[0058] The frame 54 moves along a linear path which, at the zone where the sack is transferred to the sack feed and filling unit - illustrated by the dashed line in Figure 5B, labelled 12 in its entirety - is substantially tangent to the circular path followed by the filling unit 12.

[0059] With reference to Figures 5A and 5B, the sack pickup and transfer means 52, 52 are driven by a pneumatic cylinder 55 from a retracted position (shown in Figure 5A) where the sack is received from corresponding lifting means, described in more detail below, to an advanced position (shown in Figure 5B) where the sack is transferred to a corresponding mobile filling unit 12.

[0060] During this linear movement, the frame 54 and the gripper 52, 52 mounted on it, are accelerated until they reach the same tangential speed as the sack grippers 18, 18 of the mobile rotating sack filling units.

[0061] By the time the grippers 52, 52 holding the top of the sack have reached the same speed as the mobile filling units, the upper edge of the sack is between the open grippers 18, 18 of the mobile filling unit, as illustrated in Figure 5B. At this point, the grippers 18, 18 close and the gripper 52, 52 of the transfer or linear acceleration unit open to release the empty sack to the corresponding mobile filling unit.

[0062] To enable this linear movement, the frame 54 has an offset part 54a which projects from the part 54b that mounts the gripper 52, 52 towards the zone of the rotating carousel that mounts the mobile filling units. This mounting part 54a of the frame 54 slides through bushes 58 on a pair of guide rods 56, the latter being fixed to the machine frame, which also has fixed to it, through the plate 57, the cylinder 55, the free end of whose mobile rod 55' is connected to the part 54a of the linearly mobile frame 54.

[0063] As illustrated, this part 54a is attached to a pair of bushes 58 enabling it to slide on the fixed guide rods 56, which have a circular cross section and on which another two bushes 58, 58 slide axially, the latter being attached to the front part of the portion 54b of the mobile frame 54.

[0064] Figure 5A illustrates a step in which the empty sack lifting means, labelled 60 in their entirety, transfer the sack to the linearly mobile gripping means 52, 52.

[0065] The empty sack lifting means 60 pick up the empty sack at the end of the conveyor belt 61 (clearly shown in Figure 1), on which the empty sacks are lined up, and comprise a pair of grippers (labelled 62, 62 in Figure 5A and actuated by respective pneumatic cylinders 63', 63'), each mounted on an arm 64, 64 which is rotatably connected to the machine at a point above the end of the conveyor belt 61 where the sack is picked up.

[0066] The arms 64, 64 are driven by a corresponding pneumatic cylinder which makes them perform an angular rotation in a vertical plane between a lowered position where the arms 64, 64 extend downwards vertically and the grippers 62, 62 grip the sides of the sack to pick it up from the conveyor 61, and a raised position where the arms 64, 64 are substantially horizontal and the grippers 62, 62 are ready to open, as illustrated in Figure 5A, to transfer the sack to the gripper 52, 52 above it which is designed to accelerate the sack tangentially. The step of lifting the sack is not illustrated in detail in the accompanying drawings.

[0067] To perform this sack transfer operation easily, the grippers 62, 62 of the lifting unit 60 grip the sack at a zone below the zone where the sack is gripped by the tangential acceleration gripper 52, 52.

[0068] When the lifting means 60 are in the raised position, the upper edge of the sack is inserted between the jaws 52, 52 of the linear acceleration unit 50, as illustrated in Figure 5A. After releasing the sack 13, they return to the lowered position to pick up the next sack from the feed belt 61.

[0069] In figure 5A the numerals 63', 63' denote pneumatic cylinders mounted on the arms 64, 64 and designed to open and close the grippers 62, 62.

[0070] With reference to Figures 1 and 6, the downstream unit 16 for sealing the sack and feeding it out of the machine extends on one side of the filling unit, where the carousel 14 operates, and on one side of the empty sack feed belt 61. The sack sealing and outfeed unit 16 comprises pair of opposing belts 24, 24, extending in a straight line, which transfer the full sack along a defined linear path between the sack sealing stations, illustrated schematically in Figure 1, and feed the sealed sack out from the end opposite end where the full sack is received from the carousel.

[0071] These straight, opposing belts 24, 24 are positioned above a conveyor belt, labelled 25 in Figure 6, which supports the bottom of the sack 13. The conveyor 25 extends horizontally parallel with the belts 24 and supports longitudinal rods 27, which engage the outer profile of the sacks forming lateral guide means for the sacks themselves.

[0072] As shown schematically in Figure 1, the sack sealing operation is performed by a station 63 that trims or cuts the upper edge of the sack, a station 65, immediately downstream of it, that applies glue to the upper edge of the sack, a first folding station 67 that brings this edge, with glue applied to it, into contact with an underlying outside surface of the upper portion of the sack so that it adheres, and a second folding station 69 that enables the sack to be sealed. These operations are performed with the sack orientated sideways in the direction of feed and moving in a straight line without stopping

towards the outfeed station.

[0073] The full sack might also be sealed by stitching or heat sealing.

[0074] As illustrated in Figure 1, the present sack filling and sealing machine essentially comprises a magazine 8 designed to house a plurality of piles of empty sacks to be fed into the machine, a section 9, downstream of this magazine, which aligns the sacks on the conveyor belt 61, which extends parallel to the sack outfeed and top sealing line 16, and which carries the sacks towards an end pickup position where a sack lifting unit 60 transfers them to the unit 50 that feeds them to the rotating sack filling carousel.

[0075] As illustrated in the drawings, the present apparatus has a substantially L-shaped configuration having the advantage of being extremely compact and easy for personnel to access in the event of a fault, when the machine has to be reset and restarted, or for the purposes of maintenance and repairs.

[0076] In the filling apparatus described above, the sacks follow an angular path through approximately 270°.

[0077] Thus, the total distance they travel is short and the duration of the filling process cycle is reduced to a minimum. Although the angular path through 270° is preferable, a different angular path through a different angle (greater or less than 270°) is also possible.

[0078] Moreover, the sacks are filled within an angular interval that does not exceed 90°. Thus, the sack is easily filled without imparting excessive centrifugal forces which might hamper filling operations.

[0079] In the present apparatus, the sacks are transferred to the sack sealing means 16 by the feed and filling means 12 without stopping the feed means 12 themselves. More specifically, as the sacks are transferred to the sealing means 16 by the feed means 12 they move in a substantially linear direction tangent to the circular path along which the sacks themselves were previously fed by the feed means 12.

[0080] To transfer a full sack to the belts 24, 24 of the sack top sealing unit 16, the sack gripping means 18, 18, of the corresponding mobile unit 12 release the upper edge of the sack sequentially as the upper edge reaches the belts. In practice, the gripper 18 that is at the front, in the angular direction of feed, is opened to release the sack before the opposite gripper 18, which, in said direction of feed, is behind it. Thus, the front gripper 18, which is the first to reach the belts 24, 24, releases the upper edge of the sack as soon as it is picked up by the belts. The other gripper 18, which next reaches the belts, releases the sack as soon as it arrives at the front end of the belts, which, in the meantime, have fed the front portion of the sack forward, as can be seen in Figure 6.

[0081] It should be noticed that at the linear acceleration means of the sacks, the sack gripper 52, 52 and the cylinder that drives it in a straight line, might be substituted by a pair of opposing belts to hold the sacks and feed them in a straight line, such belts being equipped with means to move them together in such a way that they catch hold of the sacks, as well as means to move them apart in such a way that they release the sacks and transfer them to the unit downstream.

[0082] Feed belts of this type might also be used at any other point in the apparatus where required or convenient.

[0083] It will be understood that the invention can be subject to modifications and variations without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by technically equivalent elements.

Claims

1. A method for filling sacks with products of different kinds, in particular, powdery or granular products, **characterised in that** the sacks are filled while they are being fed forward.

2. A method for transferring sacks to sack feed means in a sack filling apparatus, **characterised in that** the sacks are transferred to the feed means while they are being fed forward.

3. The method according to claim 2, **characterised in that** the sacks are made to travel at the same speed as the feed means before they are transferred to the feed means.

4. The method according to any of the foregoing claims, **characterised in that** the sack feed means follow a circular feed path.

5. The method according to any of the foregoing claims, **characterised in that** the means for transferring the sacks to the feed and filling means follow a linear path which, at the zone where the sack is transferred, is substantially tangent to the circular path followed by the feed means; the transfer means, when they are at the sack transfer zone, travelling at the same tangential speed as the feed and filling means.

6. The method according to any of the foregoing claims, **characterised in that** the sacks follow an angular path through approximately 270°.

7. The method according to any of the foregoing claims, **characterised in that** the sacks are filled within an angular interval that does not exceed 90°.

8. A method for transferring sacks to sack sealing means in a sack filling apparatus, **characterised in that** the sacks are transferred to the sealing means by the feed and filling means without stopping the

feed and filling means.

9. The method according to claim 8, **characterised in that** as the sacks are transferred to the sealing means by the feed means they move in a substantially linear direction tangent to the circular path along which the sacks themselves were previously fed by the feed and filling means.

10. The method according to any of the foregoing claims, **characterised in that** the sacks are fed forward on means that support them at an adjustable height.

11. An apparatus for filling sacks with a predetermined quantity of product, especially a granular or powdery product, the apparatus comprising means for feeding the sacks, means for transferring the sacks to the feed means and means for filling the sacks, **characterised in that** it comprises at least one mobile unit (12a, 12b, 12c, 12d) for feeding and filling a corresponding sack (13), the mobile unit (12a, 12b, 12c, 12d) comprising means (14a) that support means (18, 18) for gripping and holding the sack and means (22) for filling the sack; means also being provided to feed the mobile unit along a defined path.

12. The apparatus according to claim 11, **characterised in that** it comprises a plurality of mobile units (12a, 12b, 12c, 12d) for feeding and filling the sacks (13).

13. The apparatus according to claim 11 or 12, **characterised in that** the mobile units (12a, 12b, 12c, 12d) for feeding and filling the sacks follow a circular feed path.

14. The apparatus according to any of the foregoing claims from 11 to 13 or according to the preamble to claim 11, **characterised in that** the means (50) for transferring the sacks comprise means (54) which support means (52, 52) for gripping and releasing the sacks, said support means (54) being driven at the same speed as the mobile feed and filling units (12a, 12b, 12c, 12d) to enable the sack (13) to be transferred to the corresponding feed and filling unit (12a, 12b, 12c, 12d) itself.

15. The apparatus according to any of the foregoing claims from 11 to 14, **characterised in that** the means (50) for transferring the empty sack to one of the mobile feed and filling units (12a, 12b, 12c, 12d) follow a path that presents at least one section extending in a direction substantially tangent to the path followed by the sack holding means (18, 18) of the mobile filling unit.

16. The apparatus according to any of the foregoing claims from 11 to 15, **characterised in that** the mobile units (12a, 12b, 12c, 12d) for feeding and filling the sacks are mounted on a rotating mounting frame (14).

17. The apparatus according to any of the foregoing claims from 11 to 16, **characterised in that** the filling means on the mobile unit (12a, 12b, 12c, 12d) comprise a filler pipe (22) which discharges the product into the sack (13).

18. The apparatus according to any of the foregoing claims from 11 to 17, **characterised in that** each mobile feed and filling unit (12a, 12b, 12c, 12d) comprises means (14b) for supporting the bottom of the sack, said means being adjustably mounted for height so as to adapt to sacks (13) of different sizes or heights.

19. The apparatus according to any of the foregoing claims from 11 to 18, **characterised in that** each mobile feed and filling unit (12a, 12b, 12c, 12d) comprises means for stopping the bottom of the sack, said means being adjustably mounted for height so as to adapt to sacks of different sizes or heights.

20. The apparatus according to any of the foregoing claims from 11 to 19, **characterised in that** the mounting frame (14) of the mobile feeding and filling units comprises a rotatable, vertically fixed upper section (14a) and a lower section (14b) that can be adjusted in height relative to the upper section (14a) and that is operatively connected to, and rotatable with, the latter, the means for supporting the bottoms of the sacks and/or the means for stopping the bottoms of the sacks being mounted on the frame lower section (14b).

21. The apparatus according to any of the foregoing claims from 11 to 20, **characterised in that** the mobile filling unit (12a, 12b, 12c, 12d) comprises at least one upper hopper (26) that moves together with the mobile filling unit and has a lower opening (30) for discharging the product into a corresponding filler pipe (22) and an upper opening (32) for receiving the product.

22. The apparatus according to claim 21, **characterised in that** the upper opening (32) in the hopper (26) communicates with a hole made in a fixed upper flange (T') and is elongated in the direction opposite the feed direction so that a sufficient quantity of product to completely fill the sack can be discharged into the hopper.

23. The apparatus according to any of the foregoing

claims from 11 to 22, **characterised in that** each mobile feed and filling unit (12a, 12b, 12c, 12d) comprises suction means for opening the top of the sack (13).

24. The apparatus according to any of the foregoing claims from 11 to 23, or according to the preamble to claim 11, **characterised in that** it comprises a longitudinal section (16) that extends along one side of the filling section and that is designed to seal the top of the sack and feed the sack out of the apparatus.

25. The apparatus according to claim 24, **characterised in that** the sacks are transferred to the sealing means (16) by the feed and filling means (12a, 12b, 12c, 12d) without stopping the feed and filling means (12a, 12b, 12c, 12d).

26. The apparatus according to claim 24 or 25, **characterised in that** as the sacks are transferred to the sealing means (16) by the feed and filling means (12a, 12b, 12c, 12d) they move in a substantially linear direction tangent to the circular path along which the sacks themselves were previously fed by the feed and filling means (12a, 12b, 12c, 12d).

27. The apparatus according to any of the foregoing claims from 11 to 26, **characterised in that** the apparatus mounting means comprise a fixed frame (C, T, T', B) that rotatably mounts the frame (14a, 14b) which mounts the mobile filling units (12a, 12b, 12c, 12d).

28. The apparatus according to any of the foregoing claims from 11 to 27, **characterised in that** the lower mobile frame section (14b) comprises a central shaft (14'b) and a plurality of radial arms (14"b) that support the lower sections of the mobile filling units (12a, 12b, 12c, 12d).

29. The apparatus according to any of the foregoing claims from 11 to 28, **characterised in that** it comprises means for guiding the circular motion of the frame (14).

30. The apparatus according to claim 29, **characterised in that** the means for guiding the circular motion of the frame (14) comprise a circular surface (141) which slidably engages an outside surface (143) of a central column (145) that mounts a plate (14') which supports the mobile feed and filling units (12a, 12b, 12c, 12d).

31. The apparatus according to any of the foregoing claims from 29 to 30, **characterised in that** the means for guiding the circular motion of the frame (14) comprise a vertical rod (142) extending downwardly from the central shaft (14'b) that mounts the bottom section (14b) of the mobile frame.

32. The apparatus according to any of the foregoing claims from 11 to 31, **characterised in that**, seen from above, the apparatus has a substantially L-shaped configuration.

33. The apparatus according to any of the foregoing claims from 11 to 32, **characterised in that**, to transfer the full sack to the sack sealing means (16), the sack gripping means (18, 18) of the corresponding mobile unit release the upper edge of the sack sequentially as they reach the sack receiving means (24, 24) of the sealing means (16).

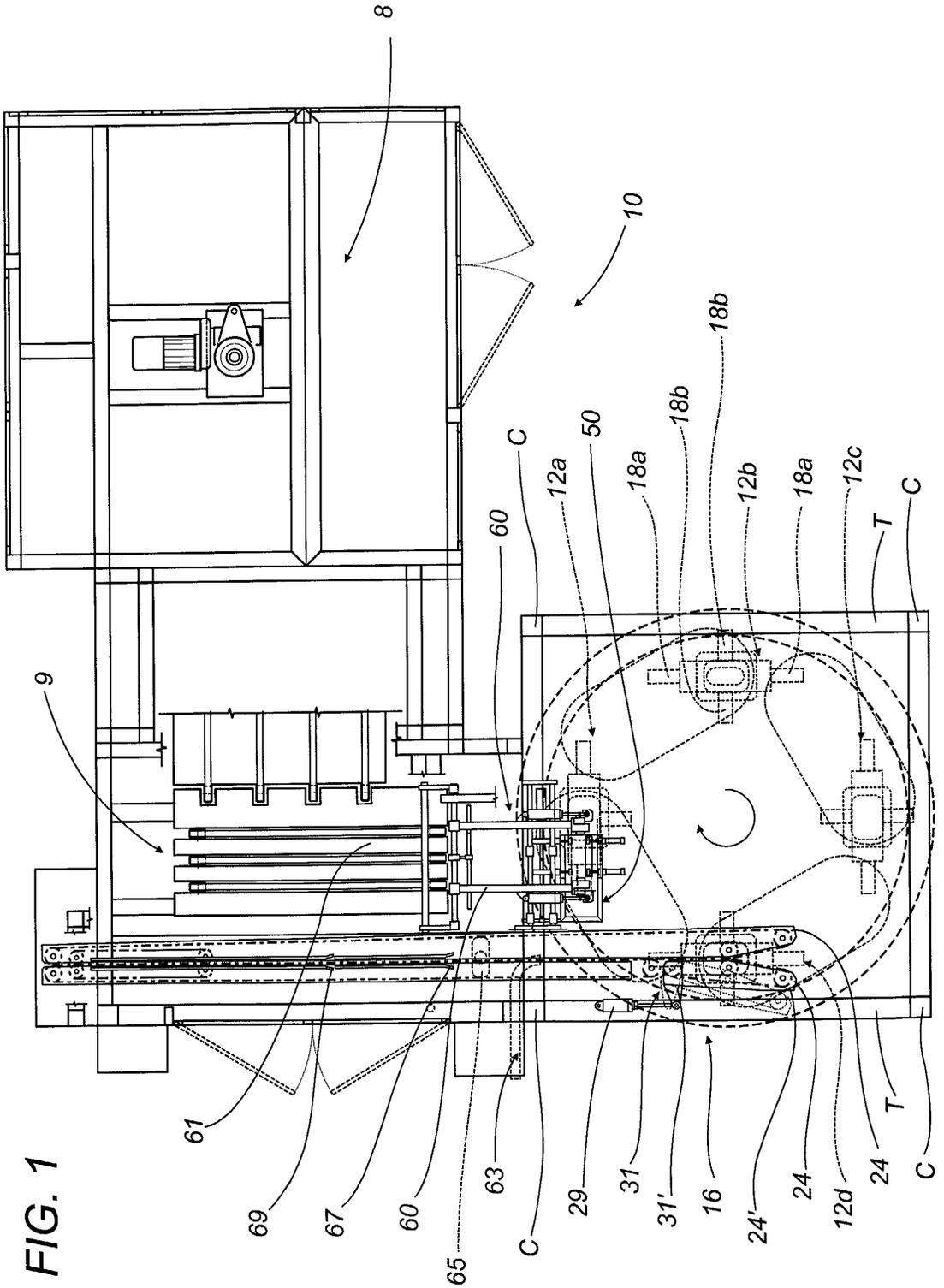

8
10
9
C
60
12a
50
18a
18b
18b
12b
18a
12c
T
C
61
69
67
60
65
63
C
29
31
31'
16
24'
24
12d
24
T
C

FIG. 1

FIG. 2A

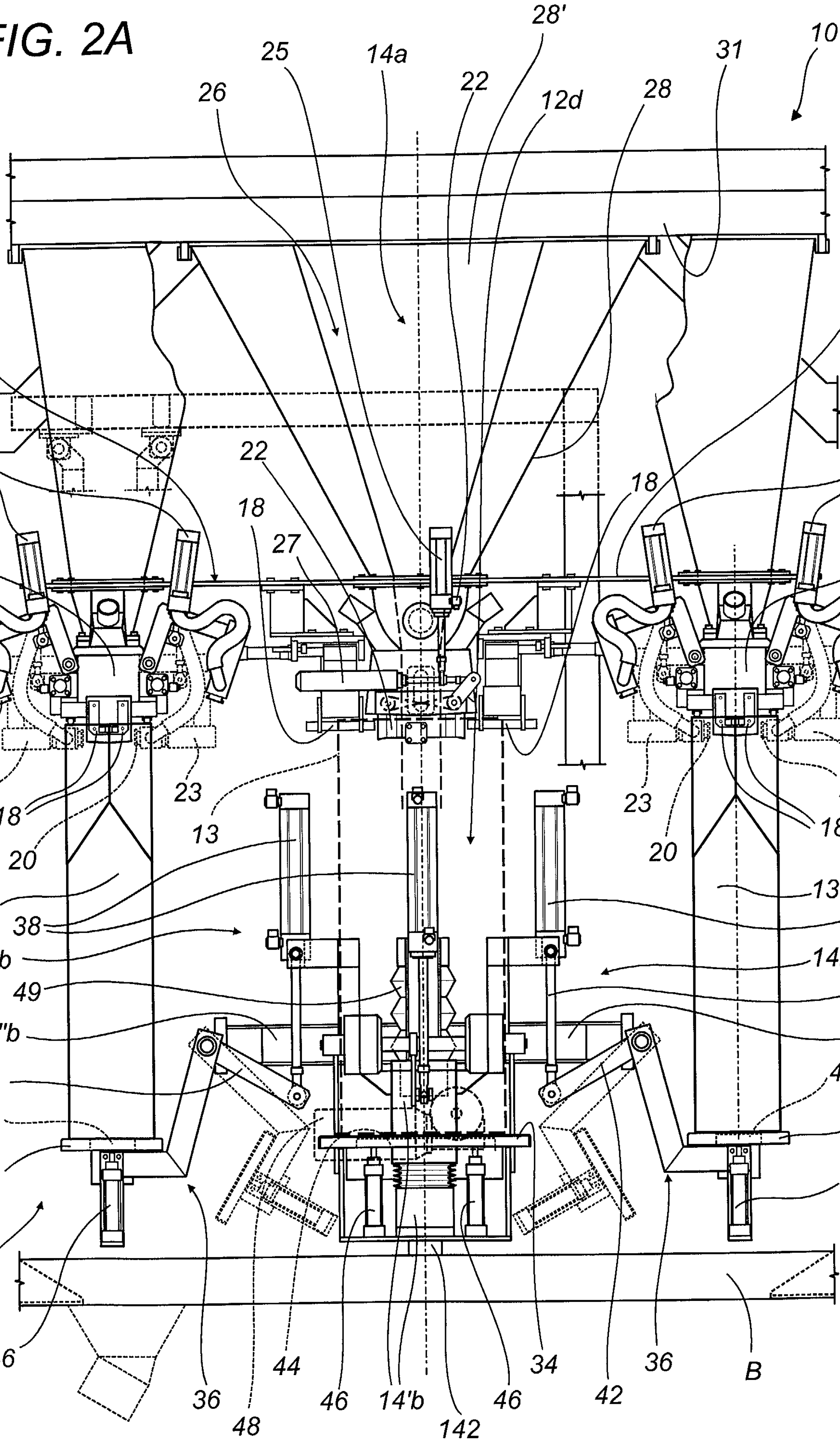

10
28'
31
25
14a
22
12d
28
26
14
14'
25
22
18
18
25
27
22
23
20
20
23
23
13
23
20
18
18
23
20
13
20
20
13
13
38
38
14b
14b
49
40
14''b
14''b
42
44
44
34
34
46
46
12a
46
36
44
46
14'b
142
46
34
42
36
B
48

FIG. 2B

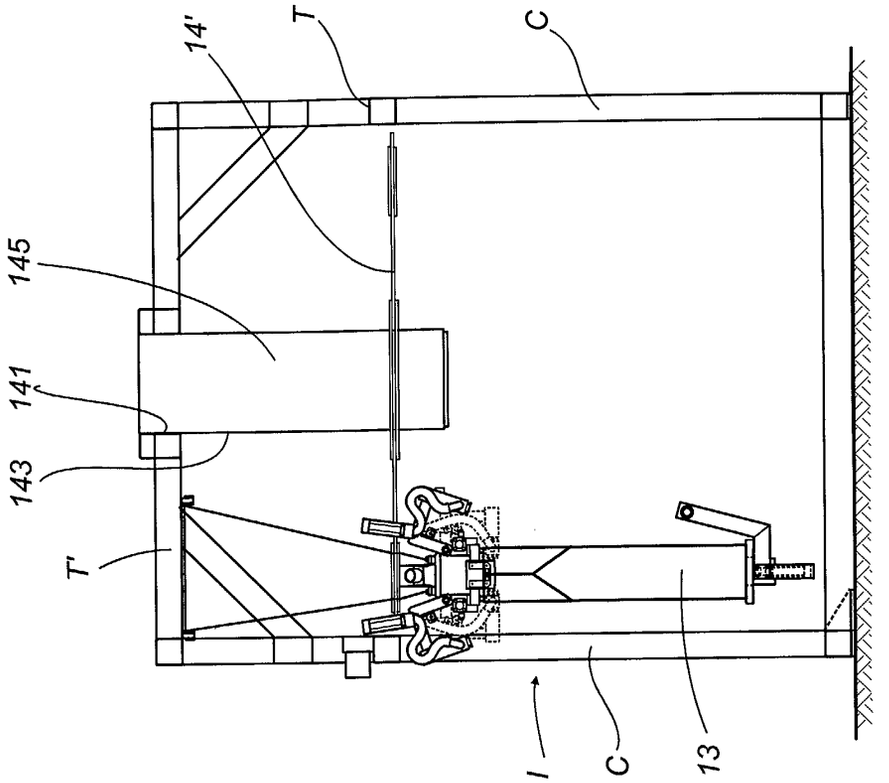
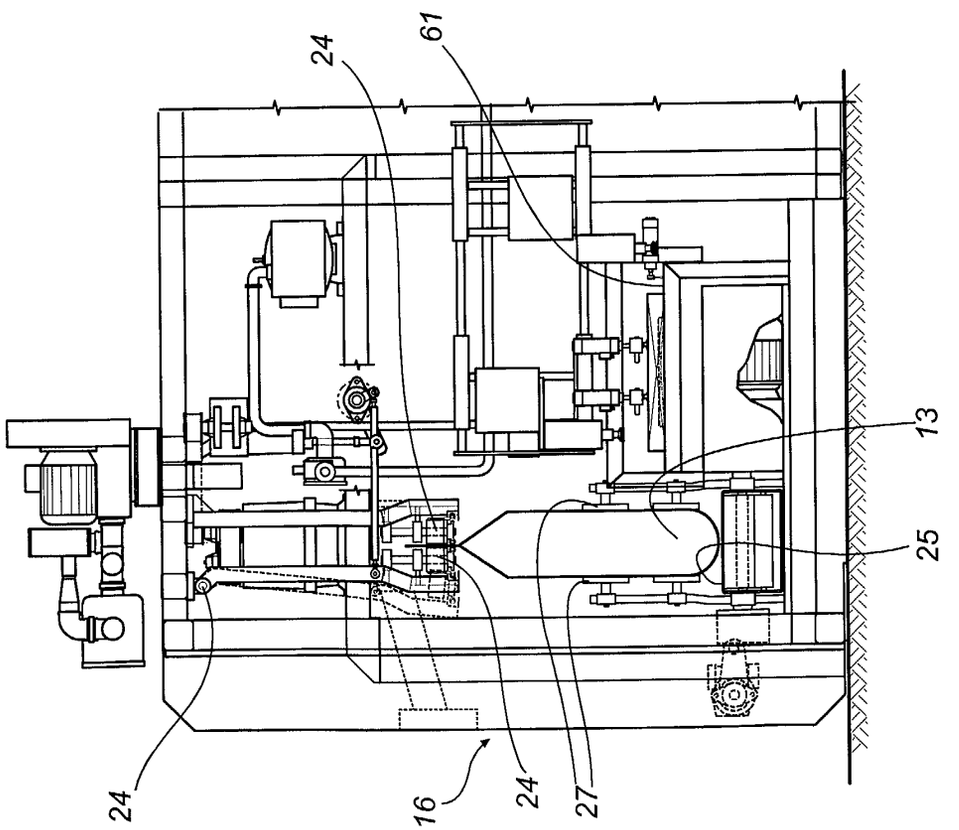


FIG. 6



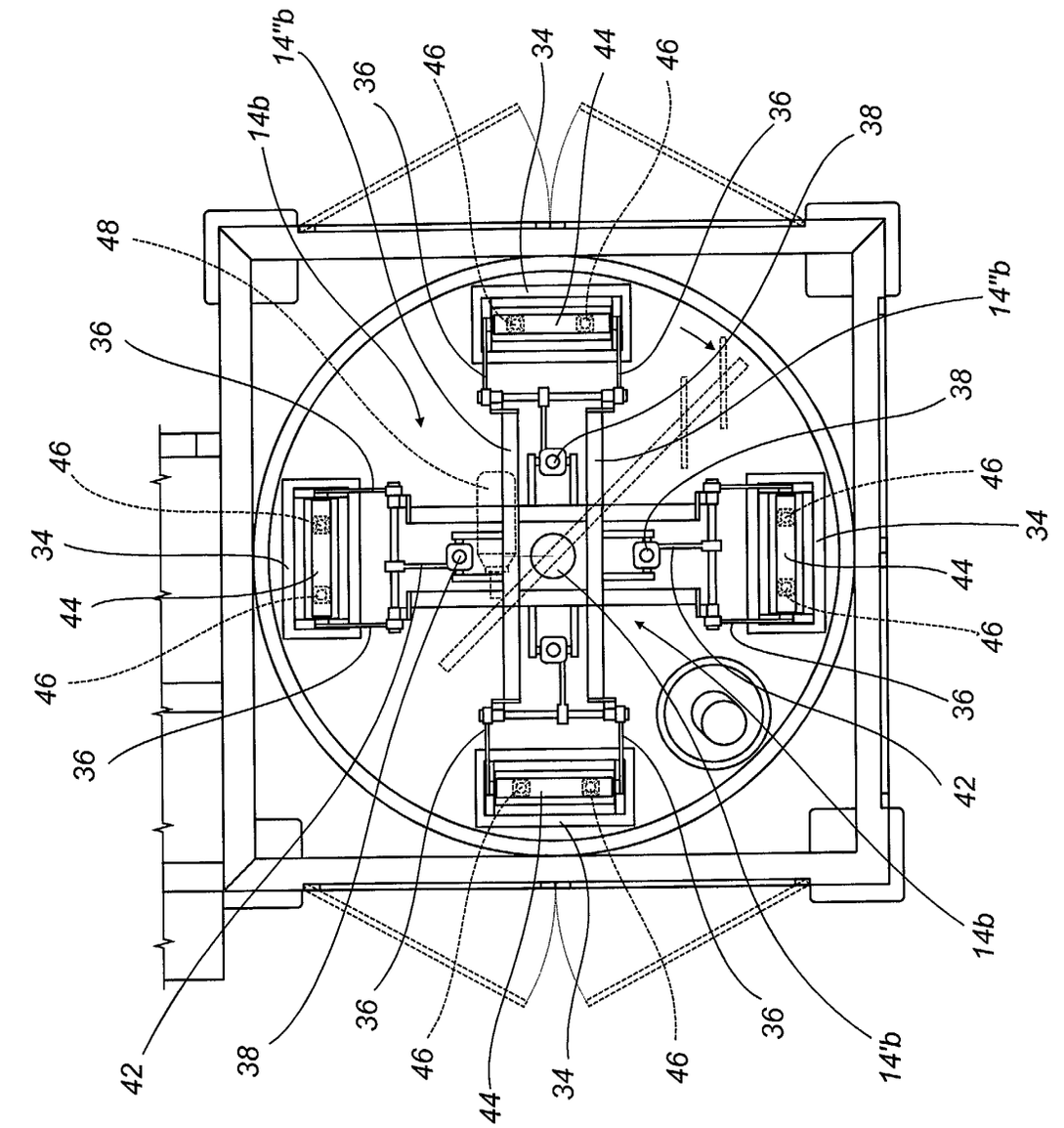


FIG. 3

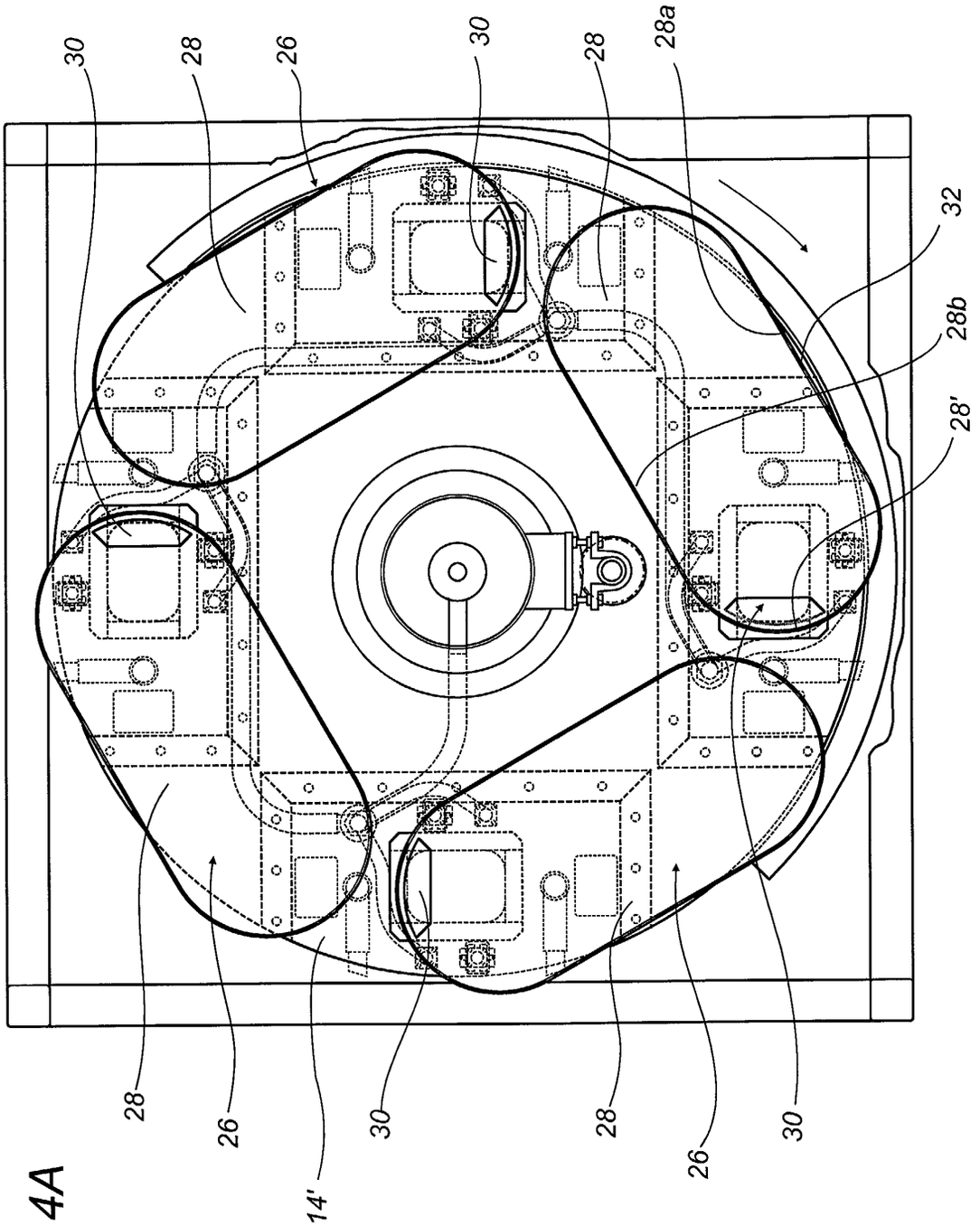


FIG. 4A

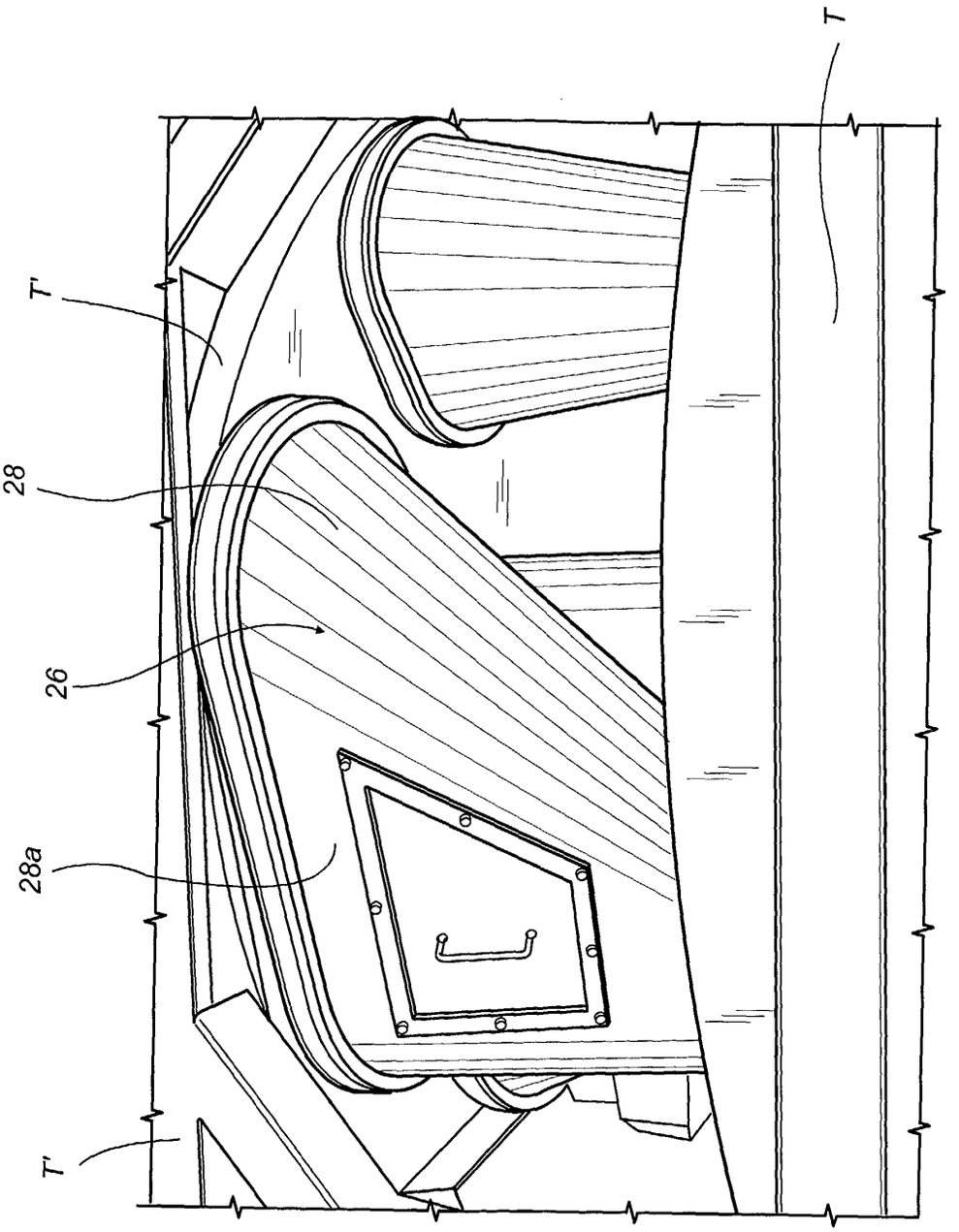


FIG. 4B

FIG. 5A

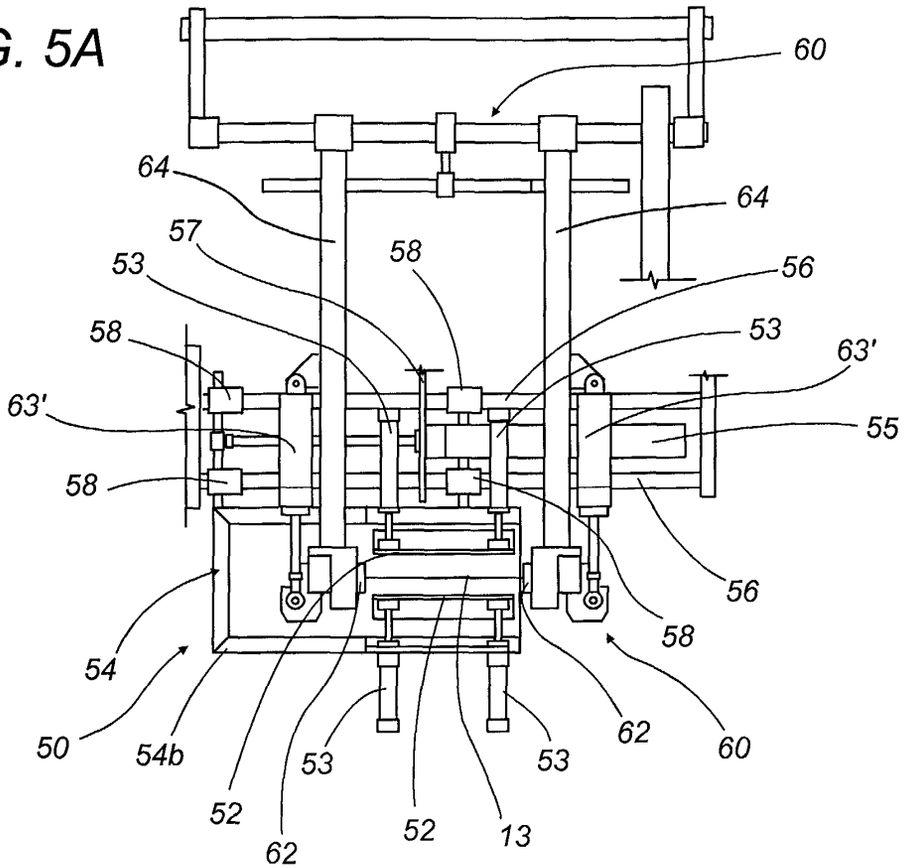
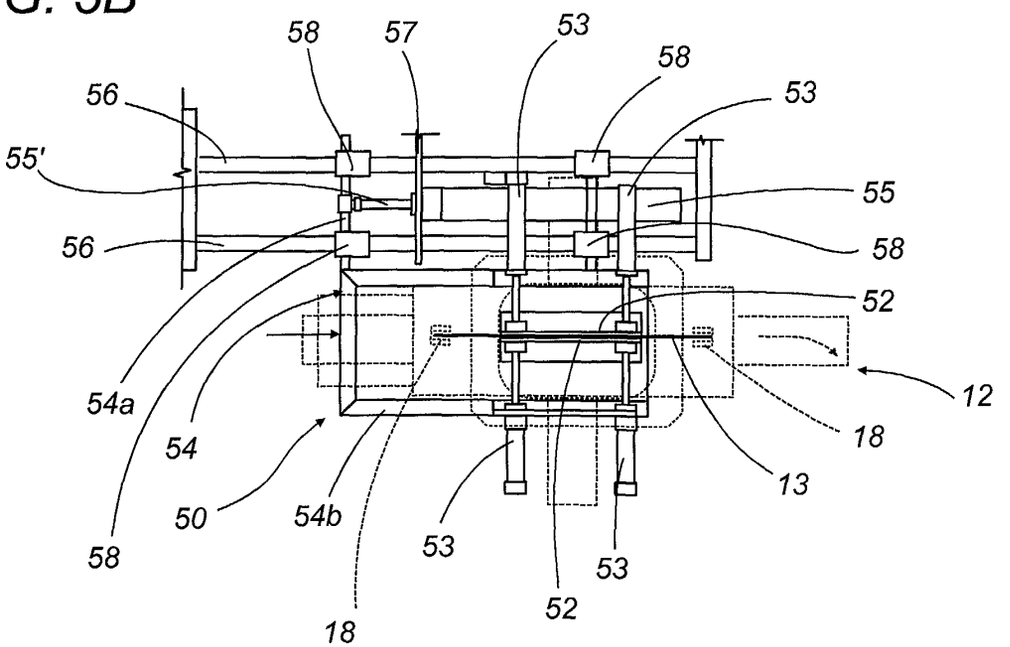

60
64
64
57
58
53
56
58
53
63'
63'
55
58
56
58
54
50
54b
53
53
62
60
52
62
52
13

FIG. 5B


58
57
53
58
56
53
55'
55
56
58
52
12
54a
54
18
13
50
54b
53
53
58
52
18