

Description

[0001] According to one aspect, the present invention relates to compacting apparatus for compressing waste material, the compacting apparatus comprising:

A filling opening for filling waste material into a filling chamber and a compression chamber comprising an arcuate front wall and an opposite rear wall and side walls,
the compacting apparatus further comprising a press plunger for compressing the waste material and adapted to be moved inside the compression chamber by a power supply,
said press plunger comprises a first surface and an opposite second surface and a circumferential edge delimiting the surfaces and is pivotally arranged about an axis placed outside the compression chamber.

[0002] The invention also relates to a method for compressing waste material by a compacting apparatus by filling waste material into a filling chamber, and the waste material is further directed into a compression chamber comprising an arcuate front wall and an opposite rear wall,
a press plunger is then moved in the compression chamber for compressing the waste material,
the press plunger pivots about an axis placed outside the compression chamber,
the press plunger comprises a first surface and an opposite second surface and a circumferential edge delimiting the surfaces,
said second surface is pressing towards the waste material placed in the compacting apparatus when the press plunger moves from a first position to a second position when compressing the waste material, and by the activating of a power supply,
whereby the press plunger moves from the filling chamber to the compression chamber and moves in a part circle motion on a circular arc Finally, the invention relates to use of the compacting apparatus for performing the method.

[0003] EP0686493 discloses a compression apparatus for handling waste material. It comprises a press plunger that is moved by a hydraulic piston-cylinder inside a compression channel and the press plunger is pivotal arranged about an axis placed inside the press channel. Due to the construction the movement of the press plunger is quite limited and a consequence of that is the size of compression chamber also is limited comprising a short arcuate channel and a straight part.

[0004] US4155297 discloses a compacting apparatus comprising a plunger placed on an axis of rotation. The power supply comprises a motor connected to a torque arm. The plunger, which also is a door for the filling opening, is then moved around 90° in the compression chamber and 90° in the filling chamber. Further, the mecha-

nism to move the press plunger takes much space in the machine.

[0005] Moreover, compactors of today are very voluminous in relation to the amount of waste material they are able to handle during a compression.

[0006] Therefor it is desirable to minimize the size of the compression apparatus while ensuring a large volume of waste material may be handled during the process.

[0007] The present invention seeks generally to improve compacting apparatus for compressing waste material such that the abovementioned insufficiencies and drawbacks of today's compressions apparatus are overcome or at least the present invention provides a useful alternative.

[0008] Up to this day, prior art has failed to teach a simple and yet reliable and inexpensive compacting apparatus which in a safe and reliable manner, without substantially increasing the cost of the device, is able to satisfy the abovementioned much desired characteristics of the mentioned compacting apparatus.

[0009] There is a need in the industry for compact compressors and in house holding for small compactors, which should most desirably occupy a minimum total volume of space and yet providing a capacity for handling a large volume of waste material. In addition, the apparatus must be adaptable for convenient location and easy operation so as not to unduly complicate or add substantial additional time to the collection cycle.

[0010] According to the invention, a compacting apparatus is provided, as per the introductory part of this specification, the whole compression chamber is formed as a uniformly arcuate channel, formed by the arcuate front wall and the rear wall also being arcuate,
said arcuate front and arcuate rear wall are concentric with each other.

[0011] The compacting apparatus occupies a very small total volume, but provides a highly efficient compaction of the waste materials. The construction is usable for industry and usable for supermarkets, shops, and for smaller household machines where the household waste material may be compacted in an easy and effective manner.

[0012] As the compression channel is curved in its full extension the volume for pressing the waste material is maximized while the space the machine occupies is minimized. The press plunger has a moving angle which is much larger compared to known technology. The moving angle of the press plunger is larger than 70° due to the construction of the machine, thereby making it possible to press larger volumes of waste material by one stroke of the pressing plunger compared to prior art. This is possible to obtain, as the centre of rotating of the press plunger is the axis, placed outside the compression chamber, and due to the front wall and the rear wall are concentric with each other.

[0013] The press plunger starts its movement above the filling opening - a first position - in a curved movement

and then reaches the compression chamber where it follows the compression channel and compresses the waste material and presses it out through an output opening of the compression chamber. Advantageously the compressed waste material is pressed into an exchangeable output module. The front and the rear walls are connected to each other by sidewalls or are integral with each other. The form of the sidewalls may be plan or rounded/part circular.

[0014] The axis the press plunger rotates about is perpendicular arranged in relation to the movement direction of the press plunger. The axis of rotation is advantageously horizontal placed.

[0015] According to one embodiment, the arcuate rear wall is a stationary wall, and that the press plunger is adapted to follow the arcuate channel following and substantially touching the entire inner surface of the arcuate channel, when the press plunger is moved inside the compression chamber.

[0016] By stationary wall is to understand that the rear wall is a fixed part of the construction, immovable when the plunger moves inside the apparatus for compressing the waste material. The front wall is also a stationary wall.

[0017] According to one embodiment, the arcuate front wall and the arcuate rear wall have a longitudinal sectional view being formed as a circular arc having the same circle centre,

[0018] the arcuate front wall placed with a radius R from the circle centre and the arcuate rear wall placed with a radius r from the centre, R being larger than r , and the axis of rotation of the axis is the centre for radius r and radius R . The front wall and the rear wall must all be concentric to ensure a consistent space between the plunger and the walls e.g. to prevent blocking.

[0019] A circular arc is a segment of a circle along its periphery. The front wall and the rear wall are concentric with each other.

[0020] By having the same centre for the radius R , the radius r and the rotation axis and the form of the arcuate channel is optimized and makes it possible to provide part circle formed front and rear walls. The press plunger is substantially touching the entire inner surface of the compression chamber with the circumferential edge.

[0021] According to one embodiment, the arcuate rear wall and the arcuate front wall each has an extension of at least 70° of a circular arc.

[0022] Typically the front wall has an extension of around 70° - 90° while the rear wall has an extension of 90° - 180° as it is extended into the filling chamber. In the compression channel/arcuate channel, the extension of the rear wall is the same as for the front wall.

[0023] According to one embodiment, the press plunger is arranged to move on a circular arc, the movement from a first to the second position having an extension of at least 70° of a circle periphery/circular arc more preferably at least 120° .

[0024] The press plunger is moved from an upper/first position to a lower/second position during the pressing

of the waste material. At the lower position, the second surface is substantially parallel to vertical, and the angle $\angle$ between the second surface and vertical is then substantially 0° . At the upper position, the angle between the second surface and vertical is in the interval 70° - 180° as the press plunger starts in a position above the compression chamber.

[0025] According to one embodiment, it further comprises a power transmission mechanism for the press plunger comprising at least one connecting member, comprising a first portion placed inside the compression chamber and an opposite second portion placed outside the compression chamber, said press plunger is attached immovable to the first portion, and that the second portion of the connecting member is placed pivotally around the axis.

[0026] The connecting member may be one or two parallel profiles placed at the edge of the pressing plunger or the first surface and fastened immovable to the press plunger and in the opposite end attached pivotally to the axis placed outside the compression chamber. The profiles are passing through the rear wall of the compression chamber in which two recesses are placed for allowing the profiles to be moved in the part circular movement.

[0027] According to one embodiment, the power supply is adapted to move the connecting member by rotating the axis, said power supply is directly connected to the axis of rotation, or the power supply is through the power transmission mechanism indirectly adapted to affect the rotation of the axis by moving the axis, and thereby the connecting member is moved and the press plunger is moved inside the compression chamber.

[0028] The power supply may for instance be an electrical motor that is directly connected to the axis or there may be a gear incorporated between the two components. The power supply may also be indirectly connected by moving a knee action suspension or a bar suspension. The suspensions are then participating in the movement of the press plunger moving it in the part circle direction. It has an angle optimizing function making it possible to move the plunger in a large angle interval.

[0029] According to one embodiment, the compacting apparatus further comprises fastening means placed at an outlet of the compression chamber, said fastening means are adapted to connect an output module to the compacting apparatus said output module is adapted to collect the compressed waste material.

[0030] Advantageously, the output module is connected to the compression apparatus with fastening means that is specially designed for the apparatus and thereby not allowing illegal and dangerous copy-output modules to be connected to the compacting apparatus.

[0031] According to one embodiment, the power transmission mechanism further encompasses force reducing transmission means such as a gear or a four-bar linkage or a knee action suspension, said force reducing transmission means is connected to/cooperates with the connecting member in a region between the first portion and

the second portion.

[0032] The force reducing means and the angle optimizing means might be the same such as an optimal placement of a bar construction.

[0033] The force reducing means may act as angle optimizing means thereby increasing the movement angle of the press plunger.

[0034] According to one embodiment, the power transmission mechanism further comprises means placed outside the compression chamber and comprises a bar linkage comprising a first bar, a second bar and the means further comprises a third unit, and the power supply being a hydraulic or pneumatic cylinder comprising a piston and a piston rod, said piston rod pivotally mounted to a first end of the first bar and to a first end of the second bar, an opposite second end of the first bar pivotally mounted to a portion of the connecting member placed between the first portion and the second portion, and an opposite end of the second bar pivotally mounted to the third unit.

[0035] By this arrangement the distance between the first and the second bar is maximal when the press plunger is in the first position and minimal when the press plunger is in the second position. This arrangement makes it possible to move the plunger press more than the full extension of the compression channel of the compression chamber. The press plunger is starting above the filling opening and then after the door is closed moves downwards.

[0036] The third unit is an immovable unit in relation to the compression chamber and stabilizes the suspension mechanism. The third unit is a profile placed between regions close to the ends of the piston.

[0037] The invention also relates to a method as described in the introduction and wherein the press plunger follows an arcuate channel of the compression chamber, and whereby the waste material is compressed said press plunger substantially touches the entire inner surface of the arcuate channel - when the press plunger is moved.

[0038] The rear wall is advantageously a stationary rear wall.

[0039] According to one embodiment, the press plunger moves on a circular arc the circular arc having an extension of at least 70° advantageously at least 120°.

[0040] The extension may advantageously be 120°-180° and more preferably 130° - 140°.

[0041] According to one embodiment, the connecting member is attached to the edge or the first surface of the pressing plunger, and that an upper position is the position when the press plunger is placed above an inlet of the compression chamber, and a lower position is the position when the press plunger is placed at the outlet of the compression chamber when the waste material has been compressed said lower position is placed below the upper position.

[0042] According to one embodiment, the compacting

apparatus further comprises angle-optimizing means adapted to optimize the moving angle for the press plunger.

[0043] According to one embodiment, the filling opening comprises a door adapted to close the filling opening when the waste material has been placed in the filling chamber.

[0044] According to one embodiment, the door comprises an inside door surface delimiting the filling chamber when the door is closed said inside surface is concave formed in the direction of the filling chamber said bending radius for the inside surface is the same as for the front wall of the compressing chamber.

[0045] According to one embodiment, the power supply is an electrical motor, a hydraulic cylinder, a manual handle or a pneumatic cylinder.

[0046] According to one embodiment, the inner cross section of the compression chamber is substantially the same in the full extension of the compression chamber.

[0047] According to one embodiment, the press plunger is adapted to be moved in a part circle movement.

[0048] According to one embodiment, the force reducing transmission means comprises a gear such as at least one tooth wheel placed inside a drum comprising teeth, which are adapted to interact with the tooth wheel, and that the power supply is an electrical motor or a manual driven unit, such as driven by a handle.

[0049] According to one embodiment the second surface is the surface pressing towards the waste material placed in the compacting apparatus when the press plunger is moved from a first position to a second position by the activating of a power supply, said first position is the starting position and with the pressing plunger placed in the filling chamber and the second position is the end position and in the region of the inlet of the outlet module.

[0050] According to one embodiment, a plate is attached to the second surface of the press plunger by moving means said moving means is adapted to move the plate fourth and back in relation to the second surface.

[0051] Thereby it is possible to compress and to move the compressed material further. This is an advantage when the compressed material has reached the outlet opening. Thereby the compressed material is moved into the output module.

[0052] According to one embodiment, it further comprises an inlet module for transporting the waste material through the filling opening into the filling chamber, said inlet module comprises an inlet part, a transport chamber and an outlet part said transport chamber comprises at least one pivotally arranged transport plunger for transporting the waste material.

[0053] This inlet module is an exchangeable part. The outlet part of the module is placed in connection with the filling opening. The inlet module then transports the waste material towards the filling chamber. The inlet module could for instance be placed with the opening of the inlet part in a kitchen worktop covered with a lid. Dur-

ing use, the lid is removed and the waste material poured down in the inlet module placed under the worktop. Then the inlet module is started activating a power moving the transport plunger and whereby the waste is transported to the compacting part of the machine and the waste material is compressed.

[0054] According to one embodiment, the transport chamber of the inlet module comprises an arcuate front wall and an opposite rear wall and side walls, a power supply for moving the transport plunger, said transport plunger is firmly connected to the rear wall and said rear wall is pivotally arranged about an axis of rotation, said plunger is adapted to be moved on a circle arc and follow the curvature of the arcuate front wall.

[0055] According to one embodiment, the transport plunger in the inlet module is adapted to be moved $360^\circ \cdot n$, n being > 0 .

[0056] According to one embodiment, the compacting apparatus for compressing waste material comprises:

A filling opening for filling waste material into a filling chamber and a compression chamber comprising an arcuate front wall and an opposite rear wall and side walls,
the compacting apparatus further comprising a press plunger for compressing the waste material and adapted to be moved inside the compression chamber by a power supply,
said press plunger comprises a first surface and an opposite second surface and a circumferential edge delimiting the surfaces and is pivotally arranged about an axis placed outside the compression chamber, wherein the whole compression chamber is formed as a uniformly arcuate channel,
said arcuate front and rear wall are concentric with each other, and that the arcuate channel comprises the arcuate front wall and a stationary arcuate rear wall,
and that the press plunger is adapted to follow the arcuate channel following and substantially touching the entire inner surface of the arcuate channel, when the press plunger is moved inside the compression chamber.

Brief description of the drawings

[0057]

FIG. 1A is a longitudinal cross-section through a first embodiment of a compacting apparatus according to the present invention and with a door closing a filling opening.

FIG. 1B is the same embodiment as the one in fig 1A but with the door in open position allowing waste material to be placed in the compacting apparatus.

FIG. 1C is the same embodiment as the one in fig

1A but where the press plunger has reached its lowest position.

FIG. 1D is a perspective view of the first embodiment.

FIG. 1E is a perspective view of the first embodiment and with an output module attached to the compacting apparatus.

FIG. 1F is a perspective view of the first embodiment and with an output module attached to the compacting apparatus and with the door in open position.

FIG. 2 is an enlarged view of a power transmission mechanism for a press plunger.

FIG 3A is a longitudinal cross-section through a second embodiment of a compacting apparatus according to the present invention and with a door in an open position.

FIG. 3B is the same embodiment as the one in fig 3A but where the press plunger has reached its lowest position.

FIG. 3C is the same embodiment as the one in fig. 3B where the press plunger has reached its lowest position but where the output module has been removed.

FIG. 4A-B are longitudinal cross-sections through a third embodiment of a compacting apparatus according to the present invention and with a door closing a filling opening. In fig. 4A the press plunger is in its upper position and in fig. 4B the press plunger is in its lowest position.

FIG. 4C-D are perspective views of the embodiment shown in fig 4 A-B.

FIG. 5 is longitudinal cross-sections through a fourth embodiment of a compacting apparatus according to the present invention and with a door formed as a drum.

FIG. 6A-C are longitudinal cross-sections through a fifth embodiment of a compacting apparatus according to the present invention and with an automatic filling container coupled to the compacting apparatus.

FIG. 7A-C are longitudinal cross-sections through another embodiment of a compacting apparatus, suitable for compressing household waste material and with a power supply being manual and comprising a handle.

FIG. 7D is the compacting apparatus shown in fig.

7A-C placed on a bin.

FIG. 8 is a perspective view of a compacting apparatus, suitable for compressing household waste material and with a power supply being an electrical motor.

FIG. 9A-C are a first embodiment of an inlet module.

FIG. 10 A-B is a second embodiment of an inlet module.

FIG. 11 is a perspective view of the first and second embodiment of the inlet module comprising an electrical power supply.

[0058] A first embodiment of the invention will be explained with reference to fig. 1A-F showing a compacting apparatus 1. The compacting apparatus 1 comprises a filling opening 3 for filling waste material into a filling chamber 2 of the compacting machine 1. The filling chamber 2 is large due to the construction of a compression chamber 4 and the moving angle of a press plunger 7 as explained below. The filling opening 3 is closed with a door 40 which in the figures is a top hinged door. The door 40 could also be a sliding door or a drum, which empties into the filling chamber 2 by tilting the drum (see fig. 5).

[0059] Below the filling chamber 2 is a compression chamber 4 placed with an inner surface comprising a front wall 5 and an opposite rear wall 6 and side walls 38 connecting the front wall 5 and the rear wall 6. The inner surface of the compression chamber 4 is formed as a uniformly arcuate/curved channel 11. The arcuate front wall 5 and the arcuate rear wall 6 form this; they are concentric formed with each other. The front 5 and rear wall 6 are both curved formed: a segment of a circle having the same centre C for the radius drawing the circle arc. The arcuate front wall 5 is placed with a radius R from the centre C and the rear wall 6 is placed with a distance r from the centre C. R is larger than r. A dimension of the radius could be R: 900 mm and r: 400 mm. The segment of the circle/circle arc for the front wall 5 is in this example around 80-90°. For the rear wall 6 it is larger around 170-180°.

[0060] A press plunger 7 is adapted to follow the arcuate compression chamber 4 following and substantially touching the entire inner surface of the arcuate channel 11 when the press plunger 7 is moved inside the compression chamber 4 from an upper position to a lower position (and conversely). The press plunger 7 is pivotally arranged around an axis 18 placed outside the compression chamber 4. The axis is the pivotal centre for the press plunger 7 and the centre C for the radius r and the radius R. The sidewalls 38 of the compression chamber 4 is advantageously plane.

[0061] The press plunger 7 is moved by a power supply 14. This could be a hydraulic or pneumatic cylinder or it

could be a rotating electrical motor. In this example, it is a hydraulic cylinder. The axis of rotation 18 is perpendicular arranged in relation to the movement direction of the press plunger 7.

[0062] The press plunger 7 is connected to the axis 18 by a power transmission mechanism 32 comprising a connecting member 19 comprising a first portion 20 placed inside the compression chamber and an opposite second portion 21 placed outside the compression chamber 4. The pressing plunger 7 is attached immovably to the first portion 20 and the second portion 21 of the connecting member 19 is pivotally mounted around the axis 18. In this case, the connecting member 19 comprises two parallel profiles placed at an edge 10 of the press plunger 7 or at a first surface 8 of the press plunger 7 said first surface 8 placed opposite the second surface 9. The second surface 9 is the surface pressing towards the waste material. The two profiles are running in two recesses 39 placed in the rear wall 6 of the compression chamber 4.

[0063] The power transmission mechanism comprises further elements, which will be explained with reference to fig. 2.

[0064] Fig 1C shows the press plunger 7 in the lower position where the waste material has been compressed. The plunger 7 presses the compressed material into an output module 31. The output module 31 is releasable attached to the compacting apparatus 1 at an outlet 13 of the compression chamber 4 by fastening means 30. When the output module 31 is filled with compressed waste, the filling process is over. A sensor detects this, and the output module 31 may now be released from the compacting apparatus 1. Due to the construction of the arcuate channel 11 and the pivoting centre for the press plunger 7 placed outside the channel/compression chamber 4 the press plunger 7 moves in a curved manner and has a large moving angle. The press plunger 7 moves on a circular arc. The arc segment being less than 180° preferably less than 150° and more preferably 130°-135°. The door 40 that closes the filling chamber 2 may also be curved at the inside surface 41. The curving of the inside surface 41 is the same as for the front wall 5 of the compression chamber 4. Hereby the compression may more effective as the compression channel in this way is extended.

[0065] The fastening means 30 may comprise two hinged frames 42 see fig. 1 D and 1E placed at each side of the outlet 13 of the compression chamber 4. In an open position of the frames 42, it is possible to remove the output module 31. In closed position, the frames 42 are placed parallel to the sidewalls of the output module 31, and locked to the sidewalls of the output module 31. This may be done with a snap lock device interacting with the frames 42. The output module 31 is firmly and sealed connected to the compression apparatus 1.

[0066] FIG. 2 is an enlarge view of a power transmission mechanism 32 for a press plunger. The power transmission mechanism 32 comprises the connecting mem-

ber 19 - a profile - and more means placed outside the compression chamber 4. The means comprises a bar linkage comprising a first bar 43, a second bar 44, and the means further comprises a third unit 45. The power supply 14 is a hydraulic or pneumatic cylinder 46 comprising a piston and a piston rod. The piston rod is mounted pivotally to a first end 43' of the first bar 43 and to a first end 44' of the second bar 44. The piston is at the opposite end fastened pivotally to a stationary part of the device. The opposite second end 43" of the first bar 43 is mounted pivotally to a portion of the connecting member 19 placed between the first portion 20 and the second portion 21. The opposite end 44" of the second bar 44 is mounted pivotally to a first end 45' of the third unit 45. In this way a four bar linkage is formed. This arrangement makes it possible to move the press plunger 7 in a large angle.

[0067] This arrangement may also be considered as a force reducing transmission means - reducing the need for power - and an angle optimizing means. It cooperates with the connecting member 19 in a region between the first portion 20 and the second portion 21. The force reducing transmission means may also comprise a separate gear construction.

[0068] A second embodiment of a compacting apparatus according to the present invention will be explained with reference to the figures 3A-C. The reference-number are the same as is the case for fig. 1A-C. The difference between this embodiment and the embodiment in fig. 1A-C is the construction of the power transmission mechanism 32 and the way the output module 31 is fastened to the compressor part.

[0069] The power transmission mechanism is built in the same way, as is the case with the mechanism shown in fig 2. However, the first bar 43 is not constructed as a straight bar but is bended whereby the first end 43' and the second end 43" of the first bar 43 are placed closer to each other. Thereby the need for transmitting power is reduced compared to the power transmission mechanism shown in fig 2.

[0070] A third embodiment of the invention will now be explained with reference to fig. 4A-D. Fig 4A-B are a longitudinal cross-section through a compacting apparatus 1 and with a door 40 closing a filling opening. In fig. 4A the press plunger 7 is in its upper position and in fig. 4B the press plunger 7 is in its lowest position. FIG. 4C-D are perspective view of the embodiment shown in fig 4 A-B.

[0071] The difference between this embodiment and the first embodiment is the construction of the output module 31. The compacting apparatus 1 is constructed in the same way as is explained with reference to fig. 1A-F. The output module 31 is formed as a gooseneck. That is, it comprises a first part connected to the compacting apparatus as explained above. Then it continuous in an arcuate part bending upwards and ending in a third part being substantially vertical. Due to the output module 31 is ending in a distance from the ground it is supported

with legs 48.

[0072] A fourth embodiment of the invention will now be explained with reference to fig. 5. The difference between this embodiment and the first embodiment is the construction of the door 40. The rest of the compacting apparatus 1 is constructed in the same way as is explained with reference to fig. 1A-F.

[0073] The door 40 is formed as a drum placed pivotally in the filling opening 3 of the filling chamber 2. The filling opening of the drum is formed curved with the same radius/arc form as the front wall 5. Thereby the drum will not interfere with the press plunger 7 when it moves inside the compacting apparatus 1.

[0074] A fifth embodiment of the invention will now be explained with reference to fig. 6A-C. The difference between this embodiment and the first embodiment is that it comprises a tipping device 50, which lifts bins or boxes 51 and empties them into the filling opening 3. The filling opening 3 may then be closed with a door 40 as disclosed above or by a sliding door (not shown).

[0075] The compacting apparatus shown in fig 7 A-D is suitable for compressing household waste material and its dimension are quite small compared to the embodiments that are explained above, and which are suitable for industry. The power supply 14 in fig. 7A-D is a manual handled handle 52. The handle 52 drives a cylinder 26. Inside the cylinder 26 a tooth wheel 36 is advantageously placed interacting with teeth 37 placed at an inside surface of the cylinder 26. Hereby the needed manual force for compressing the waste material is reduced. The outside surface 28 of the cylinder 26 comprises the rear wall 6 of the compression chamber 4. The inner surface of the compression chamber 4 is formed as a uniformly arcuate channel 11. It comprises an arcuate front wall 5 and the arcuate rear wall 6. The arcuate rear wall 6 is the outside surface 28 of the cylinder 26. The arcuate front 5 and rear wall 6 have both a sectional view being formed as a sector of a circle periphery with the same centre. The arcuate front wall 5 is placed with a radius R from the centre 18 and the arcuate rear wall 6 is placed with a radius r from the centre. R is typically 240 mm. and r is typically 75 mm.

[0076] The press plunger 7 is immovably attached to the outside surface 28 of the cylinder 26 and follows the arcuate channel 11 when moved. It substantially touches the entire inner surface of the compression channel 11 of the compression chamber 4 with the circumferential edge 10 when the press plunger 7 is moved inside the compression chamber 4. In this construction the cylinder 26 is technical equivalent to the connecting member 19 explained above. The first portion 20 being the outside surface of the cylinder 26 and the second portion 21 being the axis of rotation 18.

[0077] A hinged door 40 closes the filling chamber 2 when the compacting apparatus is to be used. The handle 52 is moved and by the rotation of the axis 18 the press plunger 7 moves from the first position to the second position whereby the waste material is compressed. The

compressed waste material is removed from the machine during an opening. In this opening, a replaceable output module 31 may be placed, or a closing door can simply close it.

[0078] The moving angle of the press plunger 7 is the same as for compression apparatus 1 used for the industry and explained with reference to fig. 1-6. As is the case for the industry model, the press plunger 7 is in the lower position substantially parallel to the vertical plane and the angle between the second surface and vertical is substantially 0°. In the upper position/first position the angle between the second surface of the press plunger and vertical plane is around 120°-140° preferably 130°-135°.

[0079] FIG. 7D is the compacting apparatus shown in fig. 7A-C but placed on the top of a bin 1.

[0080] Fig. 8 shows in principle the compacting apparatus as shown in fig 7A-C, but where an electrical motor 54 has replaced the handle, thereby making the pressing process more automatically.

[0081] FIG. 9A-C shows an inlet module 60, which may be releasable coupled to the filling opening 3. The waste material is put into the inlet module 60. The inlet module 60 transports the waste material to the filling opening 3. The inlet module 60 comprises an inlet part 61, a transport chamber 62 and an outlet part 63. The transport chamber 62 comprises at least one pivotally arranged transport plunger 64 for transporting the waste material.

[0082] The transport chamber 62 comprises an arcuate front wall 68 and an opposite rear wall 67 and side-walls. It further comprises a power supply for moving the transport plunger 64. The transport plunger 64 is firmly connected to the rear wall 67 and the rear wall 67 is pivotally arranged about an axis of rotation 66. The rear wall 67 is the outside of a cylinder arranged rotatable around the axis of rotation 66. The plunger 64 is adapted to be moved on a circle arc, and follows and touches the curvature of the arcuate front wall 68. The input module 60 is in principle built and designed as the compacting machine shown in fig. 7A-C. However, the transport plunger 64 may comprise several plates 65 arranged around the axis of rotation 66. This is shown in fig 10A-B comprising 4 transport plates 65. The power for driving the transport plunger is typically an electrical motor 54 as shown in fig 11. The motor 54 is typically engaged with the transport plunger 64 in the same way as explained with reference to fig. 1 - 9. The transport plunger is adapted to be moved $360^\circ \cdot n$, $n > 0$. The transport plunger is then able to rotate several times around the axis of rotation 66, which is not possible for the press plunger.

[0083] The inlet modules shown in fig. 9A-C, fig. 10A-B and fig 11 are all applicable to be used together with all the embodiments shown in fig. 1A-fig.6C.

[0084] Generally, the compacting apparatus - no matter which embodiment - presses waste material in a curved movement. The press plunger 7 starts above the filling opening and moves down when the filling opening is closed safely. Through the downward movement of

the press plunger 7, the material is pressed into the output module 31 on the backside of the machine.

[0085] Depending on the size of the machine, there are different types of power supply. Small machines are driven manual by a handle and the power is transmitted through gear wheels. For bigger machines, the power is supplied by an electric motor. The transmission can be either direct by a linear motor, indirect by a rotating motor with a gearbox, or hydraulic/pneumatic by a pump and one or more cylinders.

[0086] The compression apparatus 1 will be available in different sizes and follows a concept of modularity; especially the output module 31 is designed to be changed easily. Therefore the fastening means 30 are formed after the same concept no matter which output module 31 is chosen in order to fasten the output module 31 easy to the compacting apparatus 1.

[0087] Unlike other waste compactors, this machine does not need a separate sheet to cover the piston during its movement. This function is realized by the filling part. When the filling part is closed, it is flush with the arcuate front wall and forms an arcuate channel together with the rear wall. Therefore, the filling part and the channel together form a great arcuate pressing channel, which is concentric with the piston and substantially touches it during the whole pressing process. Further, the compactor has a large filling chamber due to the piston's moving angle of about 130°. The waste material can be filled directly into the compaction chamber, because the piston moves up above the filling opening. Therefore, the filling chamber and the compaction chamber are practically the same and the whole space between the output module and the upper position of the piston can be seen as a large filling chamber

[0088] Smaller machines especially these for being used in a kitchen comprises a power transmission such as:

- Gears in the handle
- Rotating electric motor, which would replace the handle for more power.

[0089] Larger machines are typically designed with a hydraulic cylinder, combined with a mechanical four-bar linkage/

[0090] Linear electric motors and pneumatic cylinders are similar to hydraulic cylinders

[0091] The door 40 may be constructed in different ways

[0092] Through a top hinged door.

[0093] Through a sliding door.

[0094] A drum, which empties into the pressing chamber through tilting it.

[0095] A tipping device, which lifts bins or boxes and empties them into the opening

[0096] Through a conveyor belt. It has to stop while the piston is not in upper position or there has to be a separate pre-filling chamber.

[0097] The door 40 may also be omitted if the filling opening is directly connected to an input module.

[0098] Filling is only possible while the press plunger 7 remains in the upper position and the press plunger 7 can only move down when the filling process is over. Sensors maintain this.

[0099] The output modules 31 may be designed in different ways:

Baler: An ordinary construction

[0100] Gooseneck, which can contain a perforator or a narrowing to generate backpressure.

[0101] Small compactors for household waste material can be put on top of bins, so the output module will be a chamber, which can be emptied at the bottom after the material, is pressed. Instead of a bin, there can also be sacks, boxes.

[0102] The compacting apparatus 1 can be combined with other machines e.g. as a pre-compaction part for underground compactors or containers It may also be constructed with a drainage part, where fluids are transported away from the solid waste.

[0103] The size of the machine can be smaller or larger.

[0104] The radius of the pressing chamber depends on the size of the whole machine. For a prototype for the industry, an inner radius of 400 mm and an outer radius of 900 mm. may be used.

Claims

1. A compacting apparatus (1) for compressing waste material the compacting apparatus (1) comprising:

A filling opening (3) for filling waste material into a filling chamber (2) and a compression chamber (4) comprising an arcuate front wall (5) and an opposite placed rear wall (6) and side walls (38),

the compacting apparatus (1) further comprising a press plunger (7) for compressing the waste material and adapted to be moved inside the compression chamber (4) by a power supply (14),

said press plunger (7) comprises a first surface (8) and an opposite second surface (9) and a circumferential edge (10) delimiting the surfaces (8,9) and is pivotally arranged about an axis (18) placed outside the compression chamber (4)

characterized in

the whole compression chamber (4) is formed as a uniformly arcuate channel (11), formed by the arcuate front wall and the rear wall also being arcuate,

said arcuate front (5) and arcuate rear (6) wall are concentric with each other.

2. A compacting apparatus (1) according to claim 1 **characterized in** the arcuate rear wall (6) is a stationary wall, and that the press plunger (7) is adapted to follow the arcuate channel (11) following and substantially touching the entire inner surface of the arcuate channel (11), when the press plunger (7) is moved inside the compression chamber (4).

3. A compacting apparatus (1) according to claim 1 or 2 **characterized in that** the arcuate front wall (5) and the arcuate rear wall (6) have a longitudinal sectional view being formed as a circular arc having the same circle centre, the arcuate front wall (5) placed with a radius R from the circle centre and the arcuate rear wall (6) placed with a radius r from the centre, R being larger than r and the axis of rotation (18) is the centre for radius r and radius R.

4. A compacting apparatus (1) according to claim 1, 2 or 3 **characterized in that** the arcuate rear wall (6) and the arcuate front wall (5) each have an extension of at least 70° of a circular arc.

5. A compacting apparatus (1) according to claim any of the previous claims **characterized in that** the press plunger (7) is arranged to move on a circular arc, the movement from a first to a second position having an extension of at least 70° of a circle periphery/circular arc more preferably at least 120°.

6. A compacting apparatus (1) according to any of the previous claims **characterized in that** it further comprises a power transmission mechanism (32) for the press plunger (7) comprising at least one connecting member (19) comprising a first portion (20) placed inside the compression chamber (4) and an opposite second portion (21) placed outside the compression chamber (4), said press plunger (7) is attached immovably to the first portion (20) and that the second portion (21) of the connecting member (19) is placed pivotally around the axis (18).

7. A compacting apparatus (1) according to claim 6 **characterized in that** the power supply (14) is adapted to move the connecting member (19) by rotating the axis (18), said power supply (14) is directly connected to the axis of rotation, or the power supply is through the power transmission mechanism (32) indirectly adapted to affect the rotation of the axis (18) by moving the axis (18), and thereby the connecting member (19) is moved and the press plunger (7) is moved inside the compression chamber (4).

8. A compacting apparatus (1) according to claim 6 or 7 **characterized in that** the power transmission

- mechanism (32) further encompasses force reducing transmission means such as a gear or a four-bar linkage or a knee action suspension, said force reducing transmission means (33) is connected to/cooperates with the connecting member (19) in a region between the first portion (20) and the second portion (21).
9. A compacting apparatus (1) according to claim 6,7 or 8 **characterized in** the power transmission mechanism (32) further comprises means placed outside the compression chamber (4) and comprises a bar linkage comprising a first bar (43) and a second bar (44), and the means further comprises a third unit (45) and the power supply (14) being a hydraulic or pneumatic cylinder (46) comprising a piston and a piston rod, said piston rod mounted pivotally to a first end (43') of the first bar (43) and to a first end (44') of the second bar (44), an opposite second end (43'') of the first bar (43) mounted pivotally to a portion of the connecting member (19) placed between the first portion (20) and the second portion (21), and an opposite placed second end (44') of the second bar (44) mounted pivotally to the third unit (45).
10. A compacting apparatus (1) according to any of the previous claims **characterized in that** the compacting apparatus (1) further comprises fastening means (30) placed at an outlet (13) of the compression chamber (4), said fastening means (30) is adapted to connect an output module (31) to the compacting apparatus (1), said output module (31) is adapted to collect the compressed waste material.
11. A compacting apparatus (1) according to any of the previous claims **characterized in that** the compacting apparatus (1) further comprises an inlet module (60) for transporting the waste material through the filling opening (3) into the filling chamber (2), said inlet module (60) comprises an inlet part (61), a transport chamber (62) and an outlet part (63), said transport chamber (62) comprises at least one pivotally arranged transport plunger (64) for transporting the waste material.
12. A compacting apparatus according to claim 11 **characterized in that** the transport chamber (62) of the inlet module (60) comprises an arcuate front wall (68) and an opposite rear wall (67) and side walls, a power supply for moving the transport plunger (64), said transport plunger (63) is firmly connected to the rear wall (67) and said rear wall (67) is pivotally arranged about an axis of rotation (66), said plunger (63) is adapted to be moved on a circle arc and follow the curvature of the arcuate front wall (68).
13. A method for compressing waste material by a compacting apparatus (1) by filling waste material into a filling chamber (2), the waste material is further directed into a compression chamber (4) comprising an arcuate front wall (5) and an opposite placed rear wall (6), a press plunger (7) is then moved in the compression chamber (4) for compressing the waste material, the press plunger pivots about an axis (18) placed outside the compression chamber (4), the press plunger (7) comprises a first surface (8) and an opposite placed second surface (9) and a circumferential edge (10) delimiting the surfaces (8,9), said second surface (9) is pressing towards the waste material placed in the compacting apparatus (1) when the press plunger (7) moves from a first position to a second position when compressing the waste material and by the activating of a power supply (14), whereby the press plunger (7) moves from the filling chamber to the compression chamber (4) and moves in a part circle motion on a circular arc **characterized in** the press plunger (7) follows an arcuate channel (11) of the compression chamber (4), and whereby the waste material is compressed, and that the press plunger (7) substantially touches the entire inner surface of the arcuate channel (11) when the press plunger (7) is moved.
14. A method according to claim 13 **characterized in** the press plunger moves in a part of a circular arc, the circular arc part having an extension of at least 70° advantageously at least 120°.
15. Use of the compacting apparatus according to claim 1-12 for performing the method according to claim 13-14.

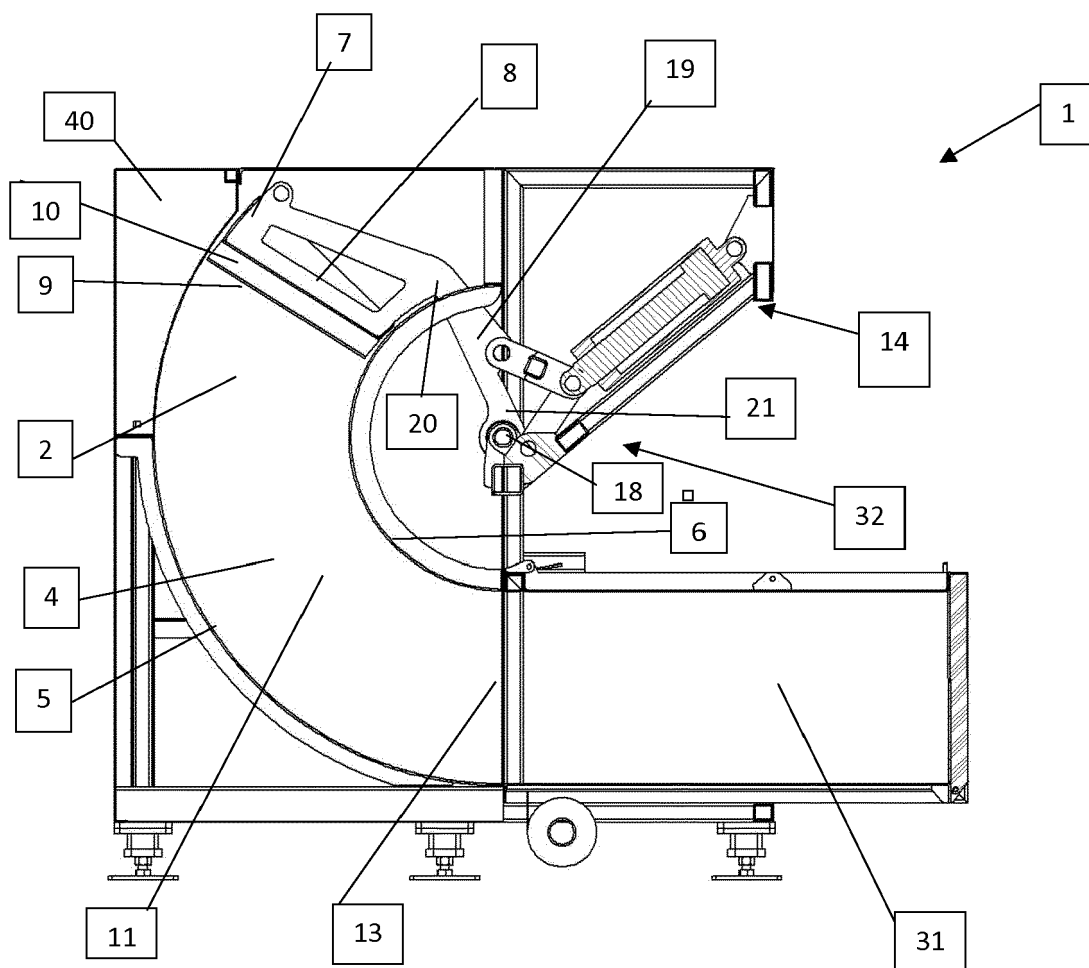


FIG. 1A

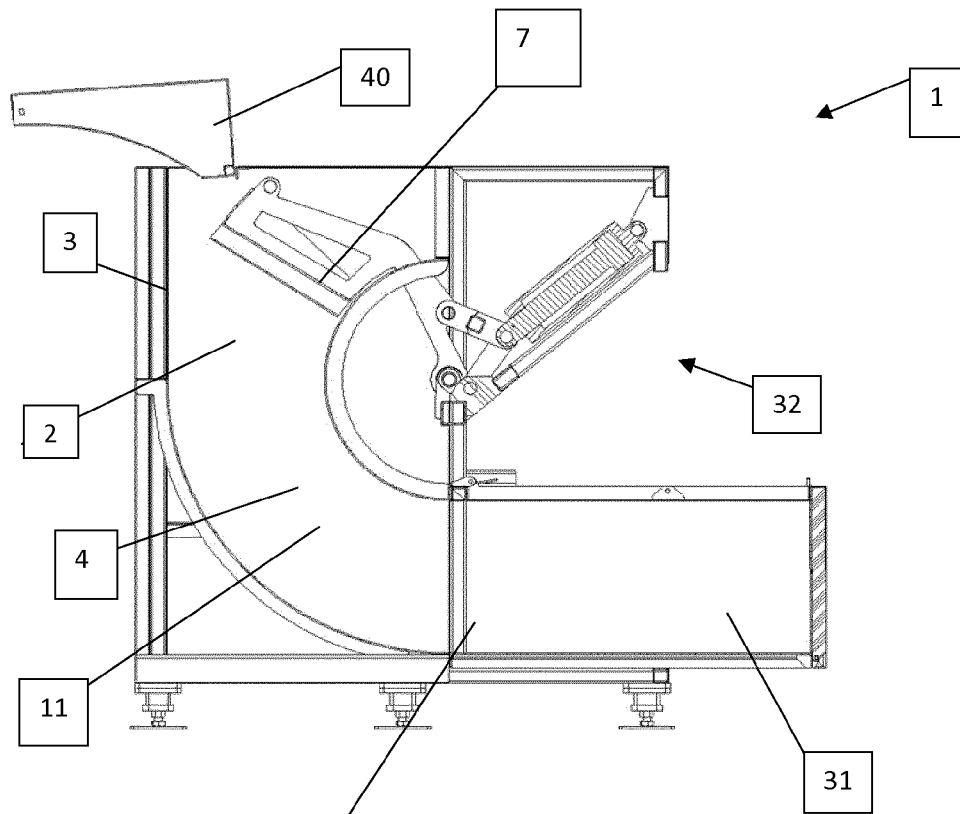


FIG. 1B

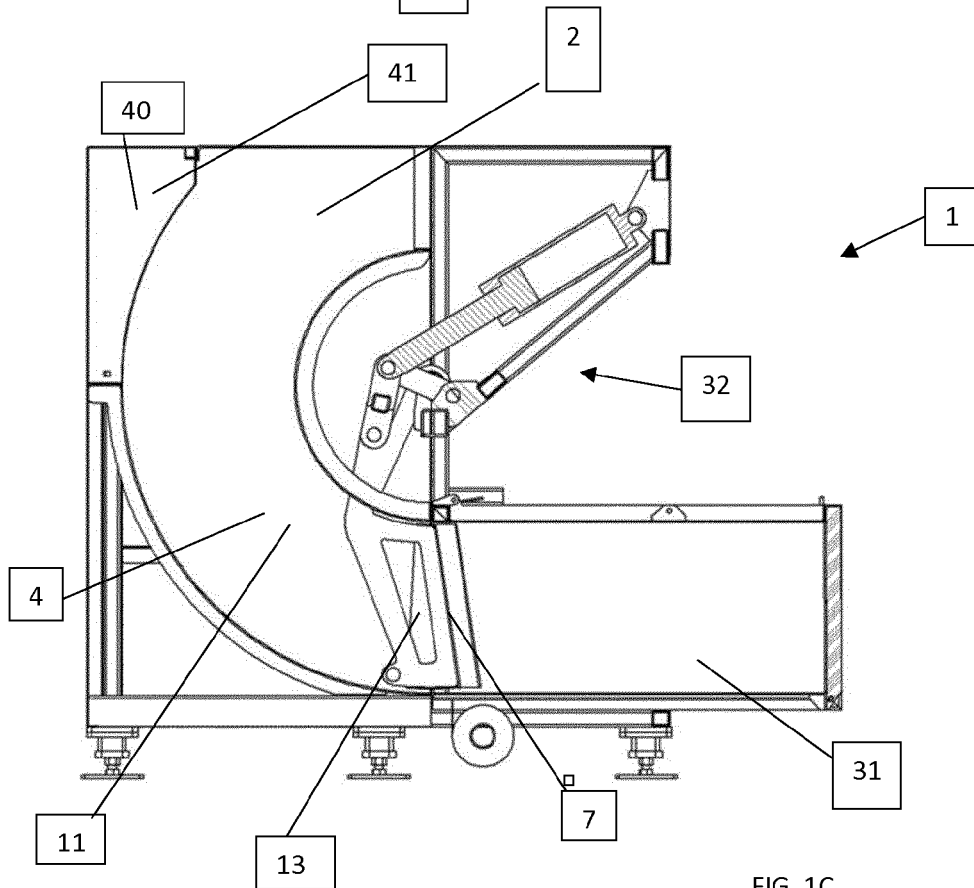


FIG. 1C

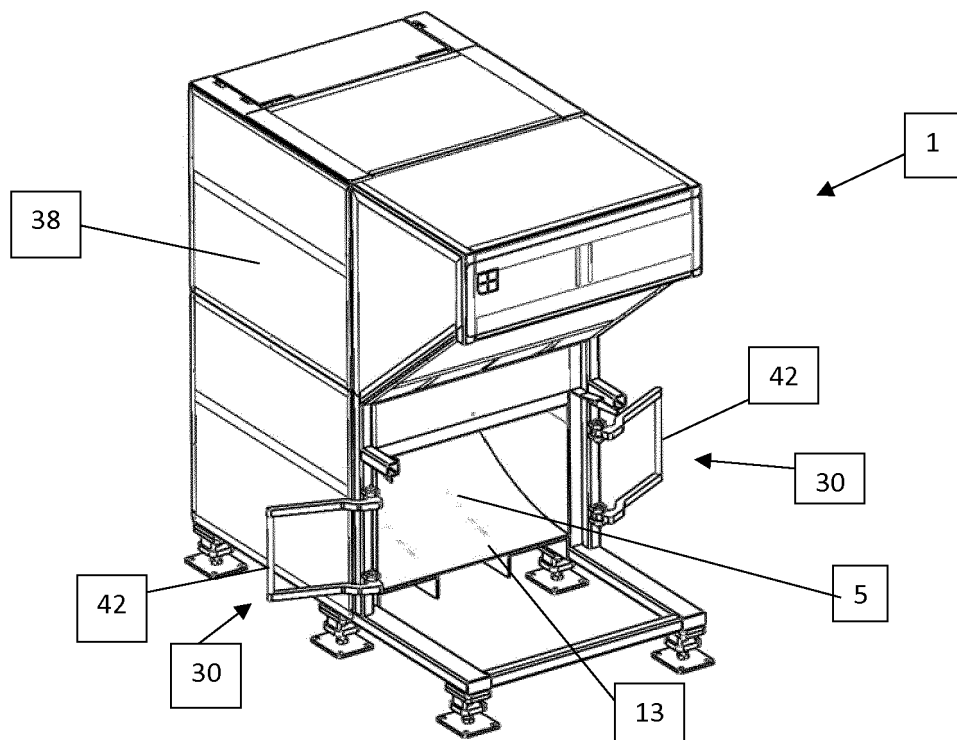


FIG. 1D

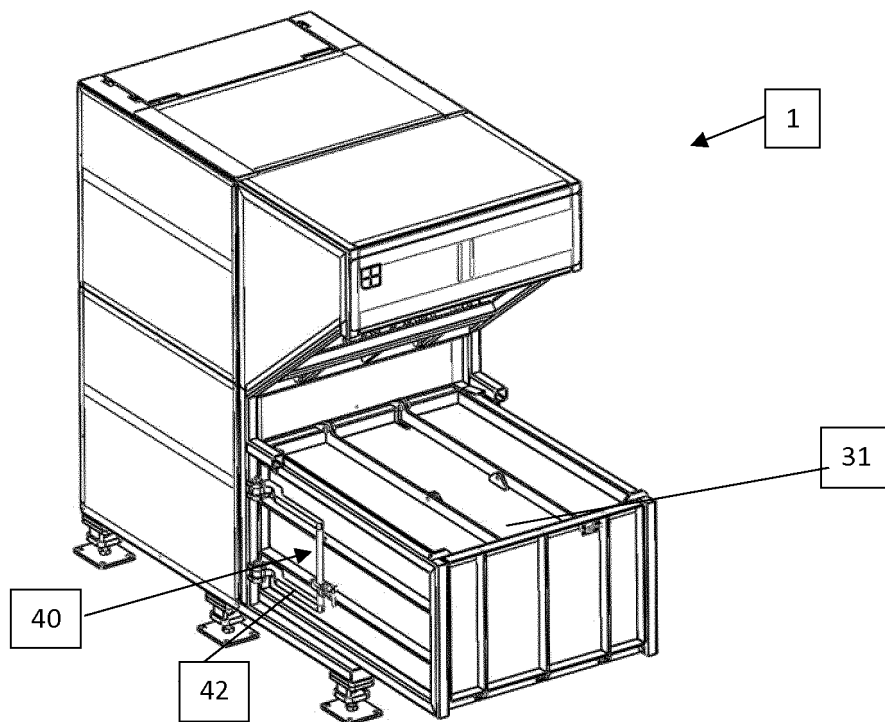


FIG. 1E

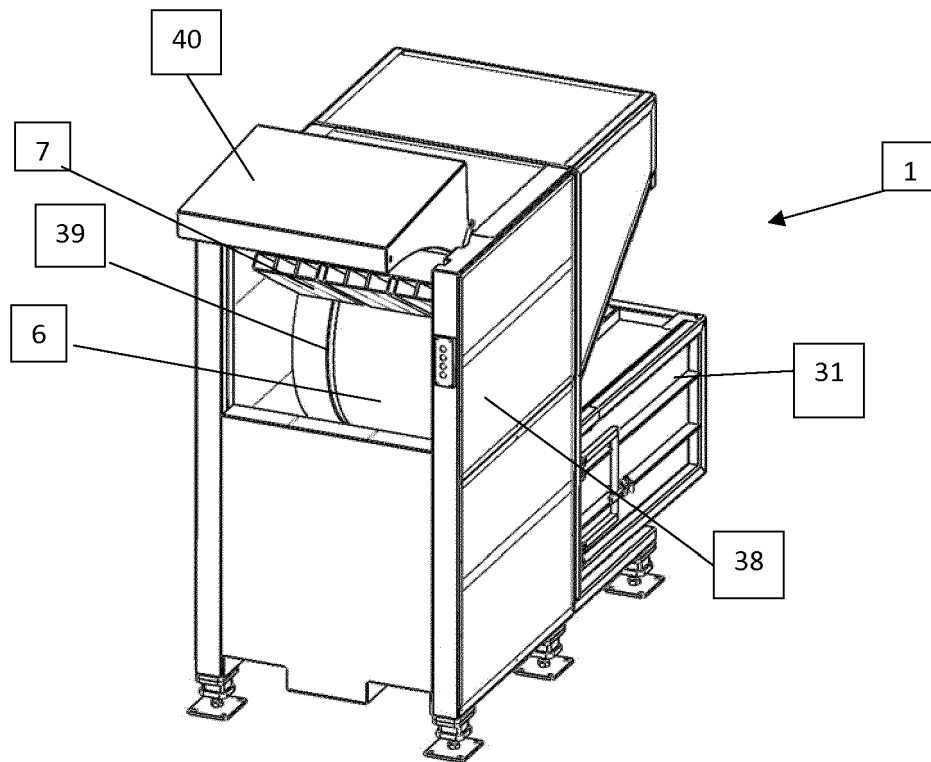
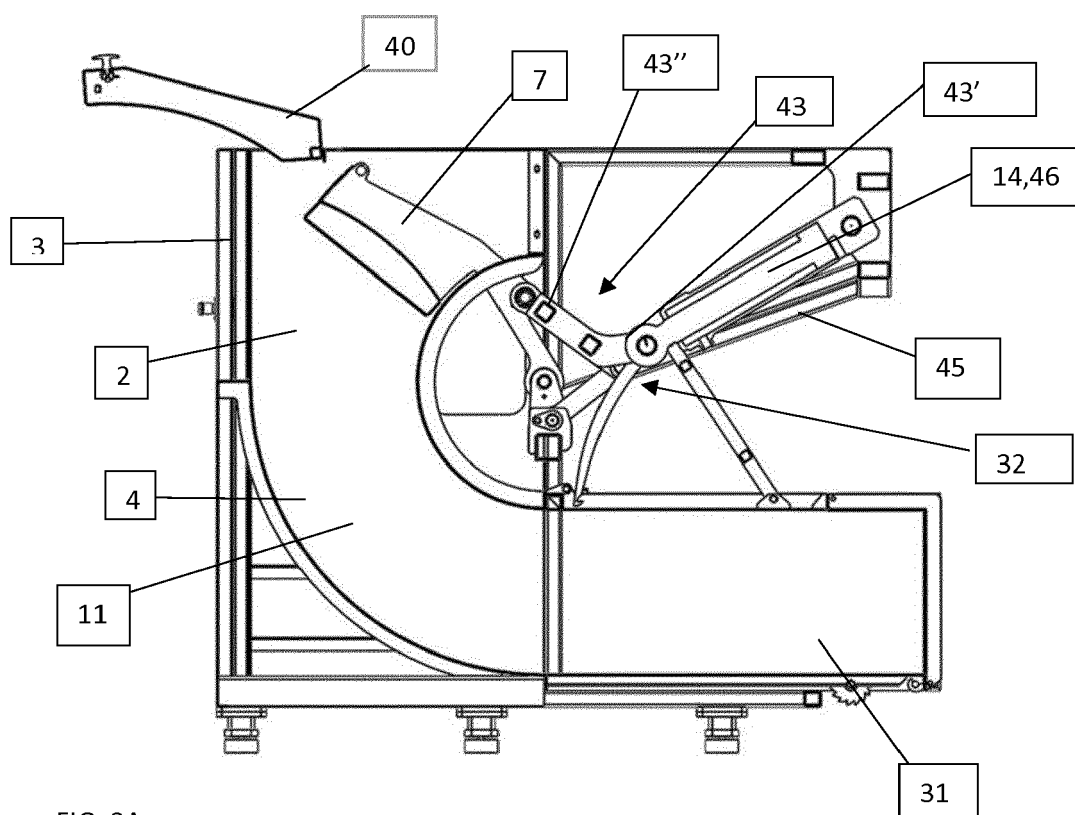
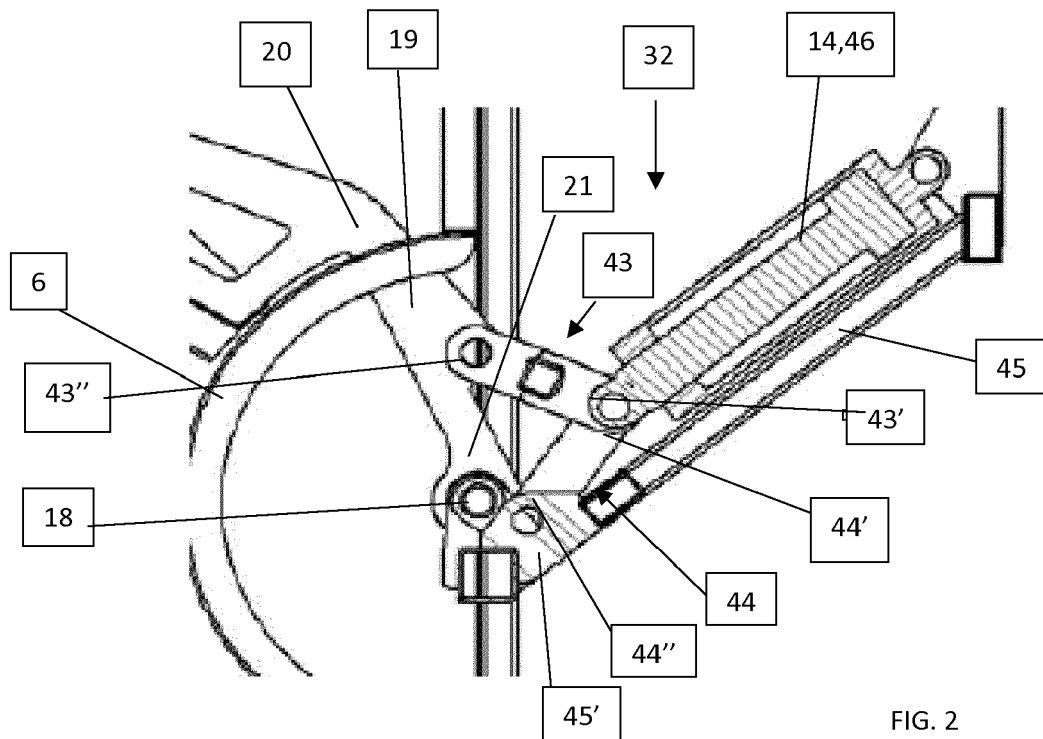


FIG. 1F



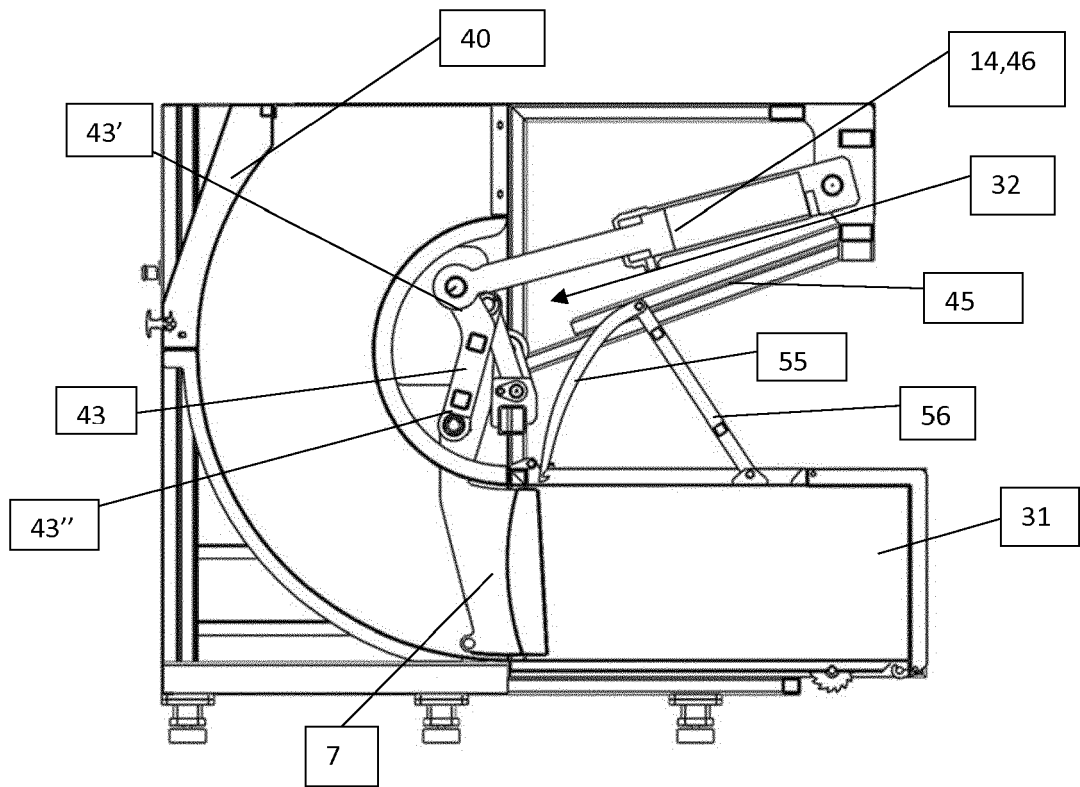


FIG. 3B

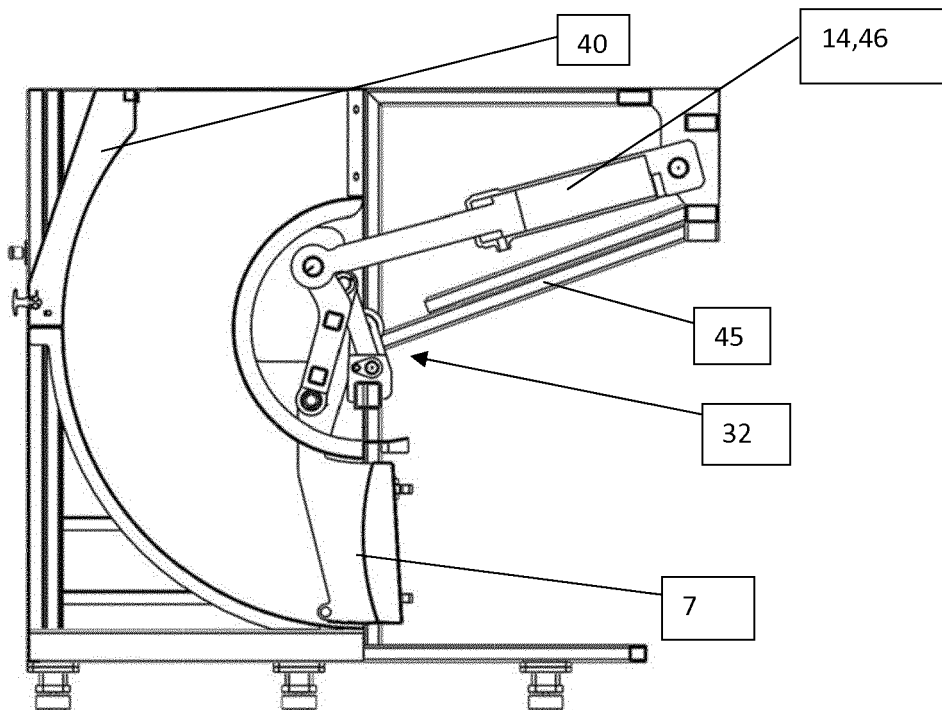


FIG. 3C

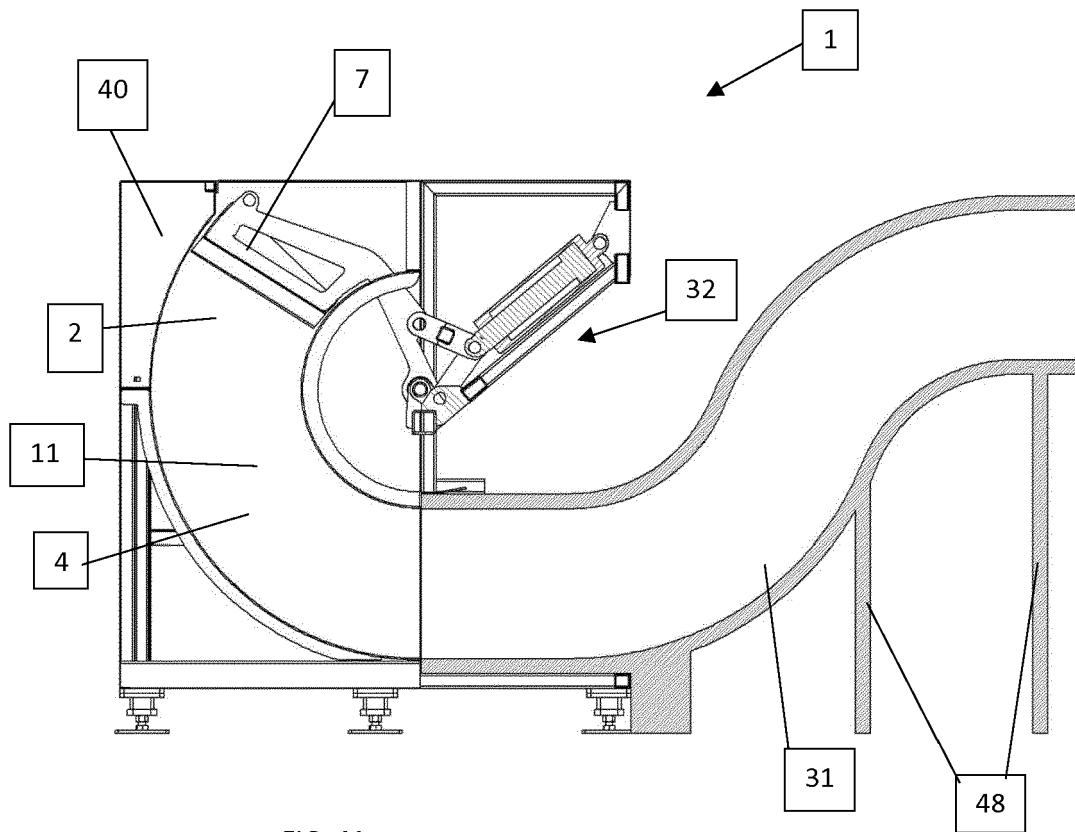


FIG. 4A

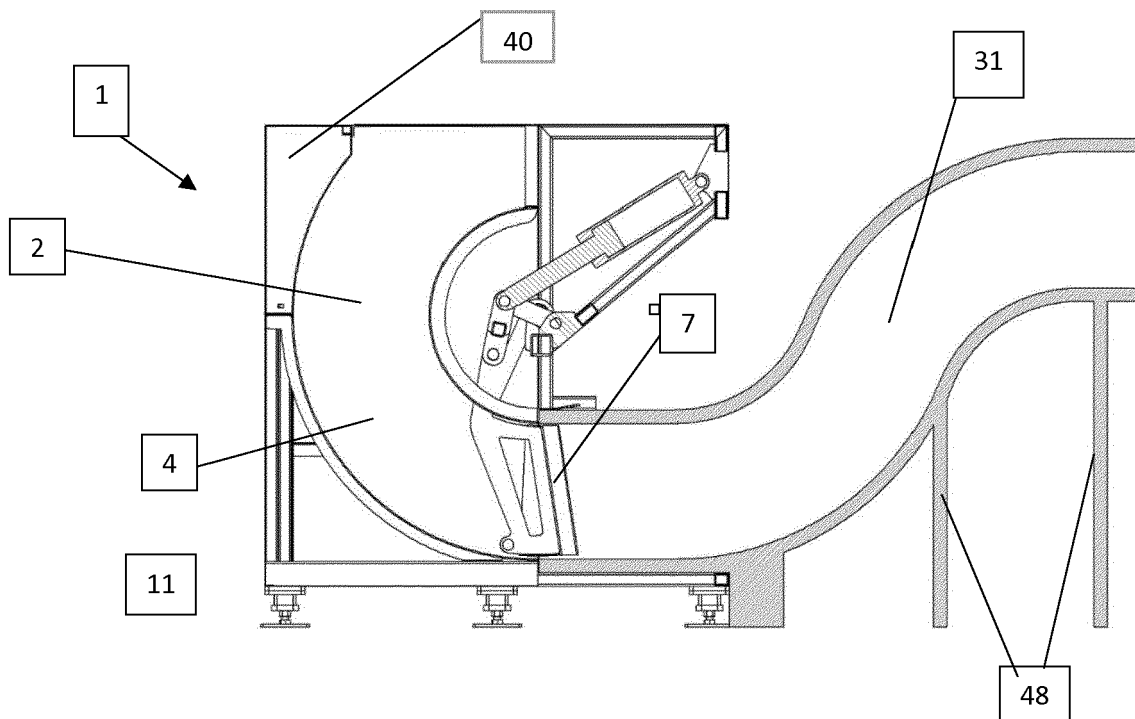


FIG. 4B

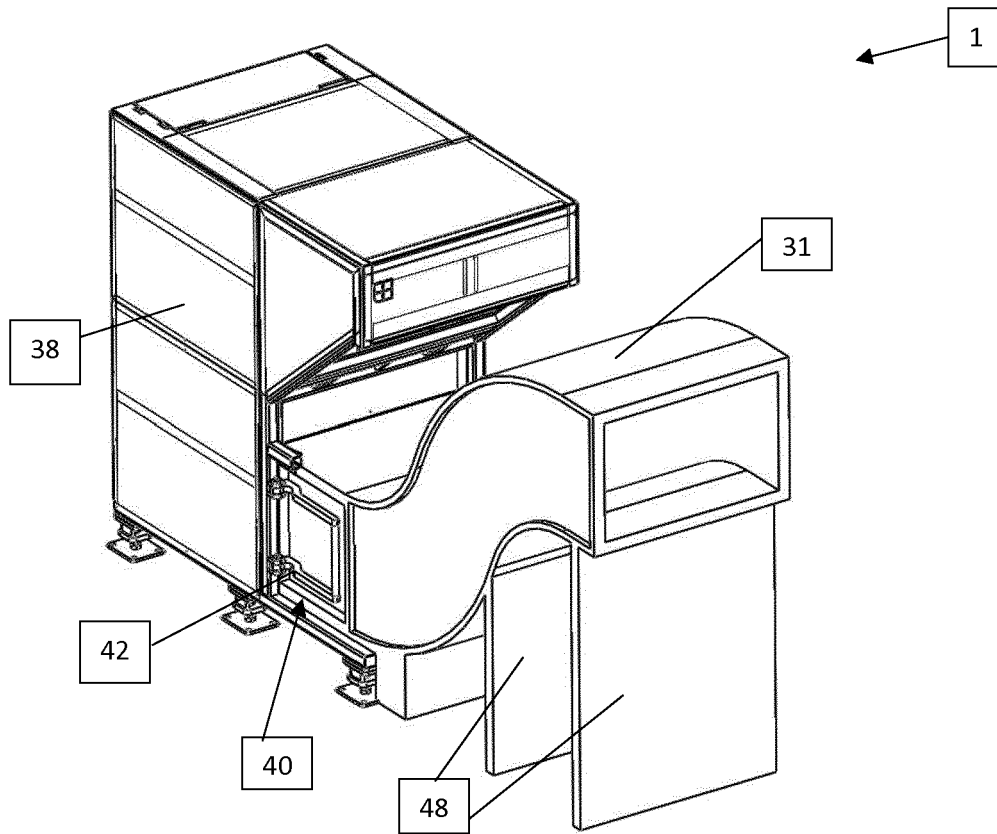


FIG. 4C

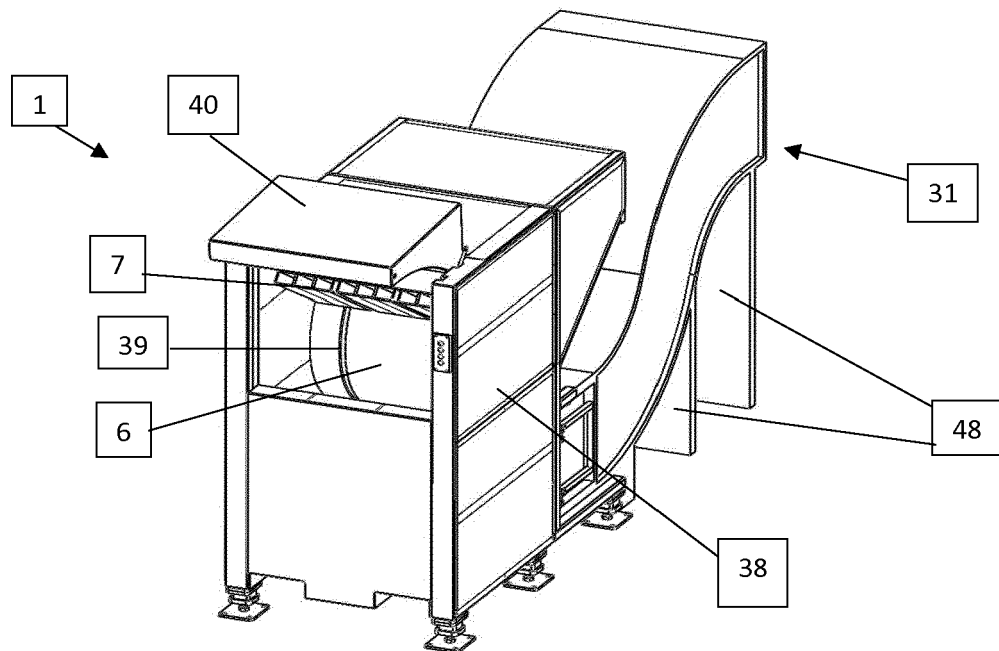


FIG. 4D

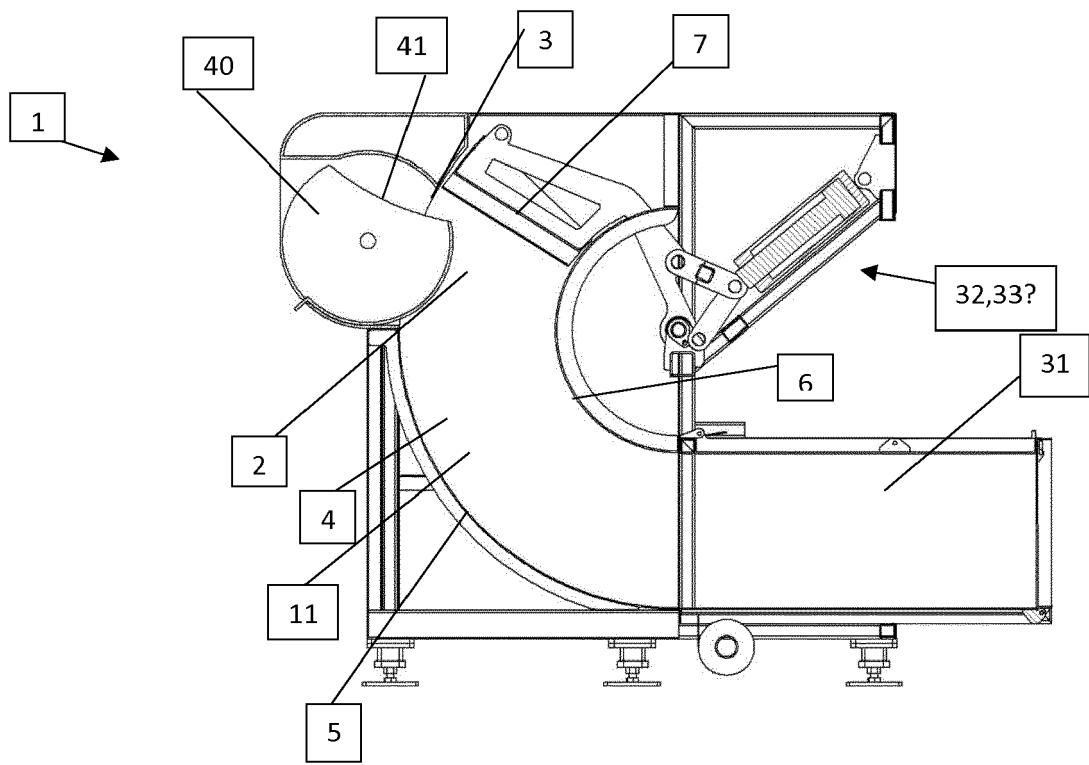


FIG. 5

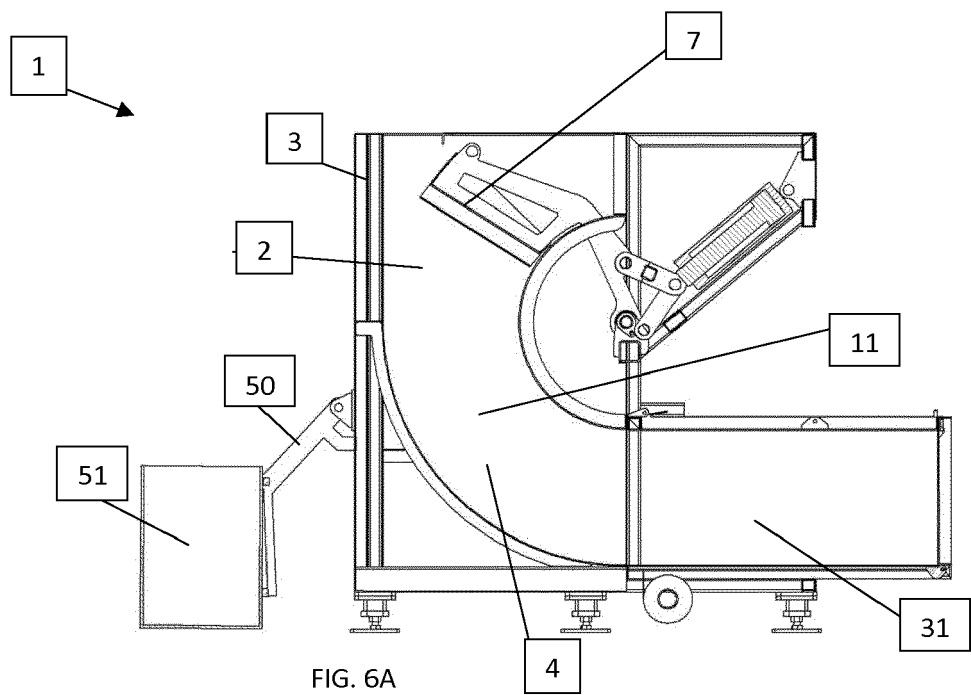


FIG. 6A

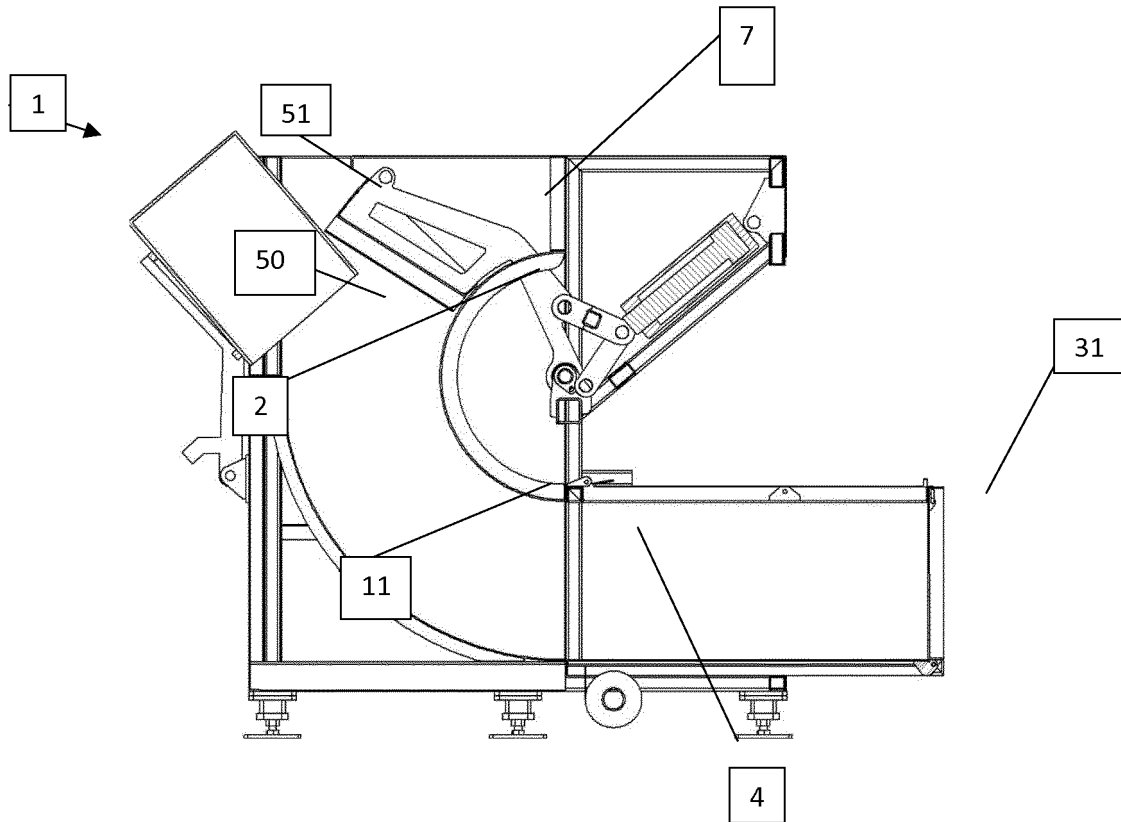


FIG. 6B

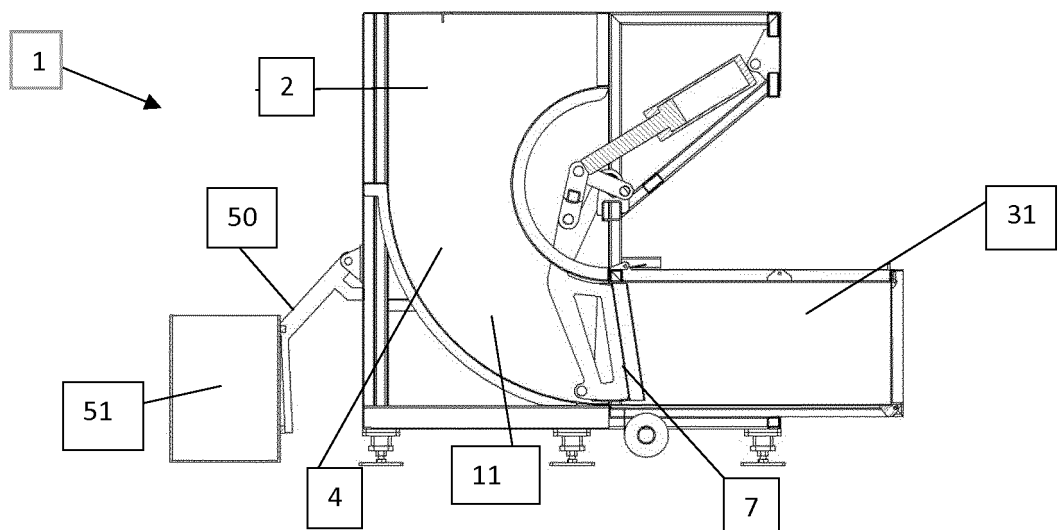


FIG. 6C

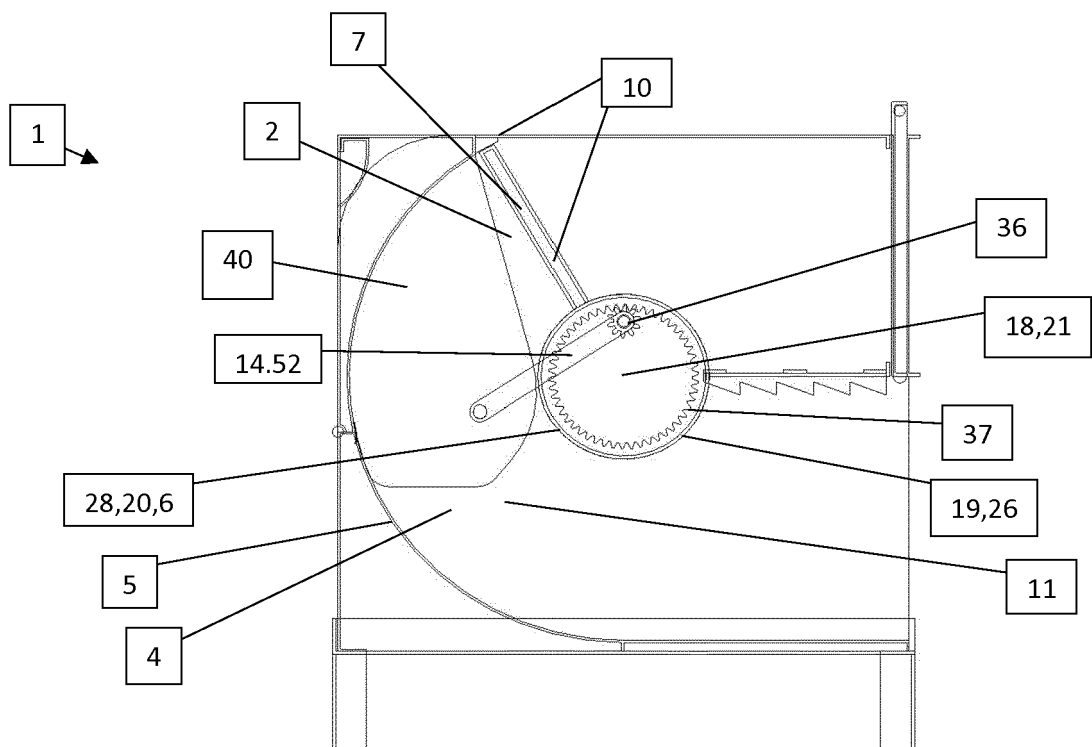


FIG. 7A

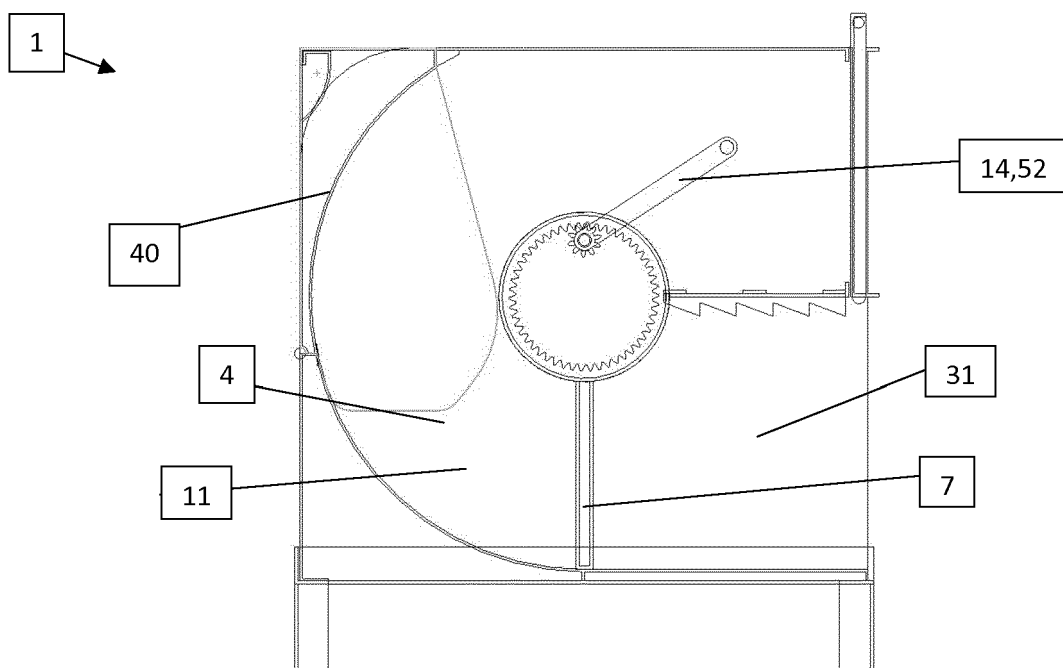
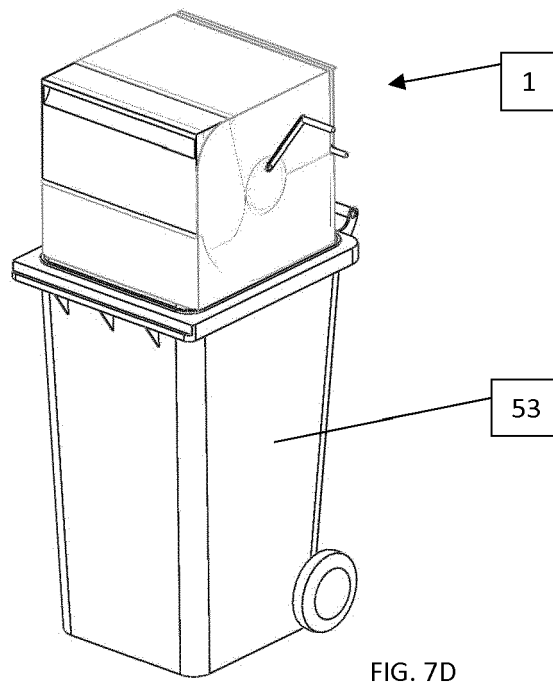
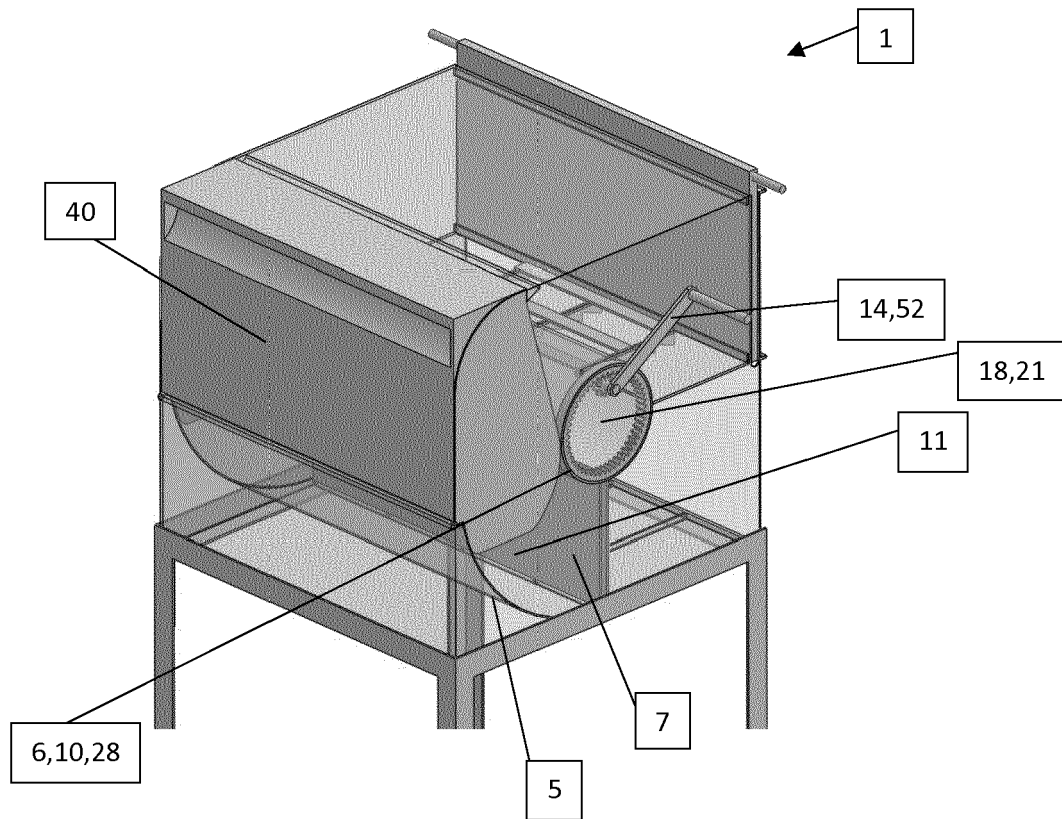


FIG. 7B



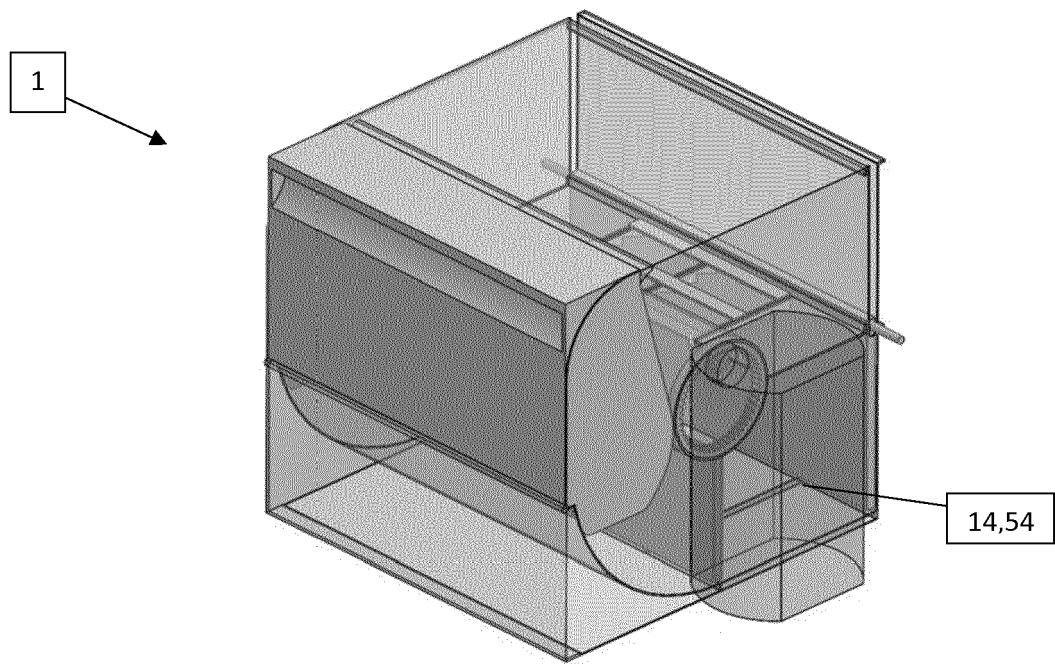


FIG. 8

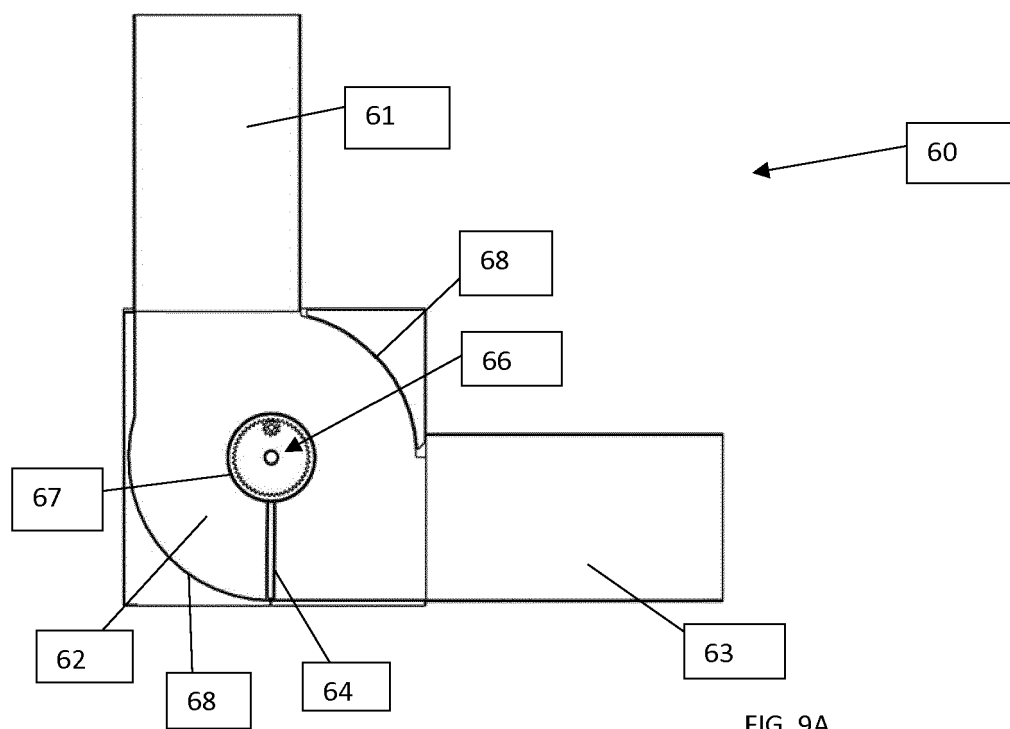
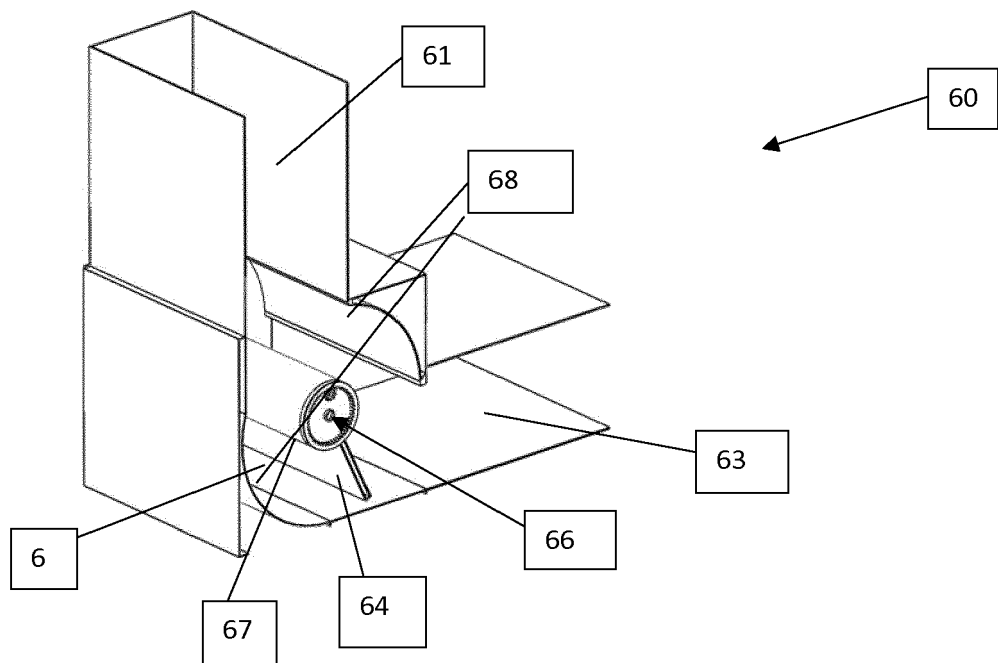
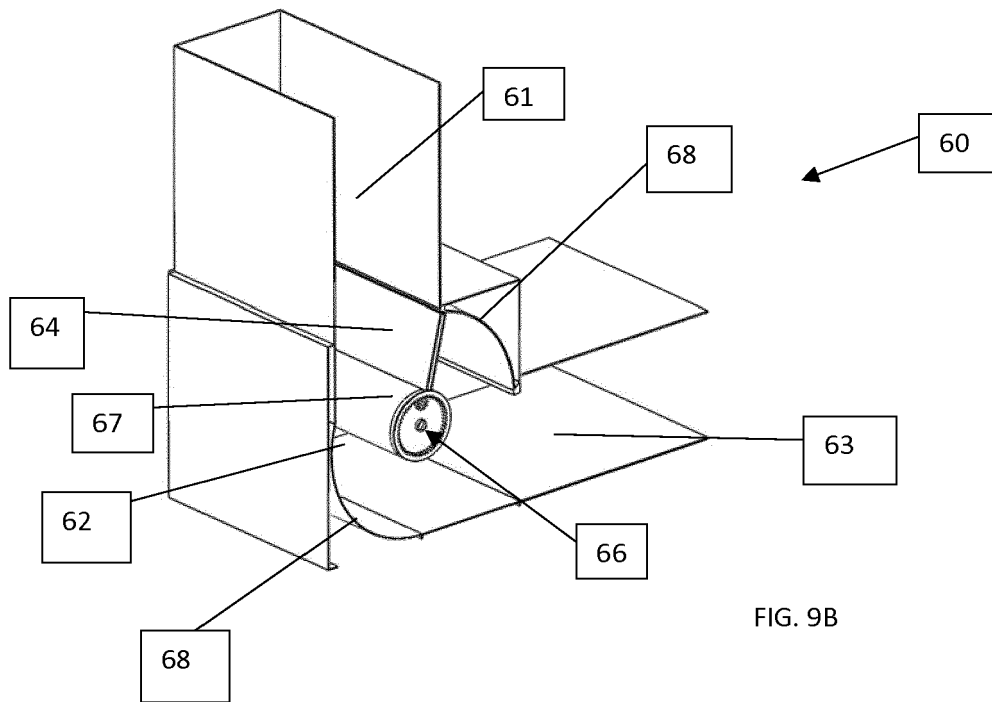


FIG. 9A



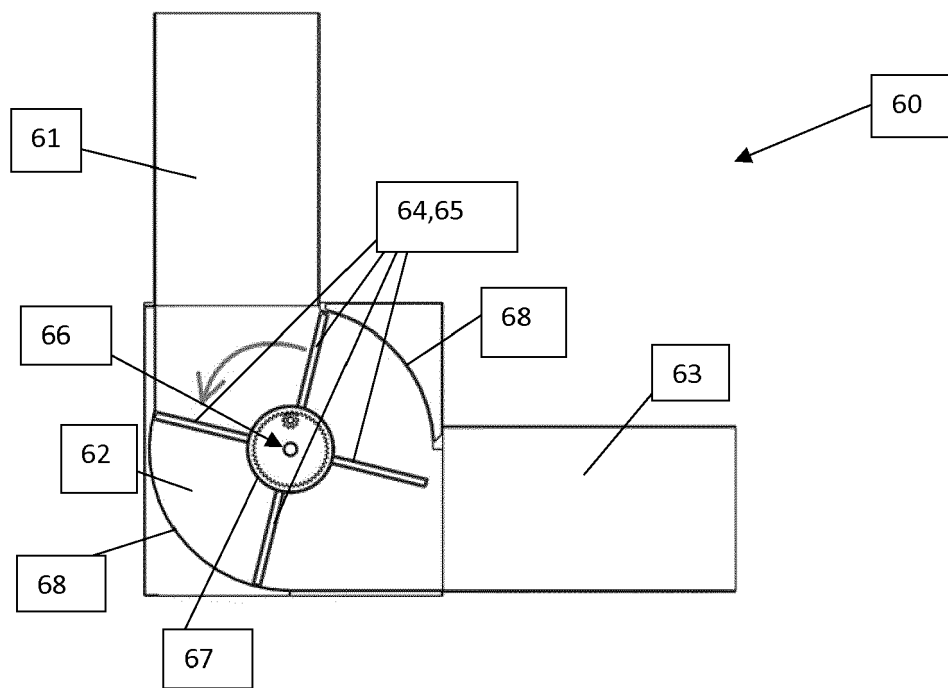


FIG. 10A

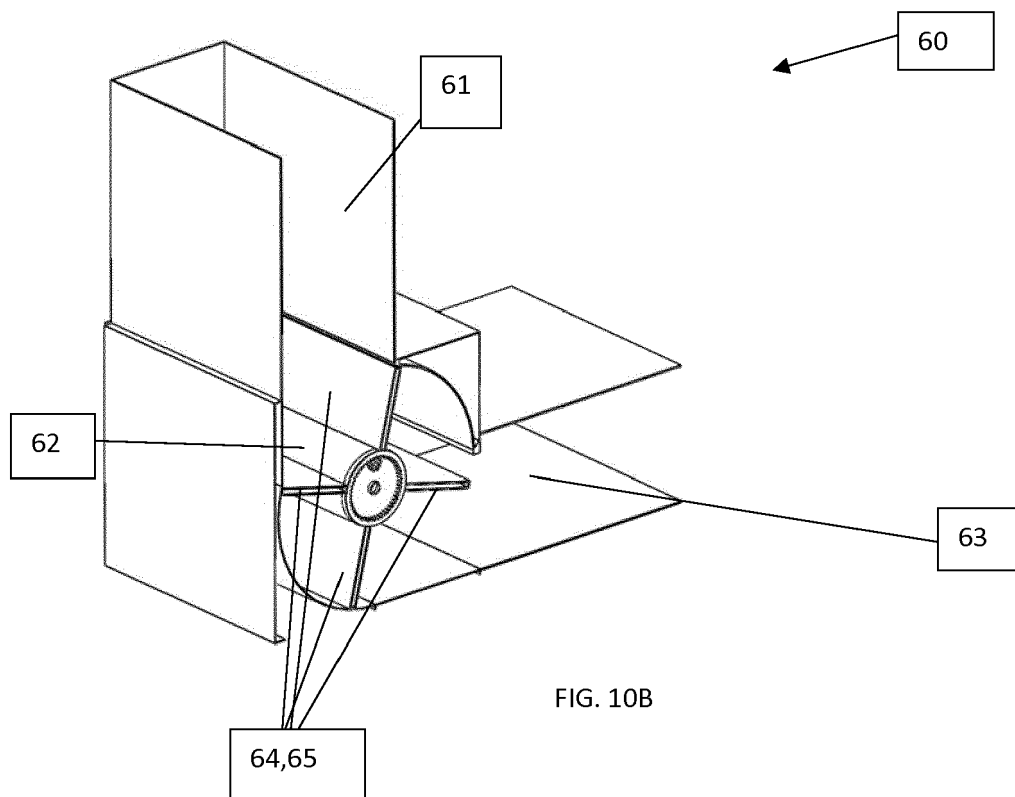
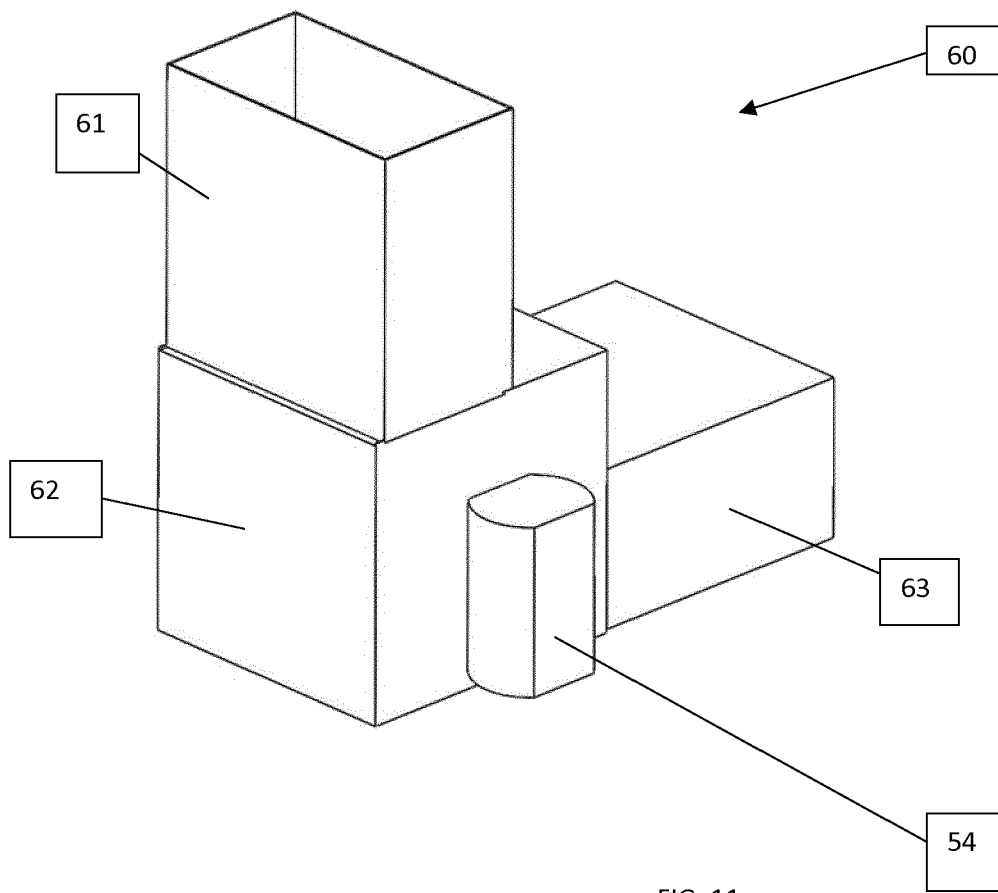


FIG. 10B





EUROPEAN SEARCH REPORT

Application Number
EP 18 16 0005

5

10

15

20

25

30

35

40

45

50

55

1

EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 423 692 A (AUGUST CLAAS; WALTER GUSTAV BRENNER) 6 February 1935 (1935-02-06) * the whole document *	1-3,6-8, 10,11, 13,15	INV. B30B9/30
X	US 3 134 321 A (ERIC LOEHNERT) 26 May 1964 (1964-05-26) * the whole document *	1-7,10, 11,13-15	
X	US 5 307 607 A (TONDO FRANK [US]) 3 May 1994 (1994-05-03) * columns 4-6; figures *	1,3-7, 10,13-15	
X	CN 103 359 434 A (UNIV ZHEJIANG TECHNOLOGY) 23 October 2013 (2013-10-23) * abstract; figures *	1,3-8, 13,15	
A	EP 0 402 723 A2 (WELGER GEB [DE]) 19 December 1990 (1990-12-19) * abstract; figures *	1,13,15	
A	DE 10 2010 026737 A1 (HEINZ BERGMANN MASCHINE FÜR DIE ABFALLWIRTSCHAFT E K [DE]) 12 January 2012 (2012-01-12) * abstract; figures *	1,13,15	TECHNICAL FIELDS SEARCHED (IPC) B30B
A	DE 20 30 914 A1 (DEMAG) 30 December 1971 (1971-12-30) * abstract; figures *	1,13,15	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 16 August 2018	Examiner Labre, Arnaud
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 16 0005

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-08-2018

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 423692 A	06-02-1935	NONE	
US 3134321 A	26-05-1964	DE 1227721 B FR 1381197 A GB 999027 A US 3134321 A	27-10-1966 04-12-1964 21-07-1965 26-05-1964
US 5307607 A	03-05-1994	NONE	
CN 103359434 A	23-10-2013	NONE	
EP 0402723 A2	19-12-1990	DE 3919434 A1 EP 0402723 A2 US 5063841 A	20-12-1990 19-12-1990 12-11-1991
DE 102010026737 A1	12-01-2012	NONE	
DE 2030914 A1	30-12-1971	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 0686493 A [0003]
- US 4155297 A [0004]