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(54) A CONTINUOUS PRESSING DEVICE AND A FUNCTIONING METHOD THEREOF

KONTINUIERLICHE PRESSVORRICHTUNG UND BETRIEBSVERFAHREN DAFÜR

DISPOSITIF DE PRESSAGE CONTINU ET SON PROCÉDÉ DE FONCTIONNEMENT

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(56) References cited:
WO-A1-81/03629 **DE-U1- 8 302 259**
ES-A1- 2 242 472 **FR-A1- 2 582 985**
FR-A1- 2 607 515 **FR-A1- 2 701 816**
FR-A1- 2 850 587 **FR-A5- 2 133 030**
FR-A5- 2 191 471 **JP-A- H11 342 496**
US-A- 3 695 448 **US-A- 6 123 018**

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Description

TECHNICAL FIELD

[0001] The present invention relates to a continuous pressing device for products containing a solid part and a liquid part, and a functioning method thereof.

[0002] In particular, the device and method of the present invention are aimed at pressing vegetable products, typically for pressing grapes in the enological field, without however excluding the possibility of the advantageous use thereof for pressing other products, among which organic refuse from animal farming or other pulps of various natures in which it is required to separate the liquid part from the solid part.

BACKGROUND ART

[0003] As is known, enological processes comprise bunches of grapes in arrival from harvesting being subjected to a first crushing step, which has the function of breaking and crushing the grapes, such as to obtain a product containing juice (must), skins, seeds, residues of pulp and also stems, should the last not have been completely eliminated in a preliminary step of de-stemming.

[0004] The product obtained by the crushing is then subjected to a pressing step which has the aim of separating the liquid part, i.e. the must, from the solid parts such as the skins, seeds and stems.

[0005] The pressing step can be performed using discontinuous enological presses which comprise a pressing element, for example a sliding piston or an inflatable membrane, which is able to press the product internally of a chamber having a perforated wall, in such a way that the must obtained from the pressing exits from the holes of the walls while the solid parts are contained internally.

[0006] Normally the product to be processed is pressed a plurality of times, with a step of mixing following each step of pressing, in which mixing step the solid parts are mixed internally of the chamber of the press in order to obtain a more complete juicing of the grapes.

[0007] As a rule, the must obtained with the first pressing steps is of better quality and is therefore used for higher-quality products, with respect to the must obtained from subsequent pressing steps.

[0008] Once complete exhaustion of the grapes has been achieved, the completely-crushed solid parts (marc) are discharged from the press chamber, which is then filled with new product to be pressed.

[0009] While effective and functional, this type of press has the disadvantage of being able to function only discontinuously, which significantly limits production capacity.

[0010] To counter this drawback, enological presses have been disclosed which have a continuous cycle, the most widespread of these comprising a perforated cylinder in which a rotary screw is housed.

[0011] The product to be processed is loaded from an inlet mouth located at a first end of the perforated cylinder, and is advanced by the screw towards an outlet mouth located at the opposite end. The screw normally exhibits a variable step which reduces from the inlet mouth towards the outlet mouth, in such a way as to subject the product to a progressive compression as it gradually advances along the perforated cylinder.

[0012] The must obtained from this progressive crushing exits continuously from the perforated walls of the cylinder while the exhausted skins are continuously discharged via the outlet mouth.

[0013] As the quality of the must obtained with this system is generally better in proximity of the inlet mouth and progressively reduces towards the outlet mouth, it is usually collected in a vessel located below the perforated cylinder and sub-divided into sectors able to maintain the different qualities of the must separate.

[0014] Thanks to this continuous-cycle functioning, screw presses exhibit the important advantage of having a greater production capacity with respect to discontinuous presses.

[0015] A disadvantage of these continuous presses is that they present a certain difficulty in adapting the pressing parameters thereof, especially the crushing pressure, to the changing conditions of the product to be processed.

[0016] Further, continuous presses often subject the grapes to significant mechanical stresses, deriving from the contact with the moving screw, which stresses can give rise to undesired dregs caused for example by the partial destruction of the skins, or even the breakage of the seeds or stems, with a possible release of undesired substances.

[0017] For example FR 2701816 discloses a discontinuous extractor-press, in particular for pressing grapes with a view to making cognac. The discontinuous extractor-press comprises a vat with a horizontal longitudinal axis and fitted with grape feeding means, the vat being fitted at its upstream end with a piston comprising a pressing head and a rod which can be moved in translation along said longitudinal axis of the vat, and at its downstream end a flap is provided equipped with closure means having an adjustable closure pressure, and with means for draining off the juices obtained. The discontinuous extractor-press further comprises means which cause the pressing head to rotate about the longitudinal axis of the vat.

[0018] US 6,123,018 discloses a method and an apparatus for extracting liquid from a liquid-containing slurry. The apparatus includes a plurality of interconnected press assemblies, the outlet of one press assembly being connected to the inlet of a successive press assembly. Each press assembly has a foraminous cylindrical container, and a two-part piston assembly movable between extended and retracted positions within the foraminous container. During operation, a pump continuously feeds slurry under pressure through the inlet of the first press assembly to cause liquid within the first stage slurry up-

stream of the two-part piston assembly to be radially expressed through the foraminous container. After a suitable amount of liquid has been extracted from the first stage slurry, batch processing of the partially dewatered slurry will commence.

DISCLOSURE OF THE INVENTION

[0019] An aim of the present invention is therefore to provide a pressing device and a functioning method thereof which is not afflicted by the drawbacks in the prior art, thanks to which it is possible to carry out an effective continuous-cycle pressing which enables adequate regulation of the pressing parameters on the basis of the characteristics of the products to be processed, and which does not subject the product to excessive mechanical stresses.

[0020] A further aim of the present invention is to attain the mentioned objective with a solution that is simple, rational and has a relatively modest cost.

[0021] These and other aims are attained with the characteristics of the invention which are reported in the independent claims 1 and 10.

[0022] The dependent claims delineate preferred or particularly advantageous aspects of the invention.

[0023] In particular, it is disclosed a device for continuous pressing of products comprising at least a liquid part and a solid part, in particular for vegetable products such as grapes, which comprises:

- a tubular body having a lateral wall that is at least partially perforated,
- a piston slidably inserted in a first end of the tubular body,
- at least an inlet mouth associated to the piston and opening into a pressing chamber defined internally of the tubular body between the piston and the second axial end of the tubular body,
- a pump connected to the inlet mouth for supplying the product to be pressed internally of the pressing chamber, and
- obturator means for opposing exit of the product from the second axial end of the tubular body, the obturator means being mobile between a position of complete closure of the pressing chamber, in which the obturator means prevent outlet of the product, and a position of complete opening of the pressing chamber, in which they enable the product to exit freely.

[0024] According to the invention, the continuous pressing device is provided with an electronic control system programmed to carry out the functioning method outlined later in this disclosure.

[0025] As will clearly emerge from the following, thanks to this solution it is advantageously possible to carry out an effective continuous-cycle pressing process, for example of grapes, without using any rotary screw internally of the pressing chamber, and thus reducing the risk of destruction and breakage of the solid parts of the product, such as for example the skins, seeds and stems of the grapes.

[0026] In an aspect of the invention, the obturator means can comprise a leaf hatch door hinged at the second axial end of the tubular body.

[0027] With this solution the hatch door in the completely closed position thereof couples with the end of the tubular body, completely closing the pressing chamber and the product to be processed internally thereof. By rotating the hatch door in an external direction, the hatch door inclines and distances from the end of the tubular body, defining a discharge outlet hole through which the product contained in the pressing chamber can exit to the outside. The dimensions of this discharge outlet hole increase together with the increase of inclination of the hatch door with respect to the axis of the tubular body.

[0028] The hatch door reaches the fully open position when it reaches a parallel position with the axis of the tubular body, i.e. when it leaves the transversal section of passage of the tubular body completely unobstructed. In each intermediate position between the completely closed position and the completely open position, the hatch door continues to exert a certain opposing action to the exit of the product, which however decreases as the dimensions of the discharge outlet hole increase.

[0029] The face of the hatch door facing internally of the pressing chamber (when the hatch door is in the completely closed position) can be perfectly flat, i.e. it can be conformed such as to improve the shape of the discharge outlet hole. For example, the face of the hatch door can be convex, or can be conical, wedge-shaped or more generally can be defined by one or more inclined surfaces which project towards the inside of the pressing chamber.

[0030] In an alternative embodiment, the obturator means can comprise a further piston which is slidably insertable in the second axial end of the tubular body. In this way, when the piston is at least partially inserted in the second end of the tubular body, the pressing chamber is completely closed. By retracting towards the outside, the piston distances from the second end of the tubular body, creating a discharge outlet hole for the exiting of the product. The piston however continues to exert a certain opposing action to the exiting of the product. This opposing action decreases as the distance between the piston and the tubular body, i.e. gradually as the dimensions of the discharge outlet hole increase, up to reaching a position of complete opening in which the piston is so distant from the tubular body that the product exiting from the second end thereof is no longer able to reach it.

[0031] In this case too, the face of the piston facing towards the inside of the pressing chamber can be perfectly flat, or can be conformed in such a way as to improve the shape of the discharge outlet hole, for example it can have a convex conformation, a conical formation, a wedge-shape or in general can be defined by one or more inclined surfaces which project towards the inside.

[0032] In a further aspect of the invention, the pump can be a peristaltic pump.

[0033] A peristaltic pump is generally a volumetric variable-flow rate pump which applies the principle of peristalsis, on the basis of which the product to be pumped is thrust towards the delivery by a choke which runs along an elastic tube.

[0034] The use of a peristaltic pump is particularly advantageous for this type of application, inasmuch as it does not lead to a direct contact between the product to be processed and the rotating parts of the pump. It is however possible that the peristaltic pump can be replaced by other types of volumetric adjustable-flow rate pumps.

[0035] According to the invention, the device comprises a scraper ring, which is coaxially inserted in the tubular body and is able to move alternatingly with respect both to the tubular body and the piston.

[0036] The presence of this scraper ring is important in order periodically to be able to clean at least a part of the perforated wall of the tubular body, the holes of which tend to be obstructed by the product which is pressed, obstructing and sometimes rendering the outflow of the must entirely impossible.

[0037] In an embodiment, the scraper ring can be conformed as a hollow cylinder, which is coaxially interposed between the piston and the tubular body and is mobile with respect to both thereof in an alternating movement, typically between the piston and the tubular body and is mobile with respect to both in alternating motion, typically between a retracted position in which it is substantially flush with the piston and an advanced position in which it projects axially with respect to the piston towards the inside of the pressing chamber. In a further embodiment, the scraper ring can be flanked to the piston internally of the pressing chamber, in such a way as to be able to move from a proximal position to a distanced position from the piston.

[0038] In a further aspect of the invention, the device can comprise a device for scraping the external surface of the tubular body.

[0039] This aspect of the invention has the advantage of preventing the holes of the perforated wall of the tubular body from being blocked by residues of product which sometimes remain attached to the external surface.

[0040] In particular this device can comprise one or more rotary brushes and movement means able to translate the rotary brushes with an alternating motion along the direction of the axis of the tubular body.

[0041] The present invention makes available a functioning method for the device delineated herein above, which comprises a start-up step which comprises:

- predisposing the obturator means in a position of complete closure,
- starting up the pump such as to load the pressing chamber, forming a compact agglomeration of pressed product at the second axial end of the tubular body,
- displacing the obturator means into a position of at least partial opening of the pressing chamber,

and then a successive step of continuous-cycle pressing which comprises:

- maintaining the pump in constant function, in such a way as to continuously supply the product to be pressed internally of the pressing chamber and such as to cause consequent outlet of the pressed product from the second end of the tubular body.

[0042] Because of this start-up step, when the obturator means are opened, the product loaded in the pressing chamber does not exit freely, but is retained internally by the friction that the cake of pressed product exerts against the lateral walls of the tubular body, possibly added-to by the constrasting action the obturator means in partially open position can continue to exert on the cake.

[0043] In this way, during the subsequent continuous-cycle pressing step, the product to be pressed which is continuously dispensed into the pressing chamber by the volumetric pump, pushes the product already present therein to slide in an axial direction towards the second end of the tubular body. With this thrust, the terminal part of the cake exits and is discharge externally of the pressing chamber, while the product already present in the chamber progressively compacts towards the discharge, re-forming the discharged portion of the cake, and while the product just inserted begins to be crushed in the initial section immediately downstream of the piston.

[0044] As the dispensing of the product by the pump is continuous, the overall effect obtained is thus a continuous pressing of the product, with the liquid part (for example the must) which exits continuously from the perforated walls of the tubular body, and with the completely crushed solid parts (for example the marc) which are continuously discharged through the second end of the tubular body.

[0045] The pressing is carried out in a total absence of mechanical actions, only by effect of the supply at pressure of the product to be processed internally of the pressing chamber.

[0046] The degree of pressing the product is subjected to is further generally progressively increasing in the axial direction towards the cake, so the quality of the liquid part (e.g. must) obtained with this system is normally better in proximity of the piston and progressively diminishes towards the second end of the tubular body, enabling a separate collection thereof.

[0047] In a preferred aspect of the invention, the loading step of the pressing chamber in particular comprises:

- predisposing the piston in an initial position internally of the tubular body,
- monitoring the pressure in the pressing chamber up

to reaching a predetermined value, i.e. a preset value, or priorly programmed, and then

- progressively moving the piston towards the first end of the tubular body up to reaching a predetermined working position, i.e. a preset, predetermined or programmed position.

[0048] In this way, the start-up step enables immediately realising a rather dense cake of completely-pressed solid parts (for example the marc) at the second axial end of the tubular body.

[0049] To obtain this effect, the piston can be maintained in the initial position up to when the pressure in the pressing chamber reaches a rather high pressure, for example comprised between 2 and 8 bar, such as to guarantee that the solid parts of the cake have a degree of compaction that is high enough for the subsequent steps.

[0050] By progressively retracting the piston towards the first end of the tubular body, the length of the pressing chamber is increased up to reaching the predetermined working position for the following continuous-cycle pressing cycle.

[0051] The working position of the piston in general depends on the characteristics on the product to be pressed and the type of working. As a general rule, this position is established in such a way that the final length of the pressing chamber is sufficiently high to obtain, during the continuous-cycle pressing step, the complete exhaustion of the product to be pressed (i.e. a substantially complete crushing of the solid parts), but not so high as to cause an excessive consolidation of the cake.

[0052] By progressively retracting the piston a progressive differentiation of the characteristics of the product accumulating in the pressing chamber is also obtained, i.e. more solid and compact towards the obturator means and progressively more liquid and less compact towards the piston.

[0053] In more detail, the step of loading the pressing chamber can comprise moving the piston towards the working position by a predetermined step, i.e. preset, prefixed or priorly programmed, for example comprised between 30 and 300mm, each time the pressure internally of the pressing chamber reaches a predetermined value, i.e. preset, prefixed or priorly programmed, for example comprised between 2 and 8 bar.

[0054] This retracting by successive steps is advantageous as it has been seen to be particularly effective in consolidating the cake and for differentiating in an axial direction the degree of compacting of the product which progressively accumulates in the tubular body.

[0055] In a further aspect of the invention, the continuous-cycle pressing step comprises:

- monitoring the pressure in the pressing chamber, and
- regulating at least a functioning parameter of the device in such a way as to maintain a predetermined value, i.e. preset, prefixed or priorly programmed, of the pressure in the pressing chamber, for example between 2 and 8 bar.

[0056] In other words, this aspect of the invention can in general comprise:

- monitoring the pressure-in the pressing chamber, and
- calculating the difference between the monitored value and the predetermined value of the pressure in the pressing chamber, and
- regulating (i.e. varying) at least a functioning parameter of the device in such a way as to reduce the difference.

[0057] By keeping the pressure in the pressing chamber substantially constant it is advantageously possible to conserve the dynamic equilibrium which enables constantly recreating a quantity of cake that is equal to the quantity discharged over the same period, thus preventing both an excessive consolidation of the cake, which might lead to blocking the device, and an excessive softening thereof, which might cause breakage thereof and thus the immediate voiding of the pressing chamber.

[0058] In a preferred aspect of the invention, the functioning parameter that is regulated in order to maintain the desired pressure is selected from among: the position of the obturator means, the supply flow-rate to the pump and the position of the piston.

[0059] This choice is advantageous inasmuch as these parameters are those which usually most greatly influence the equilibrium of the cake and thus the pressure in the pressing chamber.

[0060] In detail, in an embodiment of the invention all these functioning parameters can be regulated, even possibly sequentially one after another.

[0061] For example, if the pressure in the pressing chamber drops (i.e. the cake is softening), the method can comprise:

- shifting the obturator means into a position of complete closure, such as to increase the opposing action to the cake and thus the counter-pressure acting thereon,
- reducing the flow rate of the supply pump, such as to increase the compacting of the solid parts (marc) which form the cake,
- displacing the piston towards the first end of the tubular body, such as to increase the length of the pressing chamber and consequently increase the level of exhaustion of the solid parts (marc) which form the cake.

[0062] If all these interventions were not successful in increasing the pressure in the pressing chamber up to the predetermined pressure, the obturator means can be brought into the position of complete closure and the de-

vice start-up step can be repeated.

[0063] If on the other hand the pressure in the chamber increases (which means that the cake is hardening), the method can comprise:

- displacing the obturator means into a position of complete opening of the pressing chamber, such as to reduce the contrasting action to the exiting of the cake and thus the counter-pressure acting thereon,
- increasing the flow rate of the supply pump, such as to reduce the compacting of the solid parts (marc) that form the cake,
- displacing the piston towards the second end of the tubular body, such as to reduce the length of the pressing chamber, consequently reducing the level of exhaustion of the solid parts (marc) which form the cake.

[0064] If all these interventions do not achieve the effect of lowering the pressure in the pressing chamber up to the predetermined value, an unblocking procedure can be carried out which consists in pushing the hardened cake towards the discharge.

[0065] This operation can be carried out by advancing the piston towards the second end of the tubular body in successive steps, singly comprised for example between 30 and 300 mm. On completion of each step the conditions can be verified and if the ideal conditions have not be achieved a further thrusting step can be carried out.

[0066] It is stressed that although the main parameter to be controlled is the pressure in the pressing chamber, the method might include also controlling other process parameters, such as for example the thrust exerted by the cake on the obturator means and/or the flow rate of the liquid part (must) collected (including separated collection of the different-quality musts).

[0067] In a further aspect of the invention, the continuous-cycle pressing step can also include:

- alternatingly moving the piston starting from the working position.

[0068] This operation can be repeated continuously one or more times with a predetermined periodical frequency.

[0069] In this way, during the retracting travel towards the first end of the tubular body, the pressing chamber expands and an aspiration effect is obtained which is added to the pump delivery, facilitating the dispensing of the product to be pressed. Instead, during the advancing travel towards the second end of the tubular body a compression effect is obtained. In this way, the advancing travel of the piston contributes to the advancement of the whole cake and, thanks to the scraping of the seal rings of the piston against the lateral wall of the tubular body, also contributes to removing the product which might obstruct the drainage holes afforded in the first section of the pressing chamber and which are fundamental for collecting the must.

[0070] The piston travel during these operations can have a predetermined length, i.e preset, predetermined or priorly programmed, for example comprised between 30 and 300 mm starting from the working position for the continuous-cycle pressing step.

[0071] In the case in which the device is provided with the above-mentioned scraper cylinder, the step of cleaning the drainage holes can also be carried out by activating the scraper cylinder to move with respect to the tubular body and the piston, which stay stationary.

[0072] In a further aspect of the invention, the continuous-cycle pressing step can comprise modifying the position of the piston on the basis of a change in the characteristics of the product to be pressed.

[0073] This aspect of the invention has the advantage of adapting the functioning of the device to a variation in the characteristics of the product to be processed, without interrupting the continuous-cycle pressing step.

[0074] In a further aspect of the invention, the functioning method further comprises a final working step comprising:

- stopping the pump,
- shifting the obturator means into a position of complete closure,
- moving the piston in a nearing direction to the second end of the tubular body, applying a constant thrust of a predetermined amount, i.e. preset, predetermined or priorly programmed thereto.

[0075] This leads to a static pressing which has the effect of completely exhausting the product still contained in the pressing chamber, retaining only the exhausted solid parts (marc).

[0076] The thrust applied on the piston will preferably have to be such that the piston exerts on the product a constant pressure equal to the ideal pressure calculated for the continuous-cycle pressing.

[0077] In a further aspect of the invention, the final working step further comprises:

- monitoring the displacement of the piston while it is subjected to the thrust and, when the monitored displacement of the piston is nil,
- displacing the obturator means into a position of complete opening of the pressing chamber, and
- further advancing the piston towards the second end of the tubular body.

[0078] With this solution, once the complete exhaustion of the residual product has been achieved, the product is definitively and completely discharged to outside the tubular body.

[0079] In a further aspect of the invention, during the final working step, the piston is advanced up to being completely external of the pressing chamber, leaving the second end of the tubular body open.

[0080] In this way, after having been emptied of the completely exhausted solid parts (marc), it is easy to carry out a complete internal cleaning and sanitising of the pressing chamber, as well as of the piston and the relative scraper cylinder (if present). This represents a great advantage with respect to screw presses which are hard to clean and cannot easily be re-started from empty.

BRIEF DESCRIPTION OF THE DRAWINGS

[0081] Further characteristics and advantages of the invention will emerge from a reading of the following description, provided by way of non-limiting example, with the aid of the figures illustrated in the accompanying figures of the drawings.

Figure 1 is a perspective view of a press according to an embodiment of the present invention.

Figure 2 is a lateral view of the press of figure 1.

Figure 3 is a view from above of a loading piston belonging to the press of figure 1, shown with the scraper cylinder in section and in retracted position.

Figure 4 is the view of figure 3 shown with the scraper cylinder in the advanced position.

Figure 5 is a schematic lateral view of a pressing device according to an embodiment of the present invention, in which the press is shown in section.

Figures from 6 to 10 show the device of figure 5 in 5 different operating steps during the pressing process.

figures 11 and 12 show a press according to an alternative embodiment of the present invention, which comprises a scraper ring which is shown respectively in retracted and advanced position.

Figures 13 and 14 are a perspective elevation of the loading group of the press of figures 11 and 12, respectively with the scraper ring in the retracted and advanced position.

Figures from 15 to 17 show three views of the scraper ring of figures 13 and 14.

Figures from 18 to 20 show three views of a scraper ring according to an alternative embodiment.

Figure 21 is a lateral view of a press in a further embodiment of the present invention, which is provided with an external scraper device.

Figures 22 is the section along XXII-XXII of figure 21, in which some details have been hidden so as to evidence the characteristics of the external scraper device.

BEST MODE FOR CARRIYNG OUT THE INVENTION

[0082] Figure 5 illustrates a device 100 for continuous-cycling pressing of food products, in the example for pressing grapes in the enological field.

[0083] The device 100 schematically comprises a pump 200 destined to collect the product to be pressed from a crusher 300 and to supply the product in pressure internally of a press 400.

[0084] The crusher 300 is a device able to process whole bunches of grapes, de-stemmed or partially de-stemmed, with the aim of opening and crushing the grapes, such as to obtain a product containing a liquid part (must) and a solid part (skins, seeds, pulp residues and also stems, should the stems not have been completely eliminated with a preliminary de-stemming step).

[0085] The crusher 300 can generally comprise a loading hopper 305, by means of which the product to be crushed is conveyed between two counter-rotating grooved rollers 310, which have the function of breaking and crushing the grapes. The product crossing the grooved rollers 310 collects in a lower pan 315, internally of which a screw 320 is located. The screw 320 is activated by an electric motor 325 positioned externally of the pan 315, such as to advance the crushed product towards the pump 200.

[0086] In some embodiments, a juice separator device (not illustrated) can be interposed between the crusher 300 and the pump 200, for example a vibrating grid separator, for separating the liquid from the solid parts of the fermented grapes and skins.

[0087] The pump 200 is in general a variable-flow volumetric pump: In the illustrated example, the pump 200 is a peristaltic pump. In particular, the pump 200 comprises a flexible and elastic tube 205, for example made of silicone, PVC or other polymers, the ends of which respectively define the inlet 210 and the outlet 215 of the pump.

[0088] The pump 200 further comprises a rotor 220, which is activated in rotation by a respective motor (not illustrated). The rotor 220 bears two diametric rollers 225, which are able to rotate in contact with the flexible tube 205, such as to define a choke which moves in the direction of the length of the tube itself. In this way, discrete quantities of product are continuously pushed by the choke from the inlet 210 towards the outlet 215. The flow rate of the pump 200 can be regulated by varying the rotation velocity of the rotor 220, by means of the motor.

[0089] The use of the peristaltic pump 200 is advantageous as the pumping is done without any direct contact between the product and the mobile parts of the pump. It is however possible that in other embodiments the peristaltic pump 200 can be replaced by a volumetric pump of any other type as long as it is variable-flow.

[0090] The press 400 comprises a tubular body 405, in the example an internally hollow cylinder. The tubular body 405 is supported by a support frame 410, in the example a carriage, on which the tubular body 405 is preferably arranged with the axis X thereof orientated horizontally. The lateral wall of the tubular body 405 is perforated, i.e. it exhibits a multiplicity of through-holes for drainage.

[0091] In the illustrated example, the drainage holes are uniformly distributed on the whole lateral wall of the tubular body 405, but it is possible that in other embodiments they can be distributed over a limited part of the

lateral wall, for example only on the lower part.

[0092] The tubular body 405 exhibits two axial ends, of which a first loading end and a second discharge end. A loading mouth 415 and a discharge mouth 420 are coaxially fixed respectively to the ends, which mouths substantially have the same diameter as the tubular body 405. The loading mouth 415 is perfectly cylindrical, while the discharge mouth 420 is dovetailed.

[0093] Obturator means, denoted in their entirety by 425, are associated to the discharge mouth 420, which are able to completely close the second axial end of the tubular body 405 and open it progressively, continuing to exert an opposing action against the outlet of the product, up to reaching a position of complete aperture, in which the product can freely exit from the tubular body 405.

[0094] In other words, the obturator means 425 are mobile, i.e. able to move or configured such as to move between the position of complete closure and the position of completer opening of the second end of the tubular body 405. In particular, activating means can be present able to move the obturator means 425 between the completely closed position and the completely open position. In the illustrated example, the obturator means 425 comprise a hatch door 430, which is hinged to the discharge mouth 420 according to a rotation axis Y perpendicular to the axis X of the tubular body 405. The rotation axis Y is positioned in proximity of the second axial end of the tubular body 405, but outside the transversal section thereof.

[0095] In this way, the hatch door 430 in the completely closed position obstructs the discharge mouth 420 (see figure 6), completely closing the second axis end of the tubular body 405. When rotating externally, the hatch door inclines and distances from the edge of the tubular body 405, and is raised with respect to the lower wall of the discharge mouth 420. In this way, the hatch door 430 progressively defines a discharge mouth through which the product contained in the tubular body 405 can exit to outside, encountering more or less resistance according to the dimension of the discharge opening itself. In particular, the dimensions of the discharge opening progressively increase up to when the hatch door 430 reaches to raised position shown in figure 5. In this position, the hatch door 430 is substantially parallel to the axis X of the tubular body 405, leaving the transversal section thereof completely unobstructed and thus enabling the product to exit without encountering any obstacle.

[0096] It is observed that, in order to improve the shape of the discharge opening profile, the face of the hatch door 430 facing towards the product in outlet, exhibits a bulging profile a convexity of which projects towards the inside of the tubular body 405 (when the hatch is in the completely closed position). It is however possible in other embodiments for the face of the hatch door 430 to be perfectly flat or conical, wedge-shaped or in general have inclined walls. The displacements of the hatch door 430 between the above-cited completely-closed and completely-open positions are carried out by means of a cylinder/piston group 435, hydraulically activated and double-acting, the ends of which are hinged respectively to a horizontal support 440 fixed above the tubular body 405, and to a pair of brackets 445 fixed to the hatch door 430 and rotating solidly there-with about the axis Y as a rocker. In this way, the lengthening and shortening of the cylinder/piston group 435 enables moving into and stopping the hatch door 430 in the positions of complete closure, complete aperture and into any other intermediate position.

[0097] As illustrated in figure 1, the loading mouth 415 and the discharge mouth 420 are fixed to two longitudinal members 450, which are parallel and positioned on diametrically opposite sides of the tubular body 405. The longitudinal members 450 project axially with respect to the loading mouth 415, on the opposite side with respect to the tubular body 405, such as to function as guides for a slide 455. In the illustrated example, the slide 455 comprises a central body 460 interposed between the longitudinal members 450, and two roller skates 465 fixed to the central body 460 and singly coupled slidingly to a respective longitudinal member 450. In this way, the slide 455 is able to slide on longitudinal members 450 in the direction of the axis X of the tubular body 405, nearingly and distancingly with respect to the loading mouth 415. The displacements of the slide 455 are powered by two long-travel piston/cylinder groups 470, hydraulically-acting and double-acting, each of which is fixed to a respective longitudinal member 450 while the end of the piston 475 thereof is fixed to a respective roller skate 465.

[0098] A loading group is solidly fixed to the central group 460 of the slide 455, denoted in its entirety by 480 and visible in detail in figures 3 and 4. The loading group 480 comprises a piston 485, generally cylindrical in shape, which is located at the end of a coaxial shaft 490 (partially visible in figure 1), the opposite end of which is fixed to the central body 460 of the slide 455, in such a way that the piston 485 is able to slide solidly with the slide 455 along the axis X of the tubular body 405.

[0099] In the illustrated example, the piston 485 is coaxially inserted in a scraper cylinder 495 having an axial length that is greater than the length of the piston 485. In practice, the scraper cylinder has a substantially tubular body conformation which is coaxially inserted externally of the piston 485 and internally of the tubular body 405.

[0100] The scraper cylinder 495 is borne at the end of a cylindrical jacket 500 (partially visible in figure 1) which is slidably inserted on the shaft 490. In this way, the scraper cylinder 495 is able to displace solidly with the slide 455, but it is also able to move independently on-board the slide 455 in the direction of the axis X of the tubular body 405, between a retracted position shown in figure 3, in which the end is substantially flush with the end face of the piston 485, and an advanced position shown in figure 4, in which the end thereof passes beyond the end face of the piston 485. This movement of the scraper

cylinder 495 is carried out by two piston/cylinder groups 505, hydraulically-acting and double-acting, the ends of each of which are respectively fixed to the central body 460 of the slide 455 and to a respective ribbing projecting from the cylindrical jacket 500.

[0101] As illustrated in figure 5, the piston 485 and the scraper cylinder 495 cross the discharge mouth 415 and are coaxially and slidably inserted snugly in the tubular body 405, in such a way as to close the first end. This closure is made hermetic by one or more seal rings which are applied to the piston skirt 485, such as to be coaxially interposed between the skirt and the scraper cylinder 495, and by one or more seal rings that are applied on the scraper cylinder 495, such as to be coaxially interposed between the cylinder 495 and the tubular body 405.

[0102] It follows that the scraper cylinder 495 is mobile, i.e. able to move or configured so as to move with an alternating motion both with respect to the piston 485 and with respect to the tubular body 405. In other words, there are generally present means for moving the scraper cylinder 495 with an alternating motion both with respect to the piston 485 and with respect to the tubular body 405. It is stressed that in other embodiments the scraper cylinder 495 might not be present, in which case the piston 485 will be dimensioned such as alone to occupy the whole transversal section of the tubular body 405 with the interposing of one or more seal rings.

[0103] In any case, a pressing chamber 510 with perforated walls is defined between the end face of the piston 485 and the second end of the tubular body 405. The pressing chamber 510 can be completely closed, partially open or completely open on the basis of the position of the hatch door 430, while the internal volume is variable on the basis of the axial position occupied by the piston 485.

[0104] Lastly, the loading group 480 comprises a supply tube 515 for the product to be pressed, which is positioned eccentrically above the shaft 490 and is solidly constrained to the slide 455. A first end of this supply tube 515 is connected to the outlet 215 of the pump 200 through a flexible conduit 520, or in any case an extensible conduit such as to be able to follow the displacements of the slide 455. The second end of the supply tube 515 is coupled to a dispensing mouth 525, which is afforded in the piston body 485 and opens internally of the pressing chamber 510 through the end face of the piston.

[0105] Below the tubular body 405 the device 100 is provided with a collecting pan 530 for the must which is obtained by the pressing. The pan 530 develops over the whole length of the tubular body 405 and can be internally subdivided into sectors by a plurality of dividing walls 535 arranged in succession in the direction of the length thereof. A relative discharge conduit 540 for collecting the must can be associated to each of the sectors.

[0106] Lastly, the device 100 is completed by an electronic control system (not illustrated), which generally comprises at least an electronic processing unit connected to the various hydraulic actuators and with the electric motors of the pump 200 and the crusher 300, which is programmed such as to carry out the steps of the functioning method which are described in the following.

[0107] In general terms, the functioning method of the device 100 includes a start-up step, a continuous-cycle pressing step and a successive end-working step.

[0108] With reference to figure 6, the start-up step firstly comprises predisposing the hatch door 430 in a position of complete closure of the pressing chamber 510, and then nearing the piston 485 to the hatch door 430 up to reaching an initial position in which it is as close as possible to the second end of the tubular body 405, i.e. a position in which the volume of the pressing chamber 510 is at its smallest.

[0109] Starting from this configuration, the start-up step comprises setting the crusher 300 and the pump 200 in motion, such that the crushed product begins to be supplied to the inside of the pressing chamber 510. In this way, the must flows from the perforated walls of the tubular body 405, while the solid parts of the product thicken up and become progressively compacted against the hatch door 430, thus beginning to form a rather dense agglomeration which is known as a cake.

[0110] During this cake-forming step, the method comprises the pump 200 being made to function at a constant flow, while monitoring the pressure in the pressing chamber 510, i.e. the pressure with which the pump 200 pushes the product internally of the pressing chamber 510.

[0111] This pressure can be measured directly, for example by means of appropriate pressure sensors located in the pressing chamber 510 or in the connecting conduits 515 and 520, or it can be measured indirectly, for example by measuring the value of the torque developed by the electric motor to rotate the rotor 220 of the pump 200, or by measuring the thrust exerted by the product against the hatch door 430.

[0112] When the pressure in the pressing chamber 510 reaches a preset value, for example a value comprised between 2 and 8 bar, this means that the cake is sufficiently compact.

[0113] On reaching this condition, the start-up step comprises retracting the piston 485 by a step towards the first end of the tubular body 405, while maintaining the pump 200 in constant-flow function. This retracting step can be of a predetermined amount, for example comprised between 30 and 300 mm. In this way, the volume of the pressing chamber 510 increases while the pressure diminishes.

[0114] While keeping the pump 200 functioning at a constant flow-rate, the start-up step comprises retracting the piston 485 by a further retracting step each time the pressure in the pressing chamber 510 newly reaches the preset value.

[0115] In this way a progressive retracting of the piston 485 is obtained, and a progressive increase in the length of the pressing chamber 510, thanks to which it is advan-

tageously possible to consolidate the cake and axially differentiate the degree of compaction of the product which gradually accumulates in the tubular body 405. In practice, the solid part of the grapes accumulated in the pressing chamber 510 is more solid and compact towards the hatch door 430 and progressively more liquid and less compact towards the piston 485 (see figure 7).

[0116] The retracting of the piston 485 terminates when it reaches a predetermined working position for the successive step of continuous-cycle pressing. The working position of the piston 485 depends in general on the characteristics of the product to be pressed and on the type of working. As a rule, this position is established in such a way that the final length of the pressing chamber 510 is sufficiently long for obtaining, during the continuous-cycle pressing step, the complete exhaustion of the product to be pressed (i.e. a substantially complete pressing of the solid parts), but not so high as to cause an excessive consolidation of the cake.

[0117] When the piston 485 reaches the predetermined working position, the pump 200 is maintained in function at a constant flow, with the hatch door 430 still in the completely closed position, up to when the pressure in the pressing chamber 510 newly reaches the preset value, after which the start-up step concludes with the complete opening or at least partial opening of the hatch door 430, thus also leading to the start of the continuous-cycle pressing step (see figure 8).

[0118] When the hatch door 430 is open, the product that is already contained in the pressing chamber 510 cannot exit freely, but is retained internally of the friction that the cake of crushed grapes exerts against the lateral walls of the tubular body 405, possible added-to by the opposing action the hatch door 430 in the partly-open position can continue to exert on the cake.

[0119] Thanks to the presence of the cake, during the successive continuous-cycle pressing step, the hatch door 430 is thus maintained in a position of complete or partial opening and the pump 200 is maintained constantly in function, such as to continuously supply the product to be pressed internally of the pressing chamber 510.

[0120] In this way, the product to be pressed that is continuously dispensed into the pressing chamber 510 via the dispensing mouth 525 pushes the product already present to slide in an axial direction towards the second end of the tubular body 405. This thrust means also that the terminal part of the cake exits and is discharged externally of the pressing chamber 510, while the solid part of the product already present in the chamber compacts progressively towards the discharge, reforming the discharged portion of the cake, and while the product just inserted is crushed in the initial section immediately downstream of the piston 485.

[0121] The overall effect obtained is continuous pressing of the product, performed in the total absence of mechanical actions and only by effect of the pressured supply of the product to be processed internally of the pressing chamber 510, with the must continuously exiting from the perforated walls of the tubular body 405 and with the exhausted skins progressively discharged through the discharge mouth 420.

[0122] The degree of pressing to which the solid part of the product is subjected generally decreases in the axial direction towards the discharge mouth 420, so that the quality of the must obtained with the system is normally better in proximity of the piston 485 and progressively diminishes towards the second end of the tubular body 405, thus enabling a separate collection along the various sectors of the underlying collecting pan 530.

[0123] To maintain the dynamic equilibrium which enables constantly recreating a quantity of cake that is substantially equal to the cake discharged over the same period, the pressure in the pressing chamber 510 is preferably kept constantly at a predetermined value, i.e. a preset or priorly programmed value, for the whole duration of the continuous-cycle pressing step, for example at a value comprised between 2 and 8 bar.

[0124] To achieve this aim, during the continuous-cycle pressing step the method comprises continuing to monitor the pressure in the pressing chamber 510 and therefore regulating in a closed cycle at least a functioning parameter of the device 100, such as to minimise the error between the measured pressure value and the predetermined value.

[0125] In particular, the method includes regulating either contemporaneously or sequentially the position of the hatch door 430, the supply flow-rate of the pump 200 (for example via the regulating of the velocity of the rotor 220) and the working position of the piston 485.

[0126] For example, if during the continuous-cycle pressing, the pressure in the pressing chamber 520 drops (which means that the cake is getting softer), the method can comprise:

- shifting the hatch door 430 towards the position of complete closure, such as to reduce the dimension of the discharge aperture and thus increase the counter-pressure acting on the exiting cake,
- reducing the pump 200 flow-rate, such as to increase the time available for the compacting of the marc of the cake,
- retracting the piston 485 towards the first end of the tubular body 405, such as to increase the length of the pressing chamber 510 and consequently increase the degree of exhaustion of the marc forming the cake.

[0127] Should all these interventions not produce the effect of increasing the pressure in the pressing chamber 510 up to the predetermined value, the hatch door 430 can be brought into the position of complete closure and the start-up step of the device 100 can be repeated.

[0128] If, on the other hand, during the continuous-cycle pressing the pressure in the pressing chamber 510 increases (which means that the cake is becoming harder), the method comprises:

- displacing the hatch door 430 towards the position of complete opening, such as to increase the dimension of the discharge outlet hole and thus reduce the counter-pressure acting on the exiting cake,
- increasing the pump 200 flow-rate, such as to reduce the time available for compacting the marc in the cake,

displacing the piston 485 towards the second end of the tubular body 405, such as to reduce the length of the pressing chamber 510 and consequently reduce the degree of exhaustion of the marc forming the cake.

[0129] Should all these interventions not produce the effect of decreasing the pressure in the pressing chamber 510 down to the predetermined value, an unblocking process can be performed, which consists in strongly pushing the hardened cake towards the discharge.

[0130] This operation can be carried out by advancing the piston 485 towards the second end of the tubular body 405 in successive steps, singly comprised for example between 30 and 300 mm. On completion of each step the conditions can be verified and if the ideal conditions have not been re-established a further pushing step is made.

[0131] During the continuous-step pressing step, a further possibility is every so often to cause the piston 485, preferably solidly with the scraper cylinder 495, to systematically make one or more alternating motions starting from the working position.

[0132] In this way, during the retracting travel of the piston 485 towards the first end of the tubular body 405, the pressing chamber 510 expands and an aspirating effect is obtained which can be added to the delivery of the pump 200, facilitating the dispensing of the product to be pressed. During the advancing travel towards the second end of the tubular body 405 a compression effect is achieved. In this way, the forward travel of the piston 485 contributes to entirely advancing the cake and, thanks to the scraping of the seal rings of the scraper cylinder 495 against the lateral wall of the tubular body 405, to removing the product which might obstruct the drainage holes in the first section of the pressing chamber 510 and which are fundamental for the collection of the must.

[0133] The travel of the piston 485 during these operations can cover a predetermined distance comprised between 30 and 300 mm, starting from the working position for the continuous-cycle pressing step.

[0134] To improve the cleaning of the first section of the pressing chamber 510, every so often the scraper cylinder 495 is activated to move with an alternating motion between the retracted and advanced positions thereof, such as to de-obstruct the drainage holes without moving the piston 485 and therefore without modifying the dimensions of the pressing chamber 510.

[0135] During the continuous-cycle pressing step, also included is the possibility of modifying the working position of the piston 485 on the basis of a variation of the characteristics of the product to be pressed. This regulating of the working position can be carried out manually, or automatically with the aid of appropriate sensors which should be able to detect the characteristics of the product being worked.

[0136] When the product to be pressed is finished, the continuous pressing step terminates and the final working step is commenced.

[0137] With reference to figure 9, the final working step first comprises halting the functioning of the pump 200 and bringing the hatch door 430 into the position of complete closure.

[0138] After having completed these operations, the final working step includes moving the piston 485 nearingly to the second end of the tubular body 405, regulating the activating of the piston/cylinder groups 470 so that they generate 485 a constant thrust of a predetermined value on the piston, preferably a value equal to the ideal value calculated for the continuous-cycle pressing operations. In this way, a static pressing is performed which has the effect of completely exhausting the residual product still contained in the pressing chamber 510.

[0139] While the piston/cylinder groups 470 exert the above-mentioned constant thrust, the final working step also comprises monitoring the displacement of the piston 485. When the displacement of the piston 485 is nil, the final working step lastly comprises displacing the hatch door 430 into the completely open position of the pressing chamber 510, and thus further advancing the piston 485 towards the second end of the tubular body 405, such as to discharge the final residue of the cake externally of the pressing chamber 510, as illustrated in figure 10.

[0140] It is observed that the piston 485 is advanced up to reaching a position in which it is so advanced as to be completely external of the pressing chamber 510, also leaving open the second end of the tubular body 405. In this way, after being emptied of the exhausted grape-skins, the press 400 can be easily washed and sanitized. In particular, it is easily possible to perform a complete internal cleaning of the pressing chamber 510, as well as naturally of the piston 485 and the relative scraper cylinder 495.

[0141] In figures 11 and 12, a variant embodiment of the above-described press 400 is illustrated, which is differentiated from the previous one only in the aspects which will be described in the following. Unless an explicitly different indication is given, all the characteristics described in the foregoing for the first embodiment are understood to be identically repeated, even for the second embodiment, and are denoted using the same reference numerals.

[0142] In the second embodiment, the loading group 480 comprises a piston 600, generally cylindrical, which is directly inserted snugly into the tubular body 405. One or more seal rings can be applied to the skirt of the piston 600, which rings are coaxially interposed between the piston 600 and the tubular body 405, so as to realize a hermetic closure. The piston 600 is located at the end of

a coaxial shaft 605, the opposite end of which is fixed to the central body 460 of the slide 455 (not entirely shown in figures 11 and 12), so that the piston 600 is able to slide solidly with the piston 600 along the axis X of the tubular body 405.

[0143] The supply tube 515 of the product to be pressed is fixed to the piston 600, which is positioned offset above the shaft 605 and is in communication with a dispensing mouth 610, which is fashioned at the centre of the end face of the piston 600, so as to open internally of the pressing chamber 510 (see figure 14).

[0144] The loading group 470 further comprises a scraper ring 615, which is inserted coaxially internally of the tubular body 405, so as to be arranged by the flank of the piston 600 internally of the pressing chamber 510. This scraper ring 615, the external diameter of which is substantially equal to the internal diameter of the tubular body 405, is supported by a central support hub 620, to which it is joined by a plurality of spokes 625. The central hub 620 is realized by a hollow tubular body, so as to enable the passage of the products coming from the dispensing mouth 610 of the piston 600.

[0145] Two guide rods 630 are fixed at two diametrically opposite points of the central hub 620, each of which is slidably inserted in a through-hole fashioned in the piston 600. The free end of each guide rod 630 projects externally of the pressing chamber 510 and is fixed to a respective double-acting hydraulic cylinder 635, which is rigidly connected to the slide 455 by means of a bracket 640. In this way, whatever the relative position of the loading group 480 with respect to the tubular body 405, the scraper ring 615 is able to move with an independent motion in the direction of the axis X of the tubular body 405, between a retracted position shown in figure 13, in which it is at the position of the piston 600, and an advanced position shown in figure 14, in which it is separated from the piston 600 by a certain distance.

[0146] The functioning of the press 400 is identical to what was described in the foregoing for the first embodiment. During this functioning, every so often the scraper ring 615 is activated to move alternatingly between the retracted and advanced positions thereof, so as to deobstruct the drainage holes of the tubular body 405, without having to displace the piston 600 and thus without modifying the dimensions of the pressing chamber 510.

[0147] As illustrated in figures from 15 to 17, the scraper ring 615 can have a slightly concave shape, so that the opposite axial ends thereof have slightly barbed edges able to drag substantially in contact with the internal surface of the tubular body 405. In this way, the two end edges are able to act as two scrapers which rub against the internal surface of the tubular body 405, during both advancement and retreating thereof.

[0148] According to the alternative embodiment shown in figures from 18 to 20, the scraper ring 615 can have a slightly smaller diameter than that of the tubular body 405, and the lateral surface thereof can be clad with an external annular strip 645 provided with bristles, for example made of a plastic material. In this way, the scraper ring 615 is able to act substantially as a brush which brushes in contact with the internal surface of the tubular body 405.

[0149] In addition to or alternatively to the foregoing, the device 100 can be further equipped with an auxiliary device 650 able to scrape against the external surface of the tubular body 405.

[0150] As illustrated in figures 21 and 22, this device 650 can comprise an assembly of brushes 655 able to go into contact with the external surface of the tubular body 405, and movement means (not illustrated) able to move the brushes 655 with alternating motion in a parallel direction to the axis X.

[0151] In particular, the brushes 655 can be located in a circumferential distribution so as overall to form a ring structure which can be coaxially inserted externally of the tubular body 405 and can be moved to and fro as a single element.

[0152] The brushes 655 of this device 655 are preferably roller brushes, which are associated to activating means able to rotate them about the axes thereof during the translation, so as to increase the scraping effect.

[0153] For example, the brushes 655 can be connected to one another by universal joints, so as to be activatable in rotation all together by a single motor.

[0154] Naturally a technical expert in the sector might make numerous modifications of a technical-applicational nature to the above-described device 100 and the relative functioning method, without its forsaking the protective scope of the invention as claimed herein below.

Claims

1. A functioning method for a continuous pressing device (100) of products containing a solid part and a liquid part, wherein the device comprises:

   - a tubular body (405) having a lateral wall at least a portion of which is perforated,
   - a piston (485, 600) slidably inserted in a first end of the tubular body,
   - a pressing chamber (510) defined internally of the tubular body (405) between an end face of the piston (485, 600) and a second axial end of the tubular body (405);
   - at least an inlet mouth (525) afforded in the body of the piston (485, 600) and opening into the pressing chamber (510) through the end face of the piston (485, 600);
   - a pump (200) connected to the inlet mouth (525) for supplying the product to be pressed internally of the pressing chamber (510) and
   - obturator means (430) for opposing exit of the product from the second axial end of the tubular body (405), the obturator means (430) being able to move between a position of complete

closure of the pressing chamber (510), in which the obturator means (430) prevent outlet of the product, and a position of complete opening of the pressing chamber (510), in which the obturator means (430) enable the product to exit freely,
- a scraper ring or scraper cylinder (495, 615), which is coaxially inserted in the tubular body (405) and is able to move alternatingly with respect to both the tubular body (405) and the piston (485, 600),

wherein the functioning method comprises a start-up step which comprises:

- predisposing the obturator means (430) in a position of complete closure,
- starting up the pump (200) so as to load the product to be pressed in the pressing chamber (510) up to forming a compact agglomeration of pressed product at the second axial end of the tubular body (405),
- displacing the obturator means (430) into a position of at least partial opening of the pressing chamber (510),

and then a successive step of continuous-cycle pressing which comprises:

- maintaining the pump (200) in constant function, in such a way as to continuously supply the product to be pressed internally of the pressing chamber (510) and such as to cause consequent outlet of the pressed product from the second end of the tubular body (405).

2. The method of claim 1, wherein the step of loading the pressing chamber (510) comprises:

- predisposing the piston (485, 600) in an initial position internally of the tubular body (405),
- monitoring the pressure in the pressing chamber (510) up to reaching a predetermined value,
- progressively moving the piston (485, 600) towards the first end of the tubular body (405) up to reaching a predetermined working position.

3. The method of claim 2, wherein the step of loading the pressing chamber (510) comprises moving the piston towards the working position by a predetermined step each time that the pressure in the pressing chamber (510) reaches a predetermined value.

4. The method of any one of claims from 1 to 3, wherein the step of continuous-cycle pressing comprises:

- monitoring the pressure in the pressing chamber (510), and
- calculating a difference between the monitored value and a predetermined value of the pressure in the pressing chamber, and
- regulating at least a functioning parameter of the device (100) in such a way as reduce the difference.

5. The method of claim 4, wherein the functioning parameter is selected from among: the position of the obturator means (430), the supply flow rate of the pump (200) and the position of the piston (485).

6. The method of any one of claims from 1 to 5, wherein the step of continuous-cycle pressing comprises:

- alternatingly moving the piston (485, 600) starting from the working position.

7. The method of any one of claims from 1 to 6, comprising a step of end of working which comprises:

- stopping the pump (200),
- shifting the obturator means (430) into a position of complete closure,
- moving the piston (485, 600) in a nearing direction to the second end of the tubular body (405), applying a constant thrust of a predetermined amount thereto.

8. The method of claim 7, wherein the step of end of working further comprises:

- monitoring the displacement of the piston (485, 600) while it is subjected to the thrust and, when the monitored displacement of the piston (485) is nil,
- displacing the obturator means (430) into a position of complete opening of the pressing chamber (510), and
- further advancing the piston (485, 600) towards the second end of the tubular body (405).

9. The method of claim 8, wherein the piston is advanced up to being completely external of the pressing chamber (510), leaving the second end of the tubular body (405) open.

10. A device (100) for continuous pressing of products containing a solid part and a liquid part comprising:

- a tubular body (405) having a lateral wall at least a portion of which is perforated,
- a piston (485, 600) slidably inserted in a first end of the tubular body,
- a pressing chamber (510) defined internally of the tubular body (405) between an end face of the piston (485, 600) and a second axial end of the tubular body (405);

- at least an inlet mouth (525) afforded in the body of the piston (485, 600) and opening into the pressing chamber (510) through the end face of the piston (485, 600);
- a pump (200) connected to the inlet mouth (525) for supplying the product to be pressed internally of the pressing chamber (510) and
- obturator means (430) for opposing exit of the product from the second axial end of the tubular body (405), the obturator means (430) being able to move between position of complete closure of the pressing chamber (510), in which the obturator means (430) prevent outlet of the product, and a position of complete opening of the pressing chamber (510), in which they enable the product to exit freely,
- a scraper ring or scraper cylinder (495, 615), which is coaxially inserted in the tubular body (405) and is able to move alternatingly with respect to both the tubular body (405) and the piston (485, 600), and

an electric control system programmed to carry out a start-up step which comprises:

- predisposing the obturator means (430) in a position of complete closure,
- starting up the pump (200) so as to load the product to be pressed in the pressing chamber (510) up to forming a compact agglomeration of pressed product at the second axial end of the tubular body (405),
- displacing the obturator means (430) into a position of at least partial opening of the pressing chamber (510),

and then a successive step of continuous-cycle pressing which comprises:

- maintaining the pump (200) in constant function, in such a way as to continuously supply the product to be pressed internally of the pressing chamber (510) and such as to cause consequent outlet of the pressed product from the second end of the tubular body (405).

Patentansprüche

1. Funktionsverfahren für eine Vorrichtung (100) zum kontinuierlichen Pressen von Produkten, die einen festen Teil und einen flüssigen Teil enthalten, wobei die Vorrichtung Folgendes umfasst:

- einen röhrenförmigen Hauptteil (405), der eine Seitenwand aufweist, von der mindestens ein Abschnitt perforiert ist,
- einen Kolben (485, 600), der gleitfähig in ein erstes Ende des röhrenförmigen Körpers eingesetzt ist,
- eine Presskammer (510), die im Inneren des röhrenförmigen Körpers (405) zwischen einer Endfläche des Kolbens (485, 600) und einem zweiten axialen Ende des röhrenförmigen Körpers (405) definiert ist,
- mindestens eine Einlassmündung (525), die in dem Hauptteil des Kolbens (485, 600) bereitgestellt ist und sich durch die Endfläche des Kolbens (485, 600) in die Presskammer (510) öffnet,
- eine Pumpe (200), die mit der Einlassmündung (525) verbunden ist, um das zu pressende Produkt in das Innere der Presskammer (510) zu führen, und

Absperrmittel (430), um einem Austreten des Produkts aus dem zweiten axialen Ende des röhrenförmigen Körpers (405) entgegenzuwirken, wobei die Absperrmittel (430) in der Lage sind, sich zwischen einer Position des vollständigen Verschlusses der Presskammer (510), in welcher die Absperrmittel (430) den Auslass des Produkts verhindern, und einer Position der vollständigen Öffnung der Presskammer (510), in welcher die Absperrmittel (430) den freien Austritt des Produkts ermöglichen, zu bewegen,
- einen Abstreifring oder Abstreifzylinder (495, 615), der koaxial in den röhrenförmigen Körper (405) eingesetzt und in der Lage ist, sich in Bezug auf sowohl den röhrenförmigen Körper (405) als auch den Kolben (485, 600) hin und her zu bewegen,
wobei das Funktionsverfahren einen Inbetriebnahmeschritt umfasst, der Folgendes umfasst:

- Voranordnen der Absperrmittel (430) in einer Position des vollständigen Verschlusses,
- Inbetriebnehmen der Pumpe (200) derart, dass das zu pressende Produkt in die Presskammer (510) geladen wird, bis an dem zweiten axialen Ende des röhrenförmigen Körpers (405) eine kompakte Ansammlung des gepressten Produkts gebildet ist,
- Verlagern der Absperrmittel (430) in eine Position der zumindest teilweisen Öffnung der Presskammer (510),

und dann einen nachfolgenden Schritt des Pressens in kontinuierlichem Zyklus, der Folgendes umfasst:

- Halten der Pumpe (200) in konstanter Funktion derart, dass das zu pressende Produkt kontinuierlich in das Innere der Presskammer (510) geführt wird, und derart, dass das folgende Auslassen des gepressten Produkts aus dem

zweiten Ende des röhrenförmigen Körpers (405) bewirkt wird.

2. Verfahren nach Anspruch 1, wobei der Schritt des Beladens der Presskammer (510) Folgendes umfasst:

- Voranordnen des Kolbens (485, 600) in einer Ausgangsposition im Inneren des röhrenförmigen Körpers (405),
- Überwachen des Drucks in der Presskammer (510) bis zum Erreichen eines festgelegten Wertes,
- progressives Bewegen des Kolbens (485, 600) hin zum ersten Ende des röhrenförmigen Körpers (405) bis zum Erreichen einer festgelegten Arbeitsposition.

3. Verfahren nach Anspruch 2, wobei der Schritt des Beladens der Presskammer (510) das Bewegen des Kolbens hin zur Arbeitsposition durch einen festgelegten Schritt, jedes Mal, wenn der Druck in der Presskammer (510) einen festgelegten Wert erreicht, umfasst.

4. Verfahren nach einem der Ansprüche 1 bis 3, wobei der Schritt des Pressens in kontinuierlichem Zyklus Folgendes umfasst:

- Überwachen des Drucks in der Presskammer (510) und
- Berechnen einer Differenz zwischen dem überwachten Wert und einem festgelegten Wert des Drucks in der Presskammer und
- Regeln mindestens eines Funktionsparameters der Vorrichtung (100) derart, dass die Differenz verringert wird.

5. Verfahren nach Anspruch 4, wobei der Funktionsparameter aus Folgendem ausgewählt wird: der Position der Absperrmittel (430), der Zufuhrförderleistung der Pumpe (200) und der Position des Kolbens (485).

6. Verfahren nach einem der Ansprüche 1 bis 5, wobei der Schritt des Pressens in kontinuierlichem Zyklus Folgendes umfasst:

- Hin- und Her-Bewegen des Kolbens (485, 600), ausgehend von der Arbeitsposition.

7. Verfahren nach einem der Ansprüche 1 bis 6, wobei einen Schritt des Beendens des Arbeitens umfassend, der Folgendes umfasst:

- Anhalten der Pumpe (200),
- Verlagern der Absperrmittel (430) in eine Position des vollständigen Verschlusses,
- Bewegen des Kolbens (485, 600) in eine Annäherungsrichtung zum zweiten Ende des röhrenförmigen Körpers (405), Anlegen einer konstanten Schubkraft einer festgelegten Stärke darauf.

8. Verfahren nach Anspruch 7, wobei der Schritt des Beendens des Arbeitens ferner Folgendes umfasst:

- Überwachen der Verlagerung des Kolbens (485, 600), während er der Schubkraft unterliegt, und, wenn die überwachte Verlagerung des Kolbens (485) null ist,
- Verlagern der Absperrmittel (430) in eine Position der vollständigen Öffnung der Presskammer (510) und
- weiteres Vorwärtsbewegen des Kolbens (485, 600) hin zum zweien Ende des röhrenförmigen Körpers (405).

9. Verfahren nach Anspruch 8, wobei der Kolben vorwärtsbewegt wird, bis er sich vollständig außerhalb der Presskammer (510) befindet, das zweite Ende des röhrenförmigen Körpers (405) offen zurücklassend.

10. Vorrichtung (100) zum kontinuierlichen Pressen von Produkten, die einen festen Teil und einen flüssigen Teil enthalten, Folgendes umfassend:

- einen röhrenförmigen Hauptteil (405), der eine Seitenwand aufweist, von der mindestens ein Abschnitt perforiert ist,
- einen Kolben (485, 600), der gleitfähig in ein erstes Ende des röhrenförmigen Körpers eingesetzt ist,
- eine Presskammer (510), die im Inneren des röhrenförmigen Körpers (405) zwischen einer Endfläche des Kolbens (485, 600) und einem zweiten axialen Ende des röhrenförmigen Körpers (405) definiert ist,
- mindestens eine Einlassmündung (525), die in dem Hauptteil des Kolbens (485, 600) bereitgestellt ist und sich durch die Endfläche des Kolbens (485, 600) in die Presskammer (510) öffnet,
- eine Pumpe (200), die mit der Einlassmündung (525) verbunden ist, um das zu pressende Produkt in das Innere der Presskammer (510) zu führen, und

Absperrmittel (430), um einem Austreten des Produkts aus dem zweiten axialen Ende des röhrenförmigen Körpers (405) entgegenzuwirken, wobei die Absperrmittel (430) in der Lage sind, sich zwischen einer Position des vollständigen Verschlusses der Presskammer (510), in welcher die Absperrmittel (430) den Auslass des Produkts verhindern, und einer Position der voll-

ständigen Öffnung der Presskammer (510), in welcher sie den freien Austritt des Produkts ermöglichen, zu bewegen,
- einen Abstreifring oder Abstreifzylinder (495, 615), der koaxial in den röhrenförmigen Körper (405) eingesetzt und in der Lage ist, sich in Bezug auf sowohl den röhrenförmigen Körper (405) als auch den Kolben (485, 600) hin und her zu bewegen, und
- ein elektrisches Steuersystem, das dafür programmiert ist, einen Inbetriebnahmeschritt auszuführen, der Folgendes umfasst:

- Voranordnen der Absperrmittel (430) in einer Position des vollständigen Verschlusses,
- Inbetriebnehmen der Pumpe (200) derart, dass das zu pressende Produkt in die Presskammer (510) geladen wird, bis an dem zweiten axialen Ende des röhrenförmigen Körpers (405) eine kompakte Ansammlung des gepressten Produkts gebildet ist,
- Verlagern der Absperrmittel (430) in eine Position der zumindest teilweisen Öffnung der Presskammer (510),
und dann einen nachfolgenden Schritt des Pressens in kontinuierlichem Zyklus, der Folgendes umfasst:

- Halten der Pumpe (200) in konstanter Funktion derart, dass das zu pressende Produkt kontinuierlich in das Innere der Presskammer (510) geführt wird, und derart, dass das folgende Auslassen des gepressten Produkts aus dem zweiten Ende des röhrenförmigen Körpers (405) bewirkt wird.

Revendications

1. Procédé de fonctionnement d'un dispositif de pressage continu (100) de produits contenant une partie solide et une partie liquide, dans lequel le dispositif comprend:

- un corps tubulaire (405) disposant d'une paroi latérale dont au moins une partie est perforée,
- un piston (485, 600) inséré de manière coulissante dans une première extrémité du corps tubulaire,
- une chambre de compression (510) définie à l'intérieur du corps tubulaire (405) entre une face avant du piston (485, 600) et une deuxième extrémité axiale du corps tubulaire (405);
- au moins une bouche d'entrée (525) prévue dans le corps du piston (485, 600) et débouchant dans la chambre de compression (510) à travers la face avant du piston (485, 600);
- une pompe (200) reliée à la bouche d'entrée (525) pour fournir le produit à presser à l'intérieur de la chambre de compression (510) et
- un moyen d'obturation (430) pour s'opposer à la sortie du produit de la deuxième extrémité axiale du corps tubulaire (405), le moyen d'obturation (430) pouvant se déplacer entre une position de fermeture complète de la chambre de compression (510), dans laquelle le moyen d'obturation (430) empêche la sortie du produit, et une position d'ouverture complète de la chambre de compression (510), dans laquelle le moyen d'obturation (430) permet au produit de sortir librement,
- un segment racleur ou un cylindre rapeur (495, 615), inséré de manière coaxiale dans le corps tubulaire (405) et capable de se déplacer de manière alternée par rapport au corps tubulaire (405) et au piston (485, 600),
dans lequel le procédé de fonctionnement comprend une étape de démarrage qui comprend :

- la prédisposition du moyen d'obturation (430) dans une position de fermeture complète,
- le démarrage de la pompe (200) de façon à charger le produit à presser dans la chambre de compression (510) jusqu'à former une agglomération compacte de produit pressé à la deuxième extrémité axiale du corps tubulaire (405),
- le déplacement du moyen d'obturation (430) dans une position d'ouverture au moins partielle de la chambre de compression (510),
et ensuite une étape successive de pressage à cycle continu qui comprend :

- le maintien de la pompe (200) en fonctionnement constant, de manière à fournir de façon continue le produit à presser à l'intérieur de la chambre de compression (510) et de manière à provoquer une sortie conséquente du produit pressé depuis la deuxième extrémité du corps tubulaire (405).

2. Procédé selon la revendication 1, dans lequel l'étape de chargement de la chambre de compression (510) comprend:

- la prédisposition du piston (485, 600) dans une position initiale à l'intérieur du corps tubulaire (405),
- la surveillance de la pression dans la chambre de compression (510) jusqu'à ce qu'elle atteigne une valeur prédéterminée,

- le déplacement progressif du piston (485, 600) vers la première extrémité du corps tubulaire (405) jusqu'à ce qu'il atteigne une position de travail prédéterminée.

3. Procédé selon la revendication 2, dans lequel l'étape de chargement de la chambre de compression (510) comprend le déplacement du piston vers la position de travail par une étape prédéterminée chaque fois que la pression dans la chambre de compression (510) atteint une valeur prédéterminée.

4. Procédé selon l'une quelconque des revendications 1 à 3, dans lequel l'étape de pressage à cycle continu comprend:

- la surveillance de la pression dans la chambre de compression (510), et
- le calcul d'une différence entre la valeur surveillée et une valeur prédéterminée de la pression dans la chambre de compression et
- la régulation d'au moins un paramètre de fonctionnement du dispositif (100) de manière à réduire la différence.

5. Procédé selon la revendication 4, dans lequel le paramètre de fonctionnement est choisi parmi: la position du moyen d'obturation (430), le débit d'alimentation de la pompe (200) et la position du piston (485).

6. Procédé selon l'une quelconque des revendications 1 à 5, dans lequel l'étape de pressage à cycle continu comprend:

- le déplacement de manière alternative du piston (485, 600) à partir de la position de travail.

7. Procédé selon l'une quelconque des revendications 1 à 6, comprenant une étape de fin de travail consistant à :

- arrêter la pompe (200),
- déplacer le moyen d'obturation (430) dans une position de fermeture complète,
- déplacer le piston (485, 600) dans une direction proche de la deuxième extrémité du corps tubulaire (405), en lui appliquant une poussée constante d'une quantité prédéterminée.

8. Procédé selon la revendication 7, dans lequel l'étape de fin de travail comprend en outre :

- la surveillance du déplacement du piston (485, 600) pendant qu'il est soumis à la poussée et, lorsque le déplacement surveillé du piston (485) est nul,
- le déplacement du moyen d'obturation (430) dans une position d'ouverture complète de la chambre de compression (510), et
- l'avancement supplémentaire du piston (485, 600) vers la deuxième extrémité du corps tubulaire (405).

9. Procédé selon la revendication 8, dans lequel le piston est avancé jusqu'à ce qu'il se retrouve complètement à l'extérieur de la chambre de compression (510), laissant la deuxième extrémité du corps tubulaire (405) ouverte.

10. Dispositif (100) de pressage continu de produits contenant une partie solide et une partie liquide comprenant:

- un corps tubulaire (405) disposant d'une paroi latérale dont au moins une partie est perforée,
- un piston (485, 600) inséré de manière coulissante dans une première extrémité du corps tubulaire,
- une chambre de compression (510) définie à l'intérieur du corps tubulaire (405) entre une face avant du piston (485, 600) et une deuxième extrémité axiale du corps tubulaire (405);
- au moins une bouche d'entrée (525) prévue dans le corps du piston (485, 600) et débouchant dans la chambre de compression (510) à travers la face avant du piston (485, 600);
- une pompe (200) reliée à la bouche d'entrée (525) pour fournir le produit à presser à l'intérieur de la chambre de compression (510) et
- un moyen d'obturation (430) pour s'opposer à la sortie du produit de la deuxième extrémité axiale du corps tubulaire (405), le moyen d'obturation (430) pouvant se déplacer entre une position de fermeture complète de la chambre de compression (510), dans laquelle le moyen d'obturation (430) empêche la sortie du produit, et une position d'ouverture complète de la chambre de compression (510), dans laquelle le moyen d'obturation permet au produit de sortir librement,
- un segment racleur ou un cylindre rapeur (495, 615), inséré de manière coaxiale dans le corps tubulaire (405) et capable de se déplacer de manière alternée par rapport au corps tubulaire (405) et au piston (485, 600), et un système de contrôle électrique programmé pour effectuer une étape de démarrage comprenant:

- la prédisposition du moyen d'obturation (430) dans une position de fermeture complète,
- le démarrage de la pompe (200) de façon à charger le produit à presser dans la chambre de compression (510) jusqu'à former une agglomération compacte de produit

pressé à la deuxième extrémité axiale du corps tubulaire (405),
- le déplacement du moyen d'obturation (430) dans une position d'ouverture au moins partielle de la chambre de compression (510),
et ensuite une étape successive de pressage à cycle continu qui comprend :

- le maintien de la pompe (200) en fonctionnement constant, de manière à fournir de façon continue le produit à presser à l'intérieur de la chambre de compression (510) et de manière à provoquer une sortie conséquente du produit pressé depuis la deuxième extrémité du corps tubulaire (405).

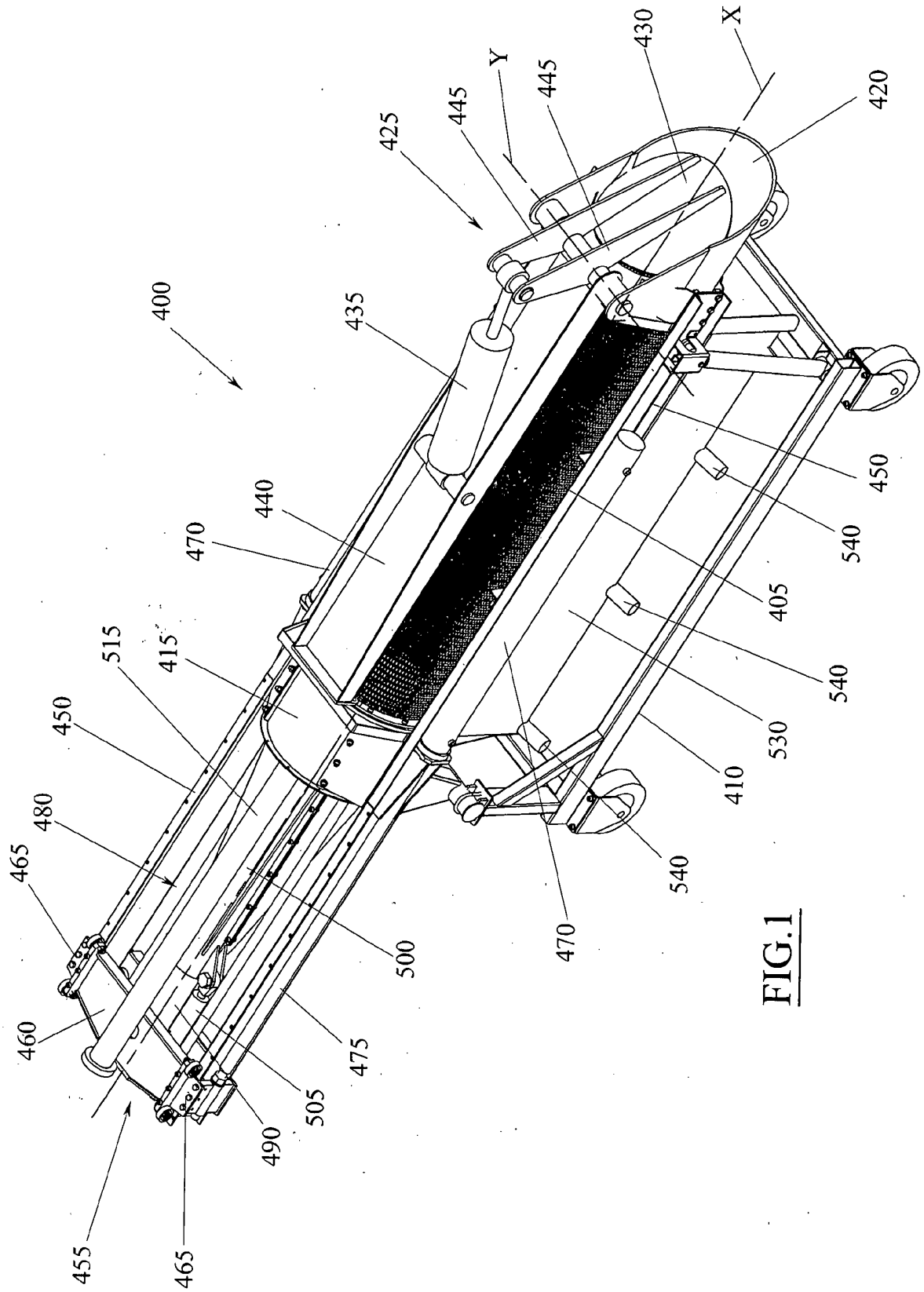
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FIG.1

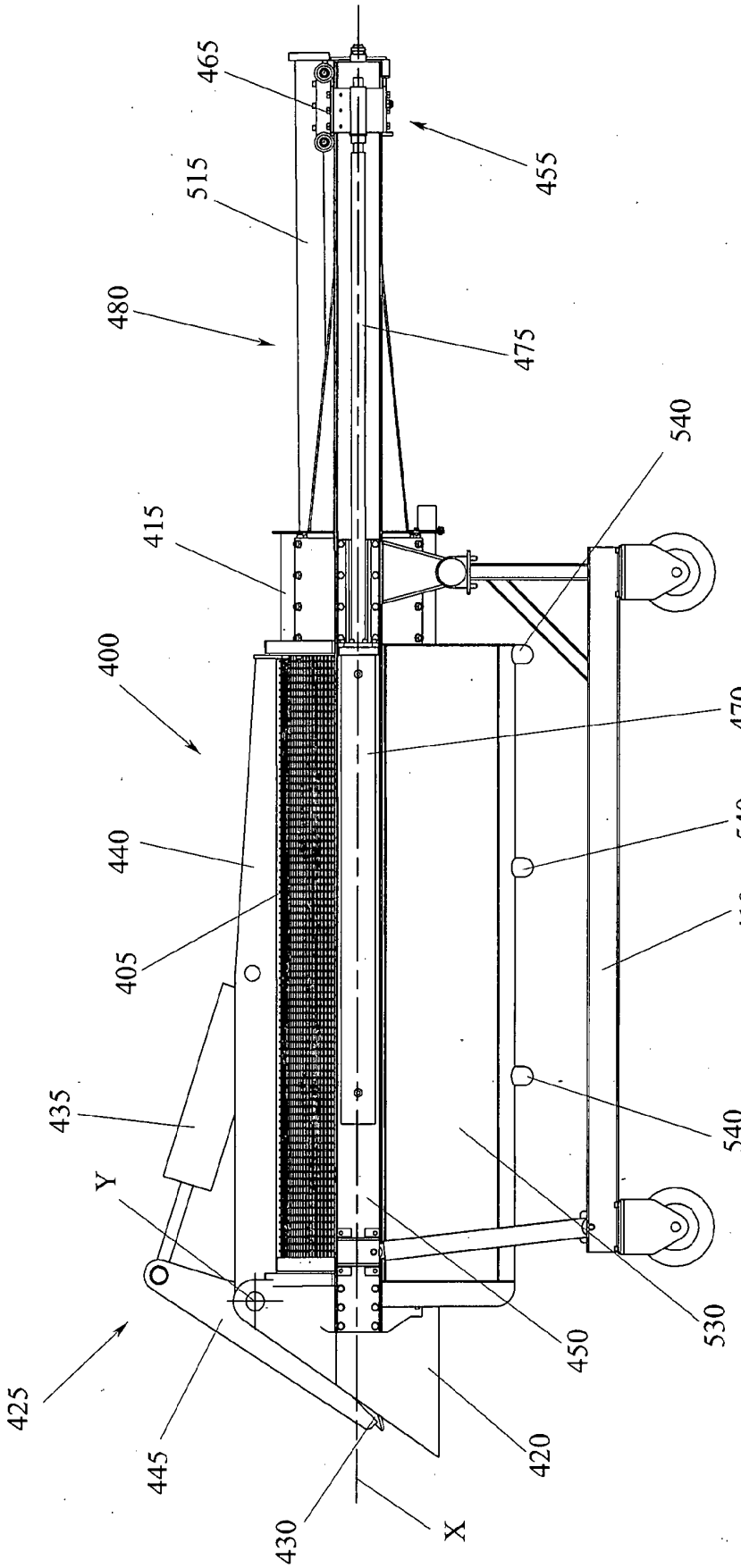
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FIG.2

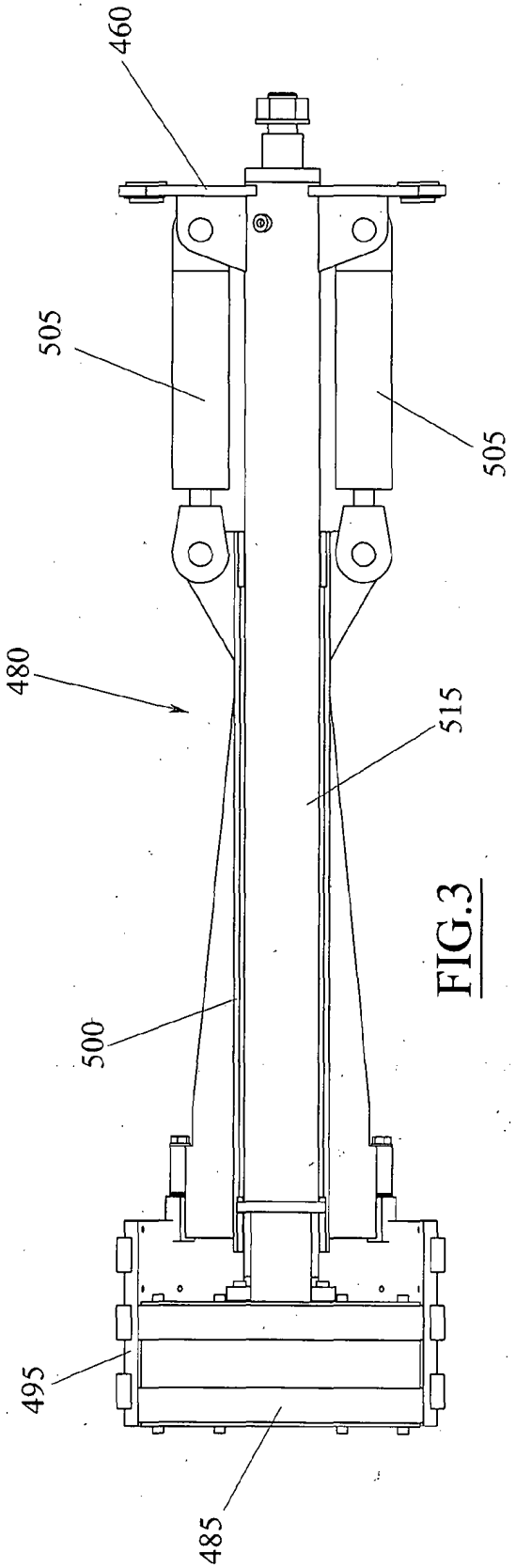

FIG.3

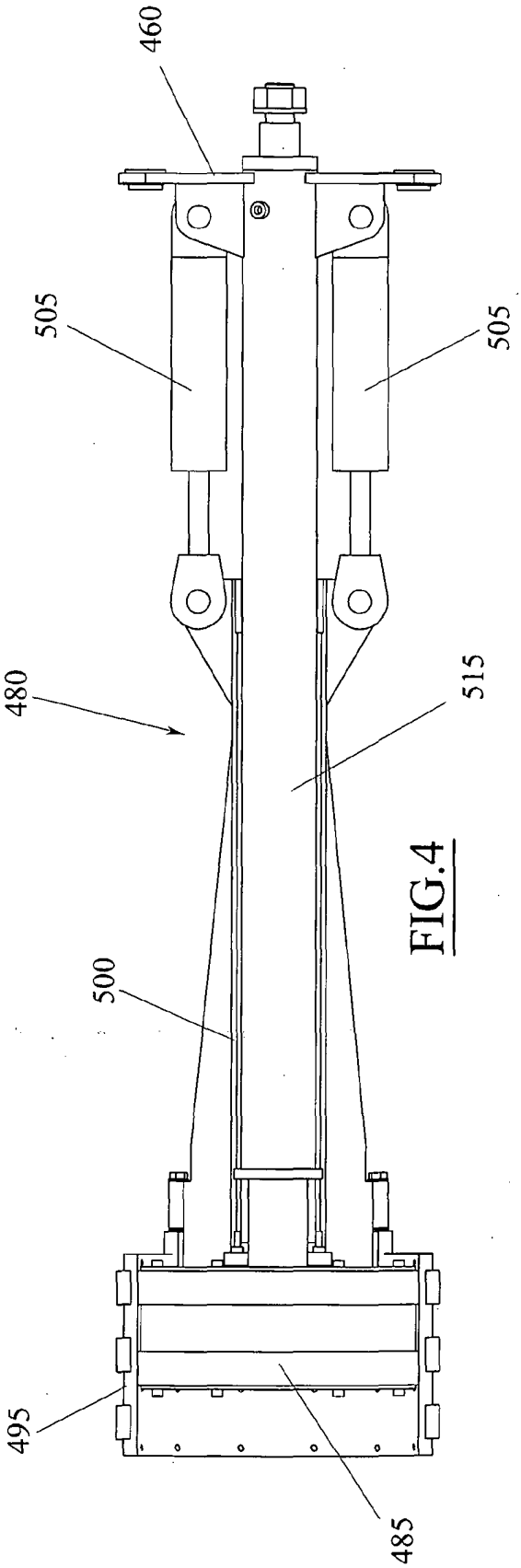

FIG.4

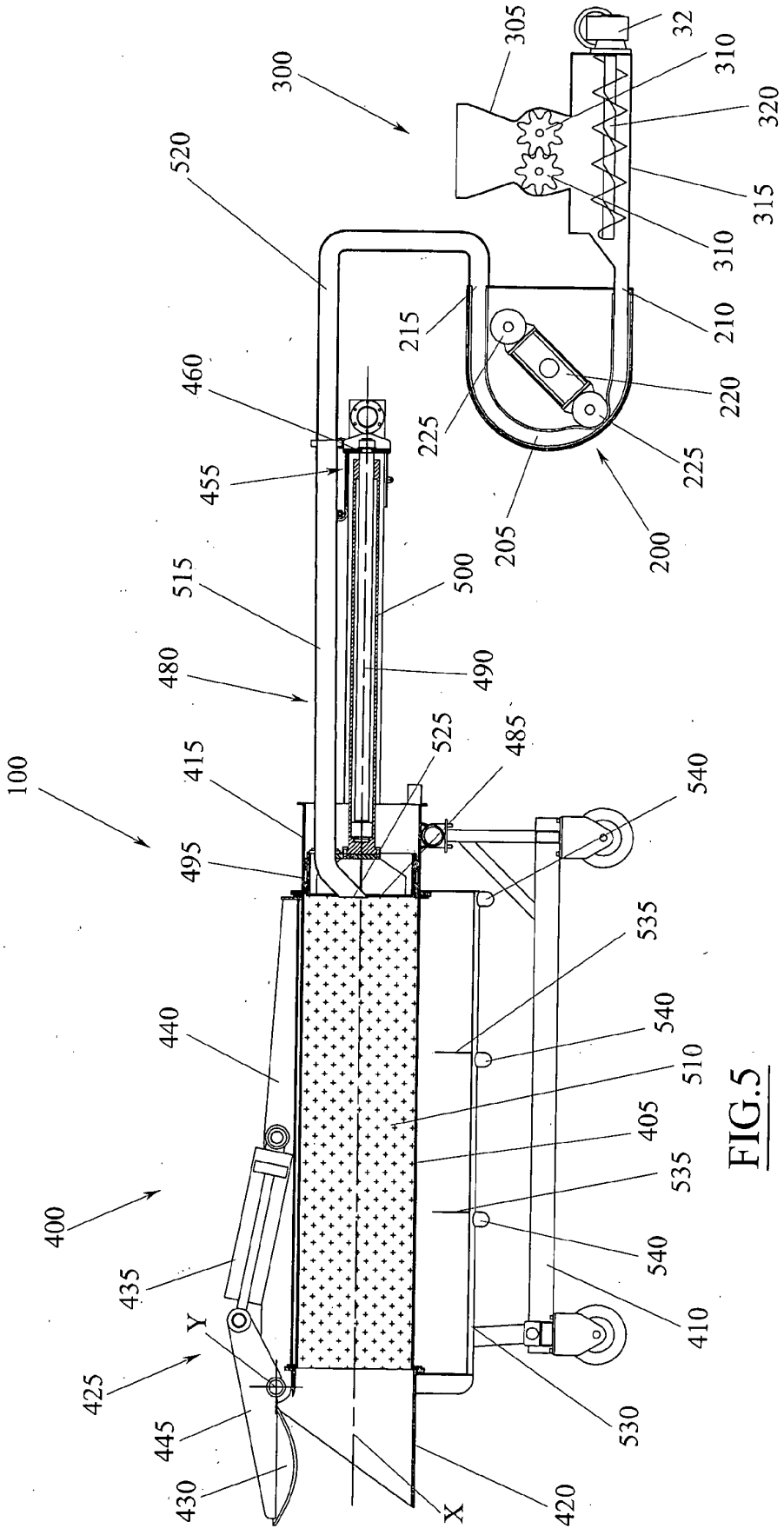
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FIG.5

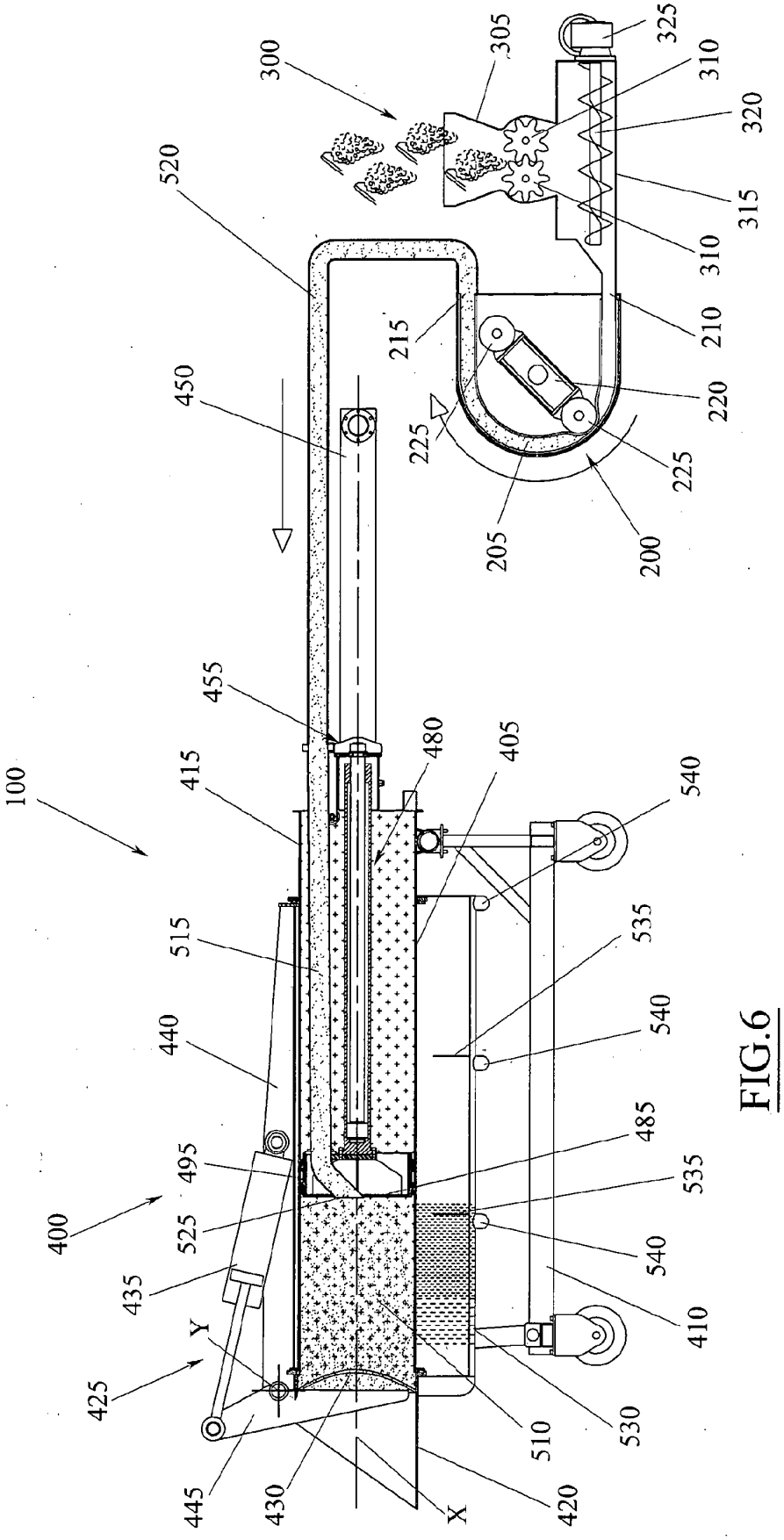
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FIG.6

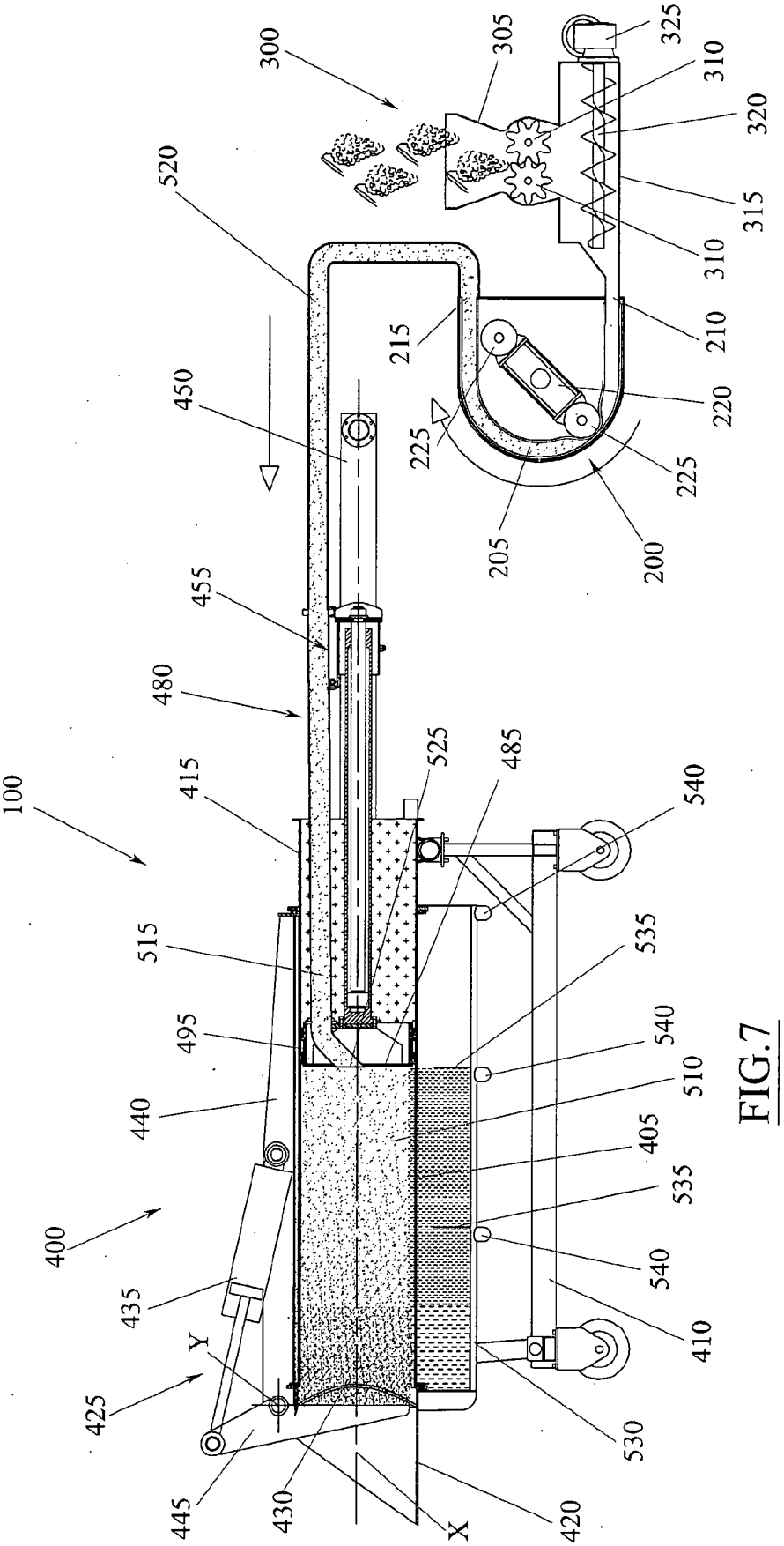
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FIG.7

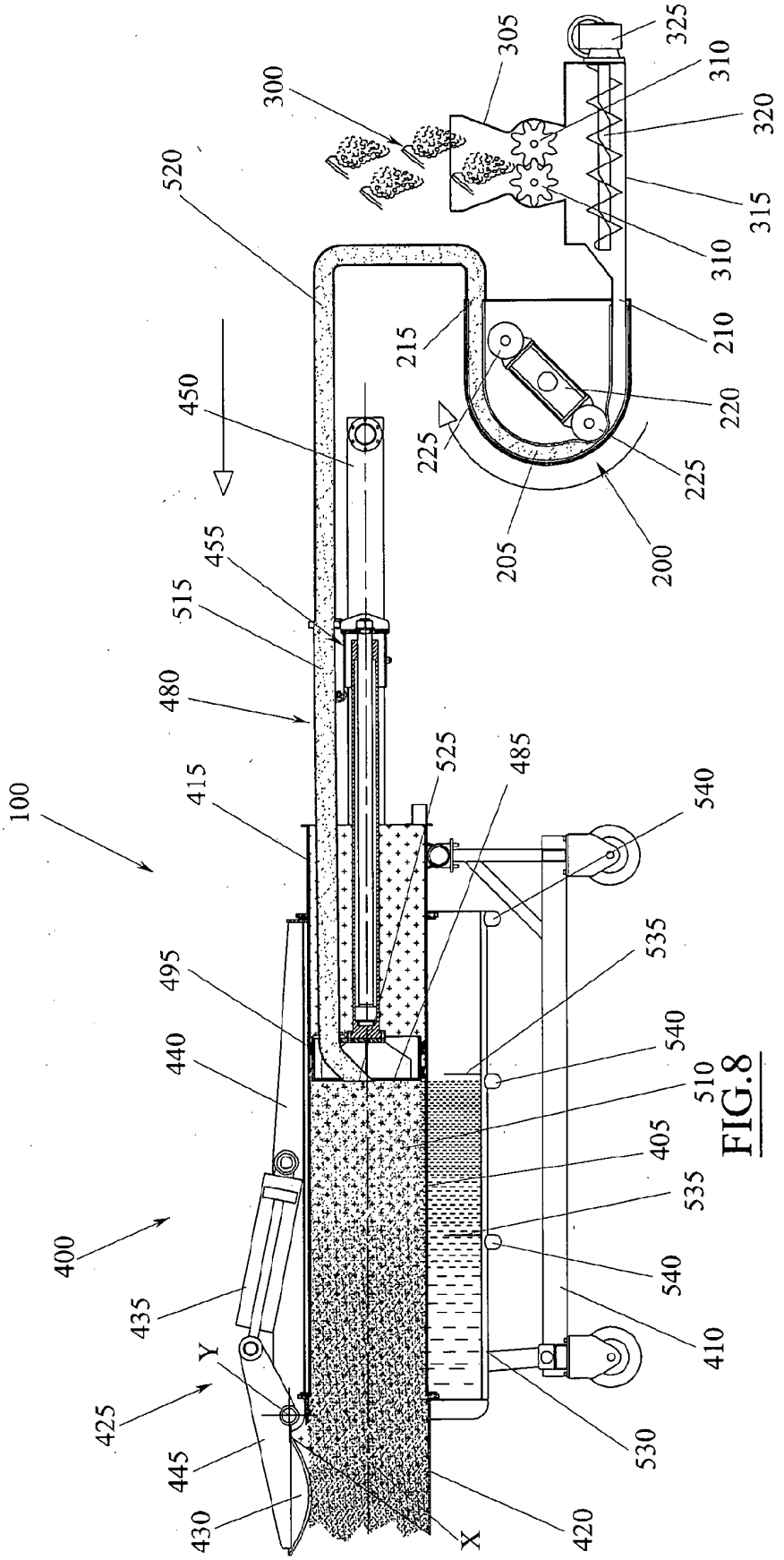
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FIG.8

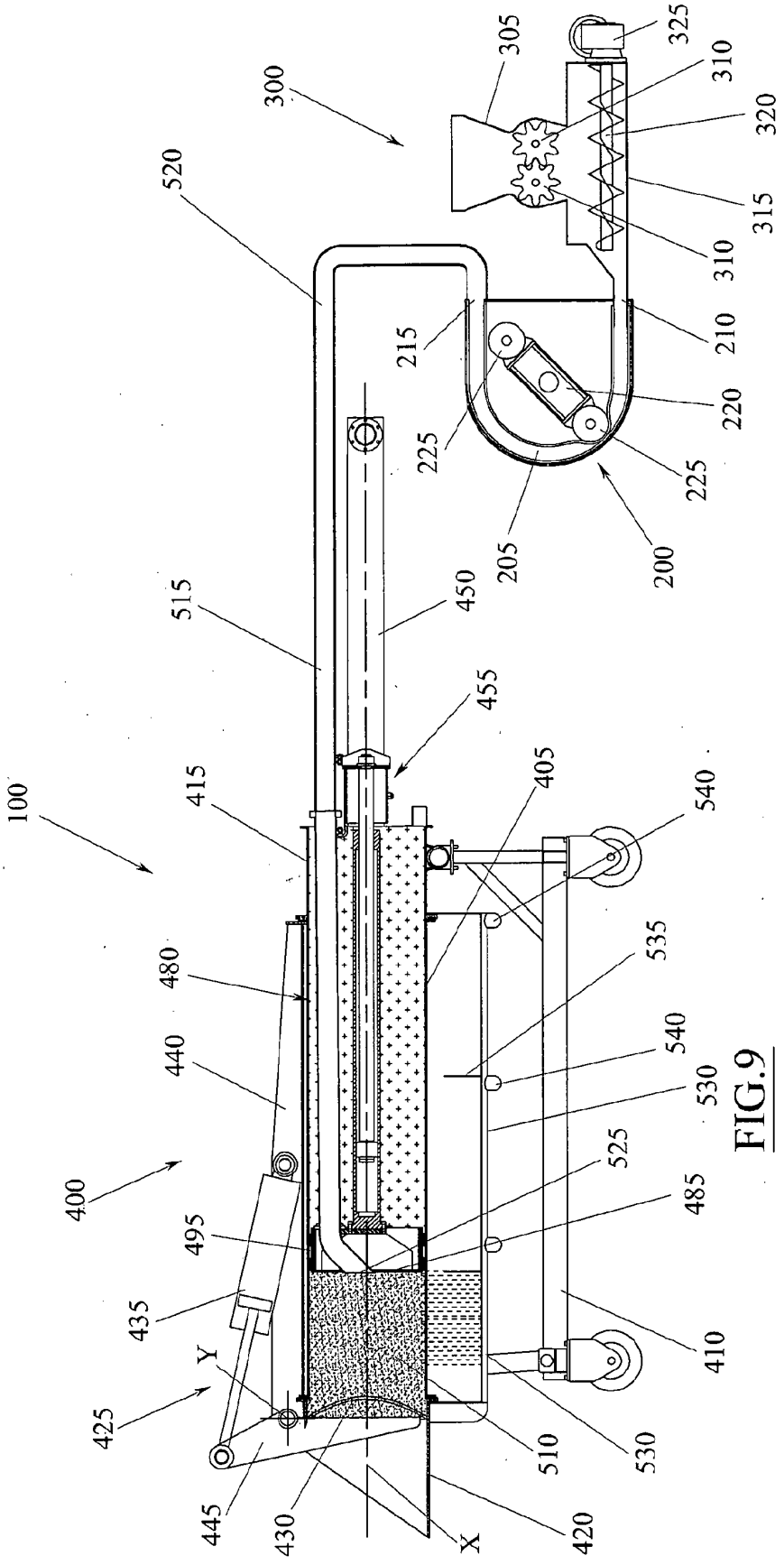
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FIG.9

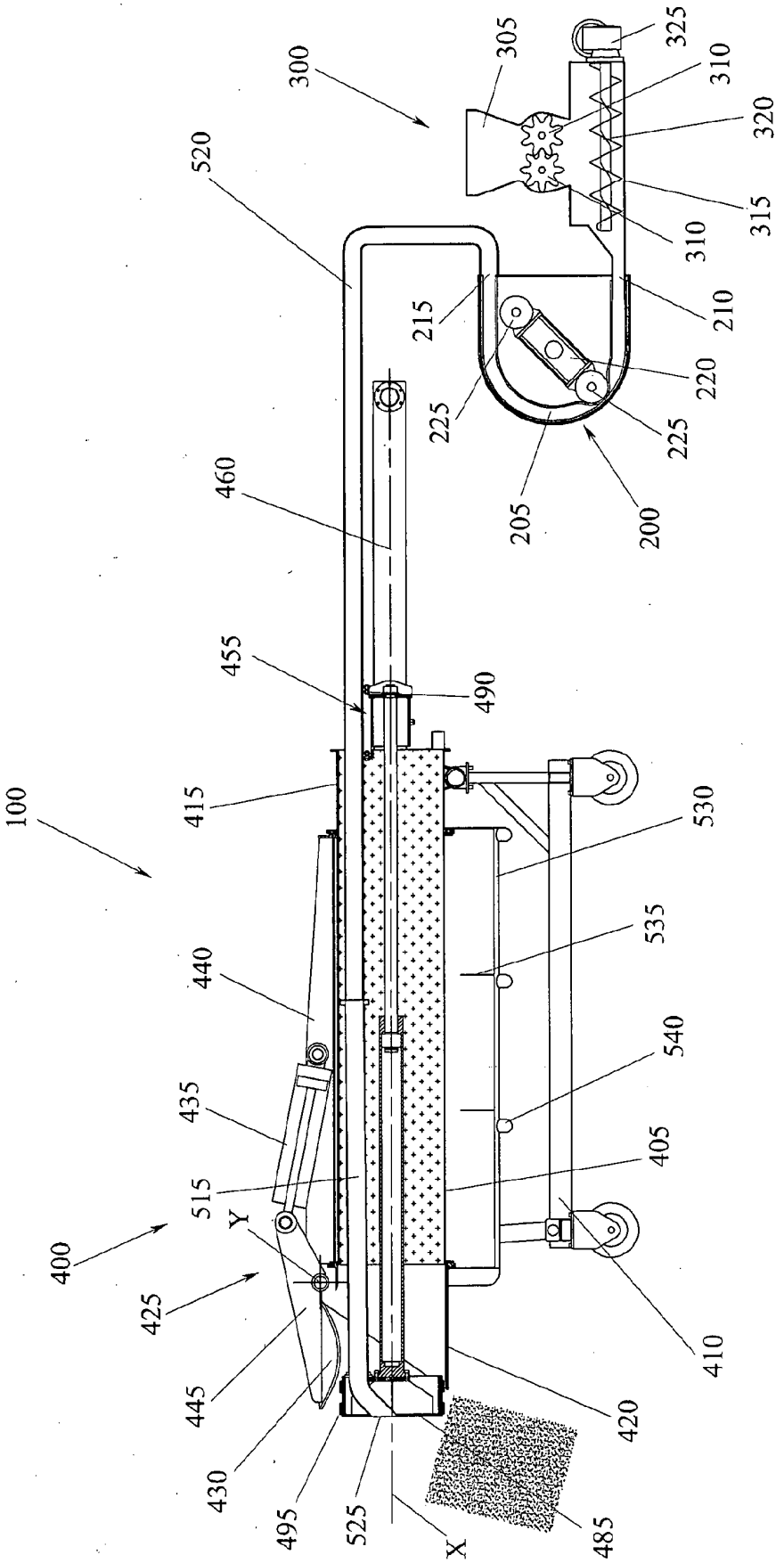
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FIG.10

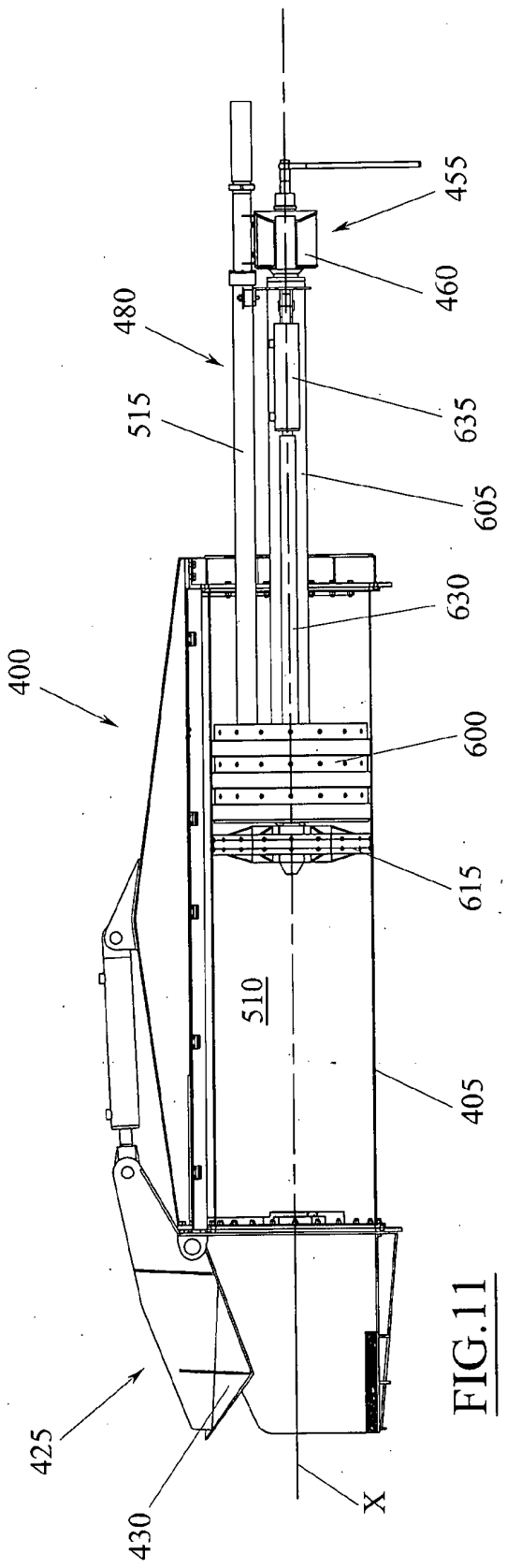
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FIG.11

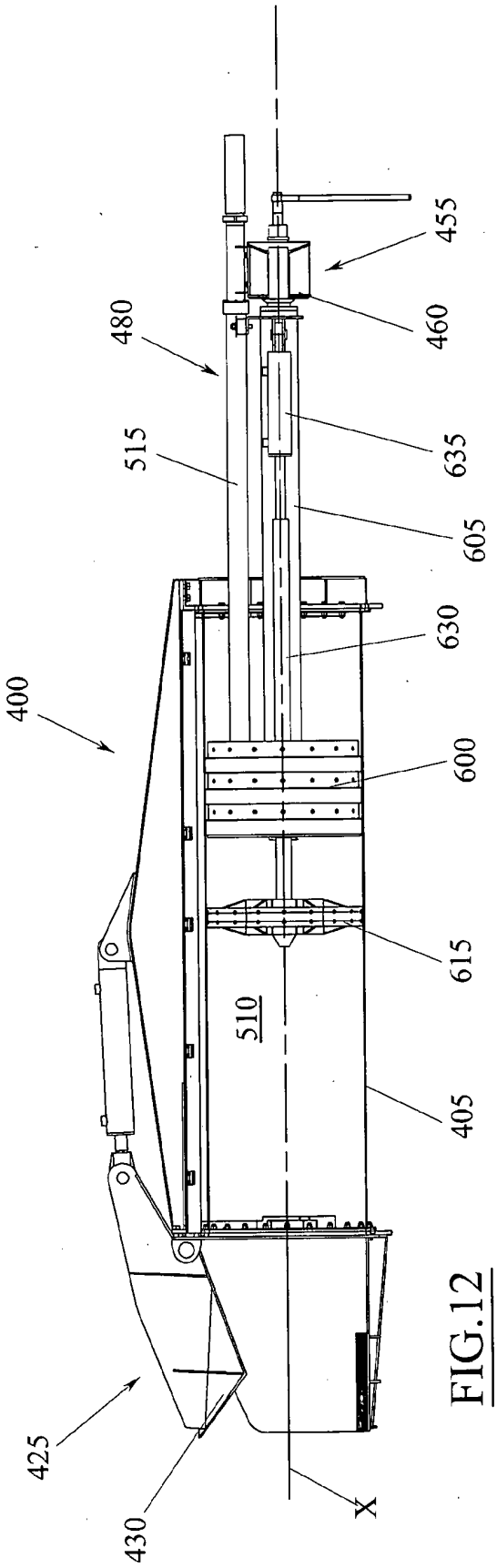
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FIG.12

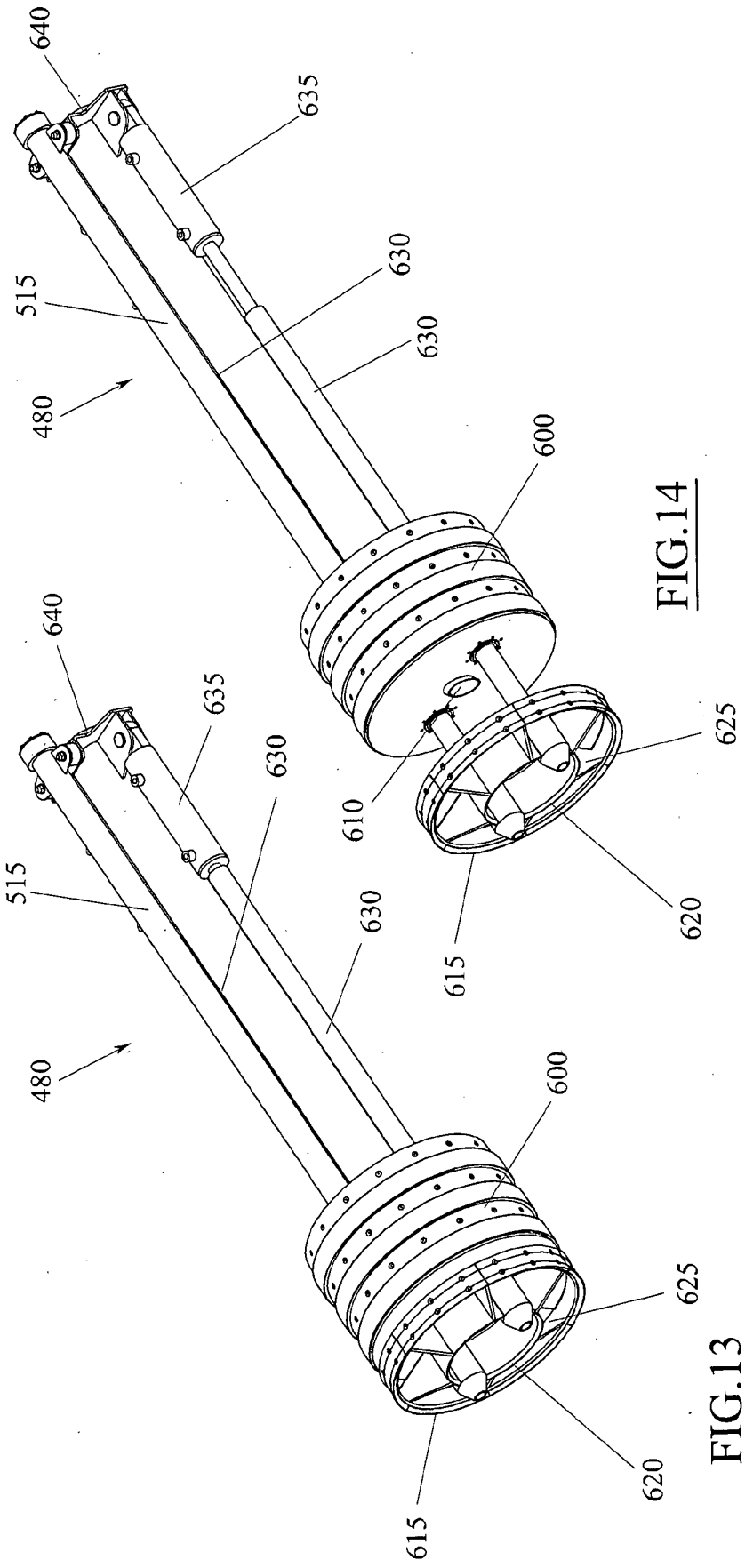
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FIG.14

FIG.13

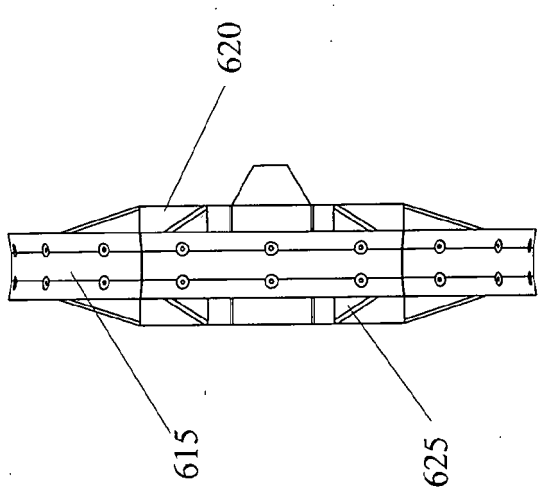


FIG.16

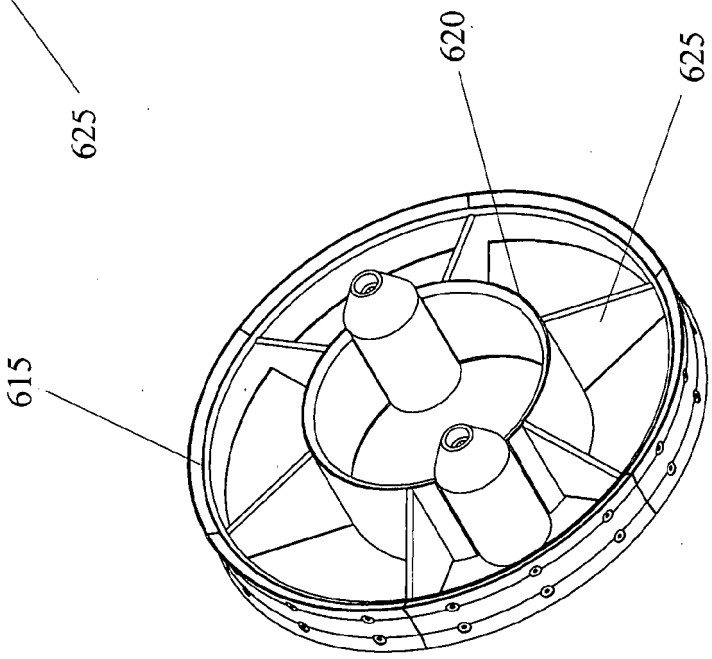


FIG.17

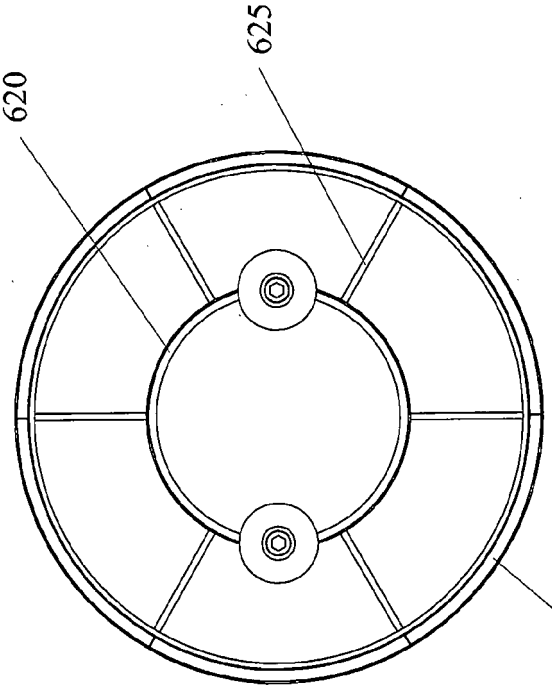
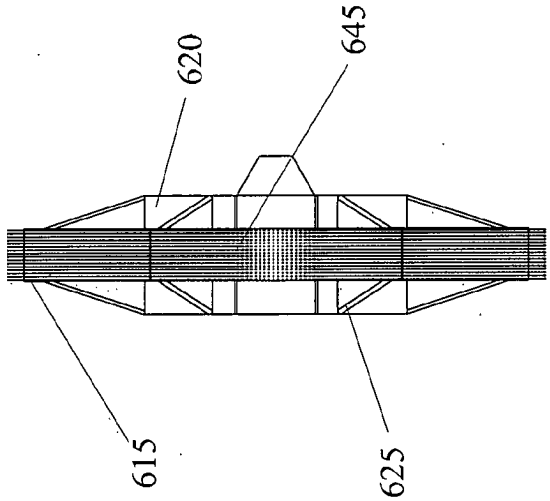


FIG.15



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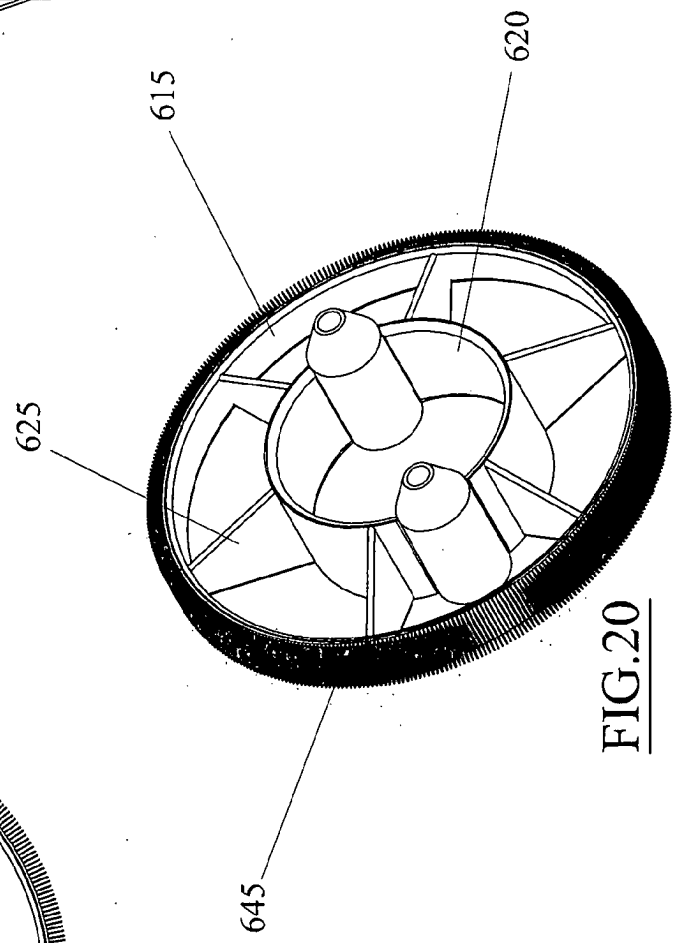

FIG.20

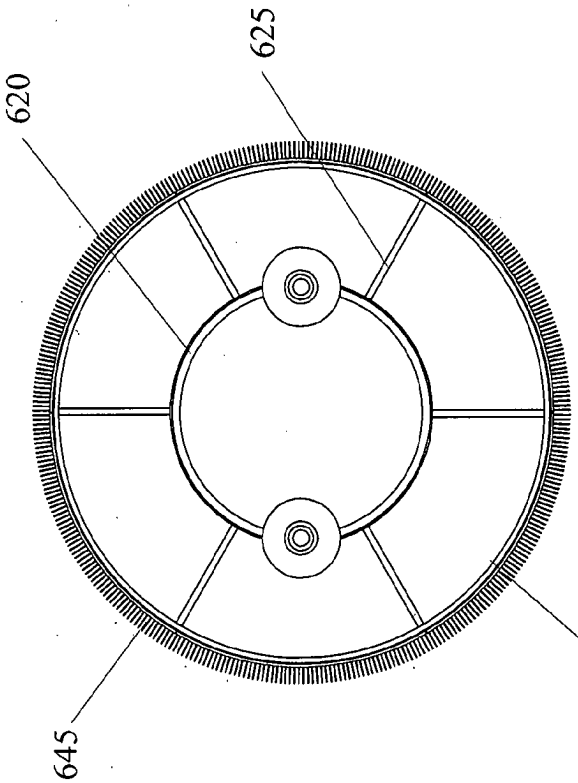

FIG.18

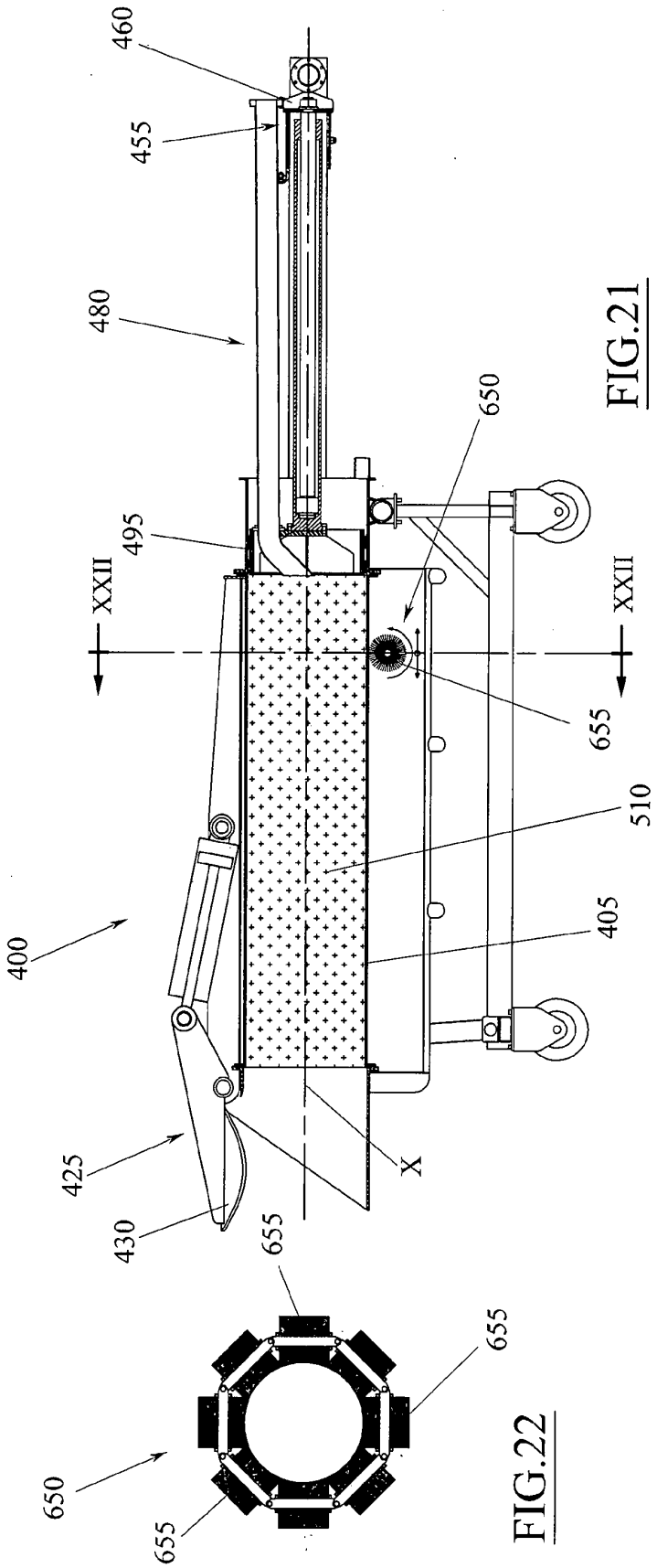
460
455
480
650
495
XXII
XXII
655
510
405
400
425
430
X
655
655
650
655

FIG.21

FIG.22

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- FR 2701816 **[0017]**
- US 6123018 A **[0018]**