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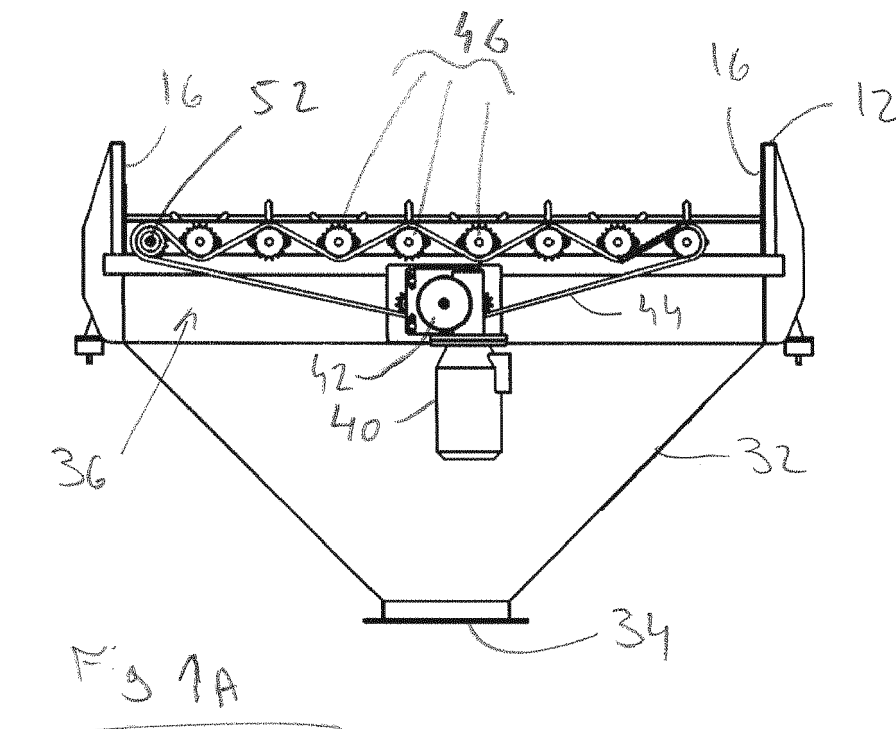
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(54) **BAGS SLITTING AND EMPTYING DEVICE**

(57) An apparatus for draining bags, comprising a bags transportation module, a bags slitting device and a bags emptying device (30) is provided. The bags slitting device comprises at least two parallel rotary blades for slitting bags, the bags transportation module being configured to displace bags horizontally parallel to the rotary blades so that the blades slash the bags as the bags are being displaced. The bags emptying device (30) com-

prises at least two rotors (28), each having a rotation axis (50) aligned horizontally, and rotor wings (54) arranged along the rotation axis (50), the rotors (28) being arranged behind the rotary blades, parallel with and as an extension of the rotary blades, so that the rotor wings rotate relative to the slashed bags thereby engaging with the slashed bags and enhancing emptying the bags.



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Description

FIELD OF THE INVENTION

[0001] The invention, in some embodiments, relates to the field of devices for emptying bags, and more particularly, but not exclusively, to devices for emptying bags assembled in apparatuses - e.g. automatic apparatuses - for Slitting and draining bags.

BACKGROUND OF THE INVENTION

[0002] Raw material in the form of powder or granular material in fields such as construction, chemistry, polymers, pharmaceuticals, food and the like, is often transported and delivered in bags. At a destination site - e.g. a factory or a plant - the contents of such bags may be drained into a receptacle such as a container using a suitable machine, possibly an automatic machine. Such a machine may be configured to grip a bag or a few bags together, and hold the bags and slit the bags above the receptacle so that the bag's contents are poured into the receptacle. After draining the bag's contents, the torn bag may be disposed of in a waste container.

[0003] European patent EP 1838582 discloses an apparatus for gripping, lifting and emptying layered bags. The apparatus includes a gripping unit including a gripper and a bag slitting and emptying device, and an optional container for debris of bags. The gripper is capable of gripping one or more bags ordered or heaped in disorder. The gripper is incorporated in a gripping unit which also lifts the gripped bags and carries them to the bag slitting and emptying device which is positioned above a receiver. The bag slitting and emptying device simultaneously slits and empties the bags by means of a plurality of rotary blades aligned with horizontal rods.

[0004] According to one approach, depicted in Figure 5 of EP 1838582, the rods are leveled at a height above the axis around which the blades rotate, and a portion of the debris of the bags, which are suspended pieces of cut bags, are forced by the weight of some of the bags' content and therefore are curved downwards into spaces between any two adjacent rods. By horizontally shaking the gripper aside in both horizontal directions to the rods above the receiver, leftover material born by these suspended debris of bags is discharged and poured downwards into the receiver.

[0005] According to an alternative approach, depicted in Figure 6 of EP 1838582, the bag slitting and emptying device includes at least two parallel rotary blades for slitting the bags, and at least two rods aligned in a row respectively with the rotary blades, the rods being shakeable relative to the slitted bag. The rods are leveled above the axis of rotation of the rotary blades, and are attached to a frame, which is off centered connected to a wheel driven by a motor, by means of a shaft. The rotating wheel moves the rods in a cyclic horizontal translation. The cyclic displacement of the rods relative to the slitted bags

discharges leftovers of the contents of the bags.

[0006] Thus, according to EP 1838582, by vigorously shaking horizontally either the gripper or the rods, the remains of the bags' contents withheld by the debris of bags, are discharged.

SUMMARY OF THE INVENTION

[0007] Aspects of the invention, in some embodiments thereof, relate to devices for emptying bags. More specifically, aspects of the invention, in some embodiments thereof, relate to devices for emptying bags assembled in apparatuses - e.g. automatic apparatuses - for slitting and draining bags.

[0008] As discussed above, current devices for emptying bags comprise a multitude of parallel rods arranged in a row with rotary blades that cut through the bags as the bags are carried above the blades towards the rods. The rods are leveled at a height so as to penetrate at least partly into the bags through the slits made by the blades. To empty the bags, either the bags are vigorously shaken by the gripper relative to the rods, or the rods are vigorously horizontally shaken by a movable frame to which they are attached relative to the bags.

[0009] The inventors of the current invention have found that shaking the torn or cut bags relative to the rods (or vice versa) is less than optimal for obtaining an effective emptying of the bags. Shaking either the bags or the rods (whereas the rods are all translated back and forth together) generates considerable vibrations to the construction of the apparatus. Also, emptying the bags by generating horizontal shaking is indirect, and therefore requires relatively long time, relatively small distances between the blades (to obtain narrow stripes of bags debris that hinder draining the content of the bags) and a corresponding high number of rods, that are arranged at relatively small distances between each other. Furthermore, to enhance the draining of the contents of the bags, the rods must penetrate into the bags, and in instances where a rod does not penetrate into the bag through a slit, emptying the content of the bag may be incomplete.

[0010] Thus, according to an aspect of some embodiments, there is provided an apparatus for draining bags, comprising a bags transportation module, a bags slitting device and a bags emptying device. The bags slitting device and the bags emptying device may be integrated in a single bags slitting and emptying device. The bags slitting device comprises at least two parallel rotary blades for slitting bags, the top portion of the rotary blades being exposed and thereby being positioned and aligned to slit bags that come into contact with the rotary blades. The bags transportation module is configured to displace bags horizontally, parallel to the rotary blades so that the blades cut through the bags, along the bottom portion of the bags, as the bags are being displaced. The bags emptying device comprises at least two rotors, each having a rotation axis aligned horizontally, and rotor wings arranged along the rotation axis. The rotors are arranged

behind the rotary blades, parallel to and as extension of the rotary blades, so that bags that are carried by the bags transportation module are slitted by the rotary blades as they are displaced towards the rotors. The slitted bags may then be positioned above the rotors and possibly above a receptacle configured to receive the contents of the bags, so that the rotor wings may engage with the bags by contacting the bags and possibly even by penetrating partly into the bags through the slits made by the rotary blades. The rotors rotate relative to the slitted bags, thereby widening the slits, and possibly stirring inside the bags and sweeping the contents of the bags downwards through the slits, and thereby draining and emptying the bags.

[0011] Emptying the bags using rotors is advantageous over emptying the bags using current systems that shake the bags and the horizontal rods relative to each other. Generating rotations in the rotors during the emptying step does not generate any lateral momentum which might generate vibrations of the construction of the apparatus. Further, the rotation of the wings affects a more effective draining of the bags, hence emptying is achieved in a shorter time and requiring a smaller number of blades compared to current systems.

[0012] According to some embodiments, the driving assembly is configured to drive the rotors to rotate in fixed directions. According to some embodiments, the driving assembly is configured to drive the rotors to repeatedly reverse the rotation direction, that is to say, to rotate back and forth.

[0013] The emptying device comprises a driving assembly comprising, according to some embodiments, a motor, a transmission gear and a chain associating the gear with the rotors. According to some embodiments, two adjacent rotors are configured to rotate in opposite directions. According to some embodiments, the rotors are arranged so that the rotor wings of adjacent rotors are interleaved. According to an aspect of some embodiments a bags emptying device is provided, configured as a retrofit to an apparatus for emptying bags. The apparatus for emptying bags may comprise a gripping unit for picking up at least one bag, and a bag slitting and emptying device to which the at least one bag is brought by the gripping unit and at which the at least one bag is emptied. The bag slitting and emptying device may comprises at least two parallel rotary blades for slitting the at least one bag, and further comprises the bags emptying device. The bags emptying device comprises at least two rotors, each having a rotation axis aligned horizontally, and rotor wings arranged along the rotation axis. The rotors are arranged behind the rotary blades parallel with as an extension of the rotary blades, so that the rotor wings rotate relative to the slitted bags thereby engaging with the slitted bags and enhancing emptying the bags.

[0014] Certain embodiments of the present invention may include some, all, or none of the above advantages. Further advantages may be readily apparent to those skilled in the art from the figures, descriptions, and claims

included herein. Aspects and embodiments of the invention are further described in the specification herein below and in the appended claims.

[0015] Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention pertains. In case of conflict, the patent specification, including definitions, governs. As used herein, the indefinite articles "a" and "an" mean "at least one" or "one or more" unless the context clearly dictates otherwise.

BRIEF DESCRIPTION OF THE FIGURES

[0016] Some embodiments of the invention are described herein with reference to the accompanying figures. The description, together with the figures, makes apparent to a person having ordinary skill in the art how some embodiments may be practiced. The figures are for the purpose of illustrative description and no attempt is made to show structural details of an embodiment in more detail than is necessary for a fundamental understanding of the invention. For the sake of clarity, some objects depicted in the figures are not to scale.

[0017] In the Figures:

FIG. 1A schematically depicts an embodiment of a bags slitting and emptying device 10 from a front view;

FIG. 1B schematically depicts the device of FIG. 1A from a perspective view;

FIG. 1C schematically depicts the device of FIG. 1A from a side view;

FIG. 1D schematically depicts the device of FIG. 1A from a top view;

FIG. 2A schematically depicts a detail of the device of FIG. 1A including a portion of the strut and a few rotors, and

FIG. 2B schematically depicts a detail of the device of FIG. 1A including a portion of the driving assembly and a few rotors.

DETAILED DESCRIPTION OF SOME EMBODIMENTS

[0018] The principles, uses and implementations of the teachings herein may be better understood with reference to the accompanying description and figures. Upon perusal of the description and figures present herein, one skilled in the art is able to implement the teachings herein without undue effort or experimentation. In the figures, like reference numerals refer to like parts throughout.

[0019] An embodiment of a bags slitting and emptying device 10 as described herein is schematically depicted

in Figures 1A-1D from a front view, from a perspective view, from a side view, and from a top view, respectively.

[0020] Bags slitting and emptying device 10 comprises a solid open frame 12 and a strut 14 extending between two opposite edges 16 of the frame 12. Strut 14 splits open frame 12 to a first region 20 and a second region 22. First region 20 is dimensioned and configured to house therein a bags slitting device (not shown), e.g. comprising a plurality of rotating blades. Second region 22 houses eight rotors 28 of a bags emptying device 30, as is detailed and explained further below. Bags slitting and emptying device 10 further comprises a receptacle 32 in a shape of a funnel, positioned below open frame 12 thereby being capable of collecting contents of a drained bag (not shown) which is emptied by emptying device 30, and routing such contents to a bottom opening 34 thereof. When bags slitting and emptying device 10 is used, a bags transportation module (not shown here) may carry bags to be emptied towards first region 20 of bags slitting and emptying device 10. Such a bags transportation module may comprise a gripping unit, e.g. as described for example in EP 1838582, capable of lifting bags and displacing then, hung from a gripper, towards a slitting device (not shown) housed in first region 20 and then, after the bags are slitted, towards emptying device 30 in second region 22. According to some embodiments other bags transportation modules may be used.

[0021] Bags emptying device 30 comprises a driving assembly 36, assembled onto a back edge 38 of open frame 12. Driving assembly 36 comprises a motor 40, a gear unit 42, a chain 44 and eight sprockets 46, each sprocket being mechanically associated with a rotor 28 by a rotor shaft 50 which extends between back edge 38 and strut 14. Driving assembly 36 is configured to drive rotors 28 and each rotor 28 is thus configured to rotate around a respective horizontal rotation axis defined by a respective rotor shaft 50. Motor 40 is engaged with gear unit 42 thereby driving gear unit 42, which drives chain 44. Chain 44 engages gear unit 42 with sprockets 46, so that when gear unit 42 is driven, chain 44 rotates sprockets 46. Chain 44 courses in a closed loop between gear unit 42 and sprockets 46, whereas the chain zig-zags between the sprockets, so that, when chain 44 moves, each two adjacent sprockets revolve in opposite directions. Driving assembly 36 further comprises an auxiliary sprocket 52, configured to define a suitable zig-zag course of chain 44 around all sprockets 46.

[0022] Each rotor 28 comprises four rotor wings 54 extending along the rotor shaft, each being directed outwards from the shaft at 90 degrees from the two neighboring rotor wings. Rotors 28 are initially arranged so that the rotor wings 54 of adjacent rotors are interleaved. By being interleaved it is meant that the rotor wings of one rotor are directed at an angle of 45 degrees relative to the rotor wings of the adjacent rotor. Thus, if, for example, the four rotor wings of one rotor are directed along the vertical and the horizontal, respectively, then the rotor wings of the adjacent rotor(s) are directed at 45 degrees

from the vertical and the horizontal respectively. According to some embodiments each rotor wing 54 comprises a u-shaped rod directed outwards from the rotor shaft 50 as described above and as is schematically depicted in Figures 2A and 2B. According to some embodiments the rotor wings may have a shape of flat or curved sheets (not shown here) extending substantially along the rotor shaft and being directed outwards from rotor shaft 50. According to some embodiments, driving assembly 36 may be configured and operable to drive rotors 28 to continuously rotate in a fixed direction (each two adjacent rotors rotate in opposite directions from each other) for optimal emptying the bags. According to some embodiments, driving assembly 36 may be configured and operable to drive rotors 28 to repeatedly reverse the direction of rotation thereof.

[0023] According to some embodiments bags emptying device 30 may be used as a retrofit in a bags emptying apparatus such as an automatic bags emptying apparatus as described in EP 1838582. According to some such embodiments, bags emptying device 30 may be retrofitted in the slitting and emptying device of Figure 6 of EP 1838582 instead of frame 184 and rods 182 and provided in a row with rotary blades 194 therein.

[0024] It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention, which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable sub-combination or as suitable in any other described embodiment of the invention. No feature described in the context of an embodiment is to be considered an essential feature of that embodiment, unless explicitly specified as such.

[0025] Although steps of methods according to some embodiments may be described in a specific sequence, methods of the invention may comprise some or all of the described steps carried out in a different order. A method of the invention may comprise all of the steps described or only a few of the described steps. No particular step in a disclosed method is to be considered an essential step of that method, unless explicitly specified as such.

[0026] Although the invention is described in conjunction with specific embodiments thereof, it is evident that numerous alternatives, modifications and variations that are apparent to those skilled in the art may exist. Accordingly, the invention embraces all such alternatives, modifications and variations that fall within the scope of the appended claims. It is to be understood that the invention is not necessarily limited in its application to the details of construction and the arrangement of the components and/or methods set forth herein. Other embodiments may be practiced, and an embodiment may be carried out in various ways.

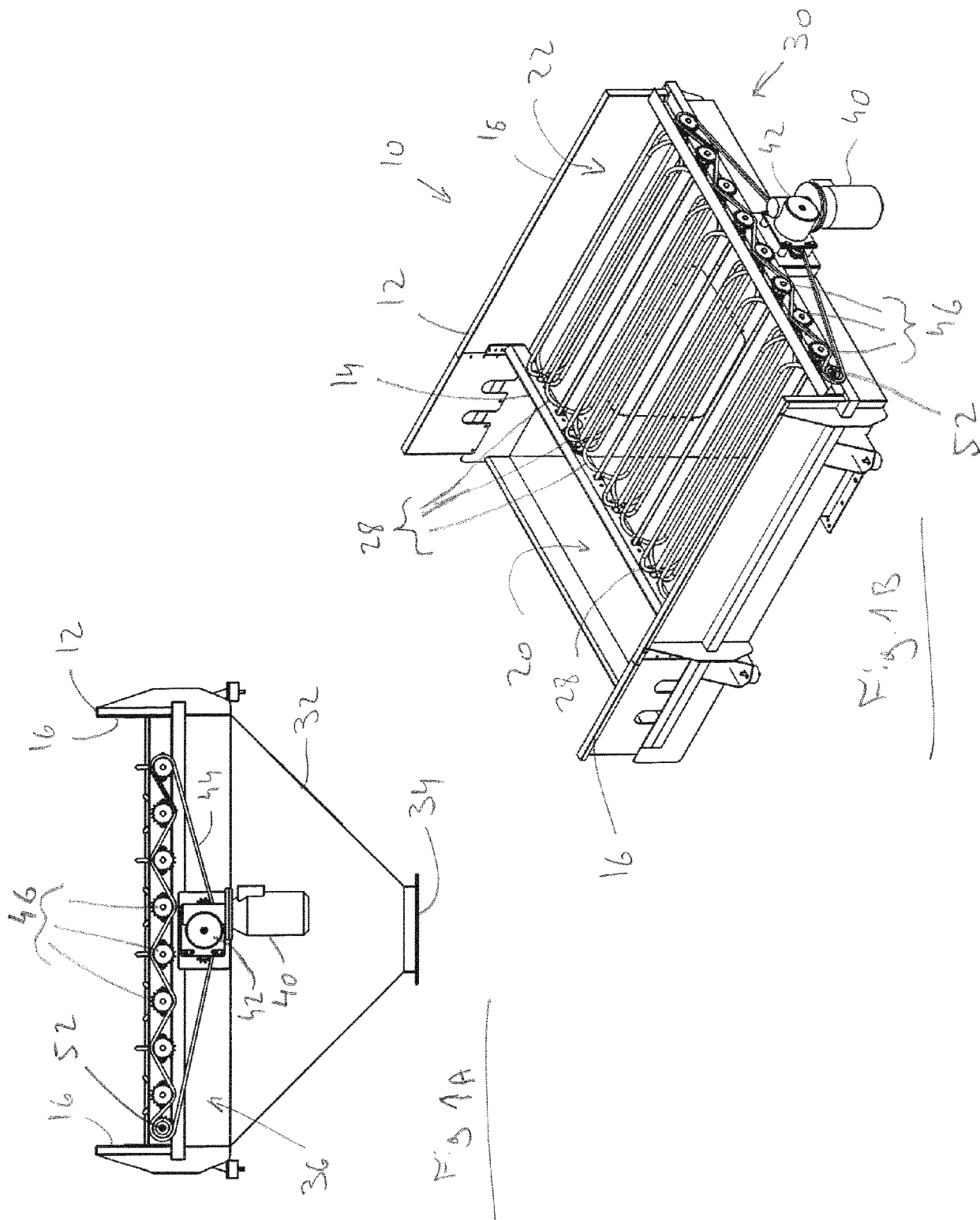
[0027] The phraseology and terminology employed herein are for descriptive purpose and should not be re-

garded as limiting. Citation or identification of any reference in this application shall not be construed as an admission that such reference is available as prior art to the invention. Section headings are used herein to ease understanding of the specification and should not be construed as necessarily limiting.

comprising at least two rotors, each having a rotation axis aligned horizontally, and rotor wings arranged along the rotation axis, the rotors being arranged behind the rotary blades, parallel with and as an extension of the rotary blades, so that the rotor wings rotate relative to the slashed bags thereby engaging with the slashed bags and enhancing emptying the bags.

Claims

1. An apparatus for draining bags, comprising a bags transportation module, a bags slitting device and a bags emptying device, the bags slitting device comprising at least two parallel rotary blades for slitting bags, the bags transportation module being configured to displace bags horizontally parallel to the rotary blades so that the blades slash the bags as the bags are being displaced, the apparatus being **characterized in that** the bags emptying device comprises at least two rotors, each having a rotation axis aligned horizontally, and rotor wings arranged along the rotation axis, the rotors being arranged behind the bags slitting device and parallel with and as an extension of the rotary blades, so that the rotor wings rotate relative to the slashed bags thereby engaging with the slashed bags and enhancing emptying the bags. 10
2. The apparatus of claim 1 wherein the rotors are configured to rotate in fixed directions. 15
3. The apparatus of claim 1 wherein the rotors are configured to repeatedly reverse the rotation direction, thereby rotating back and forth. 20
4. The apparatus of claim 1 wherein each two adjacent rotors are configured to rotate in opposite directions. 25
5. The apparatus of claim 1 wherein said rotors are arranged so that the rotor wings of adjacent rotors are interleaved. 30
6. The apparatus of claim 1 further comprising a driving assembly configured to drive the rotors, the driving assembly comprising a motor, a gear unit engaged with the motor and a chain engaging the gear unit with the rotors. 35
7. A bags emptying device configured as a retrofit to a an apparatus for emptying bags, the apparatus comprising a gripping unit for picking up at least one bag, and a bag slitting and emptying device to which the at least one bag is brought by the gripping unit and at which the at least one bag is emptied, wherein the bag slitting and emptying device comprises at least two parallel rotary blades for slitting said at least one bag, further comprises the bags emptying device, the bags emptying device being **characterized in** 40



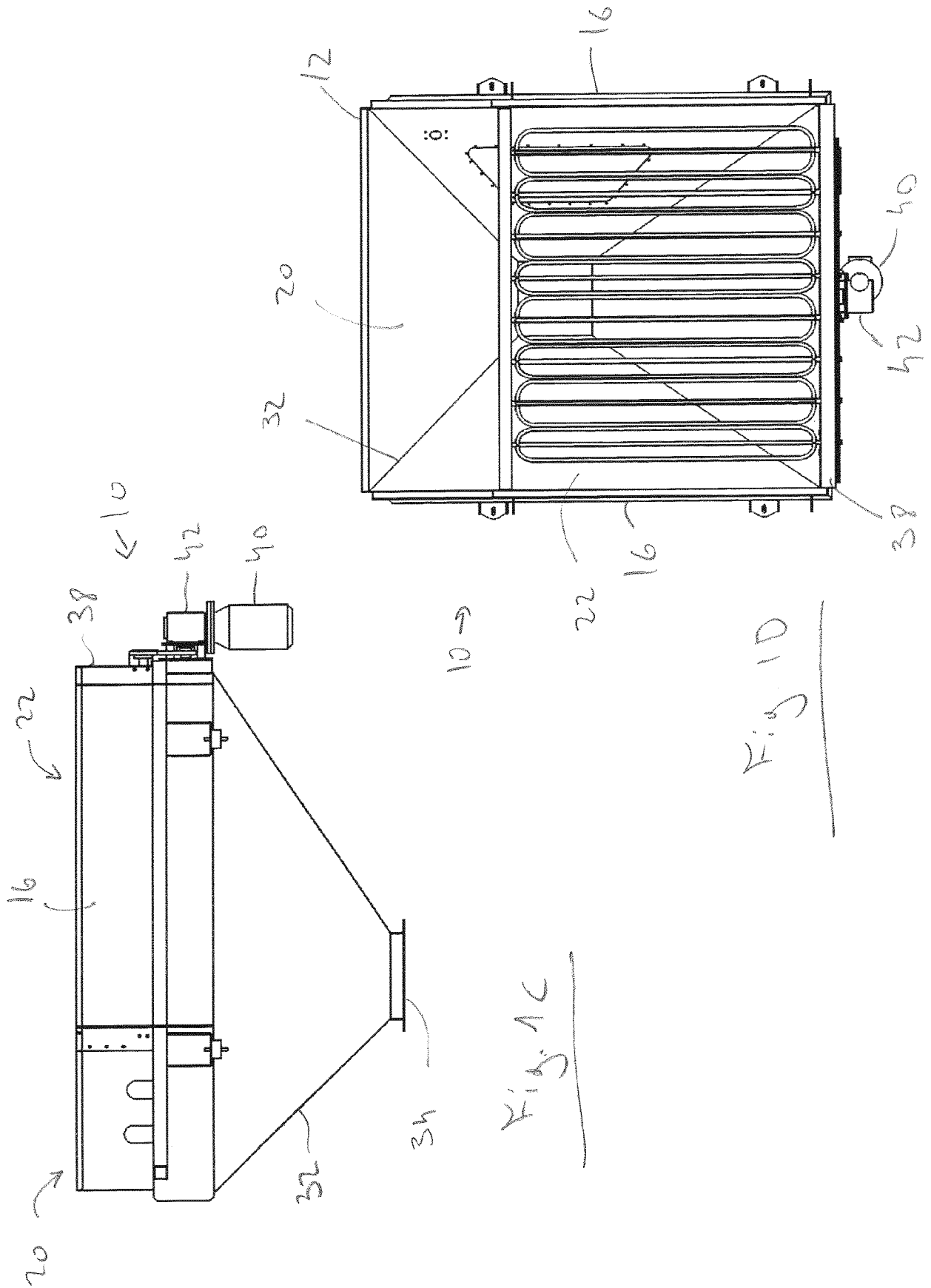


Fig. 2A

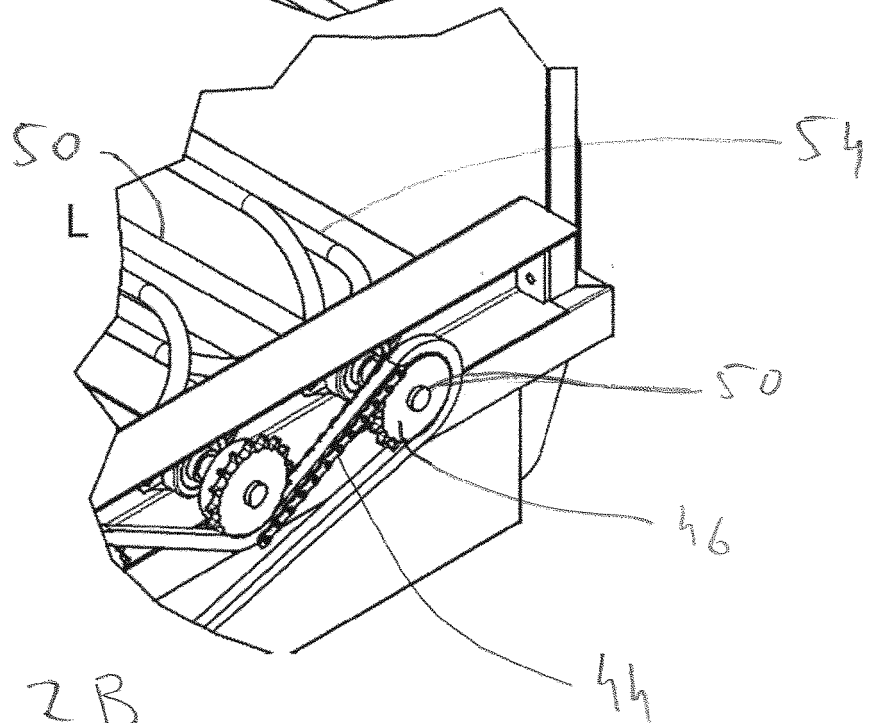
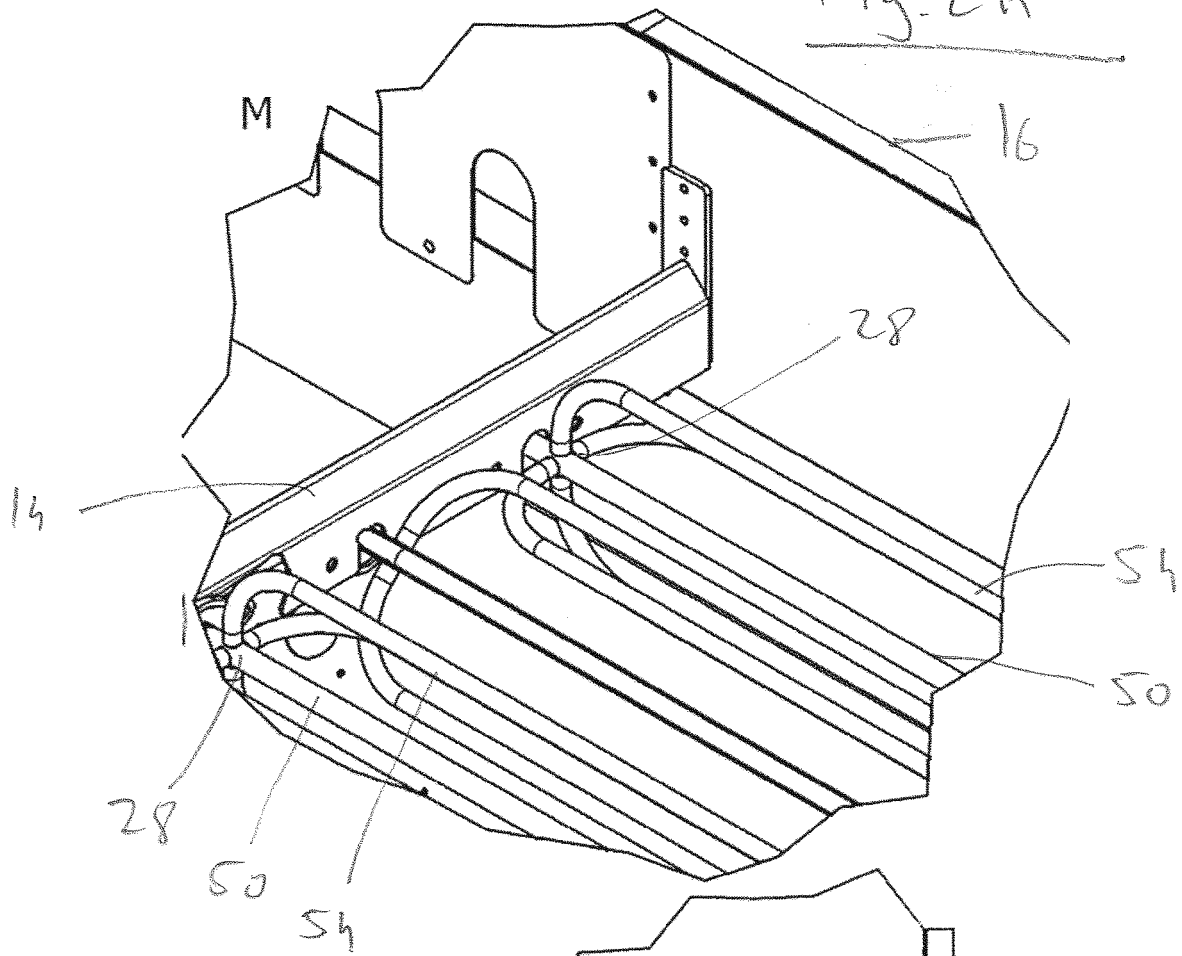


Fig. 2B



EUROPEAN SEARCH REPORT

Application Number
EP 16 15 7867

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 838 582 A1 (AYAL ROBOTICS AND ENGINEERING [IL]) 3 October 2007 (2007-10-03) * the whole document *	1-7	INV. B65B69/00
A	WO 95/31377 A1 (BULK HANDLING SYSTEMS INC [US]; CLARK BRIAN K [US]; MILLER ROY R [US]) 23 November 1995 (1995-11-23) * the whole document *	1,7	
A	US 4 995 770 A (CRANE JACK W [US]) 26 February 1991 (1991-02-26) * the whole document *	1,7	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 11 July 2016	Examiner Ungureanu, Mirela
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	

EPO FORM 1503 03/02 (P04C01)

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

EP 16 15 7867

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
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11-07-2016

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1838582 A [0003] [0004] [0005] [0006] [0020]
[0023]