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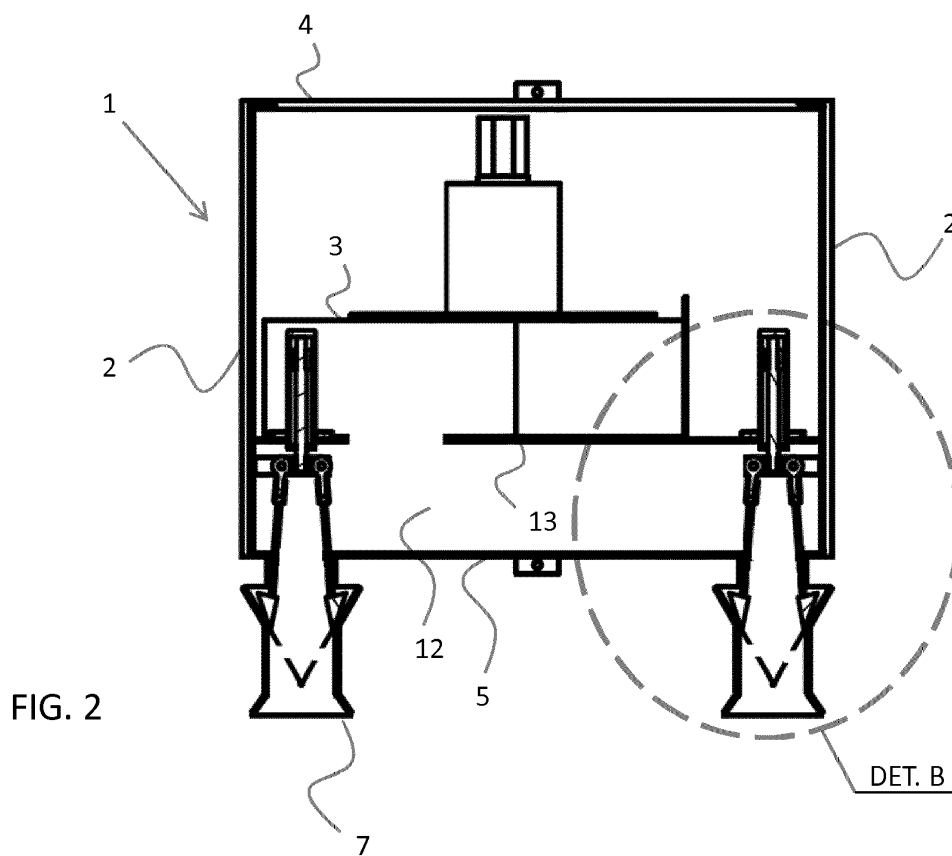
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(54) **LIFTING ARRANGEMENT AND METHOD FOR MOVING BULK SACKS AND THE LIKE**

(57) The present invention relates to a lifting arrangement (1) and a method for moving a bulk sack (10) or the like. The invention is characterized in that such a lifting arrangement (1) comprises at least one device (3) for generating an air current and at least one suction unit (7)

for turning the air current generated by such a device into a guidable air flow (8). Providing the device with at least one gripping unit (9) allows a lifting loop (11) located on the bulk sack (10) and lifted to the suction unit (7) by the air flow to be gripped and the bulk sack to be moved.



## Description

### Background of the invention

[0001] The present invention relates to a device according to the preamble of claim 1 for making moving of a bulk sack, for example, simpler than before.

[0002] The invention also relates to a method according to the preamble of claim 6 for making moving of said bulk sack simpler.

[0003] It is known from the prior art to use various cranes, forklifts, clamps or grab attachments for moving bulk sacks, in particular. Such prior art has, however, significant drawbacks. Thus, using a crane is laborious as it requires, in most cases, a helper who attaches the lifting loops on the bulk sack to the crane hook and, correspondingly, also has to detach the bulk sack. The work is slow and dangerous to the helper as he has to be climbing upon the bulk sacks. Dangerous moments are further caused by the helper moving in the vicinity of the work machine.

[0004] On the other hand, a bulk sack can be moved without a helper's immediate help by using a forklift and the forks mounted on it. However, since bulk sacks are frequently loaded on top of each other, it is extremely challenging to guide the forks both to their lifting loops and below them. Consequently, sacks often break and their contents spread to the environment. The material transported in the sack is thus lost. In addition, the material contaminates remaining sacks and the loading area, which means that more resources must be used for cleaning them.

[0005] There have been attempts to alleviate the above problems by applying clamps or grab attachments intended for treating bales, for example, to lifting and transporting bulk sacks. There are several problems with the use of these as well. On the one hand, tightly loaded bulk sacks cause a problem even to grab attachments because it is difficult to get between the sacks with their arms. So, even grab attachments break bulk sacks in the same way as forklifts' forks. On the other hand, a grab attachment is not always capable of keeping a grip on the bulk sack it has lifted up from the load, which results in the sack falling to the ground - and frequently breaking. If, in turn, the grab attachment's pressing force is increased, there is a risk that the bulk sack will not withstand the pressing it is subjected to and breaks in spite of it. Further, emptying a sack transported by a clamp or grab attachment is also problematic. It is not possible to get a proper grip on the sack being emptied, which leads to the sack that is emptying or is already empty falling onto the transport means below or, in the worst case, to the device treating the material in the sack. Removing the sack then interferes with or even interrupts the other work process under way.

## Summary of the invention

[0006] It is an object of the present invention to eliminate drawbacks of the prior art and to provide a completely novel solution with which bulk sacks and the like products are movable in a simple and reliable manner.

[0007] This object is achieved in such a manner that a lifting arrangement for moving a bulk sack and the like is, in accordance with the present invention, provided with the characteristic features defined in the claims. In particular, the present problems can be solved by combining the characteristics as disclosed in the characterising parts of claims 1 and 6.

[0008] Preferred embodiments of the invention are disclosed in the dependent claims.

[0009] The invention is based on the idea that mobilizing lifting loops of bulk sacks allows them to be gripped without a separate helper being needed for the work.

[0010] The invention provides considerable advantages. Hence, bulk sacks can be treated easily and hygienically by the driver only without there being a need for him or her to get off the cabin. The work may also be carried out without touching the sack itself and breaking it.

[0011] The structural height of the lifting arrangement according to the invention is also small, so bulk sacks can be treated even in confined spaces. This aspect is emphasized particularly when the present solution is compared with a situation where bulk sacks need to be treated with chains and lifting hooks.

[0012] No special work machines are required for using the present lifting arrangement but it can be mounted on a machine that is part of the available work equipment already in operation. Learning how to operate the lifting arrangement is also easy, which minimizes the commissioning costs of the arrangement.

[0013] The device according to the invention allows the treatment of bulk sacks to be made simpler and faster. The invention reduces the need for labour force for the work, and in addition, the time needed for the moving and loading work is reduced, which, in turn, speeds up the operation of the whole treatment chain for the bulk sack.

[0014] Other advantages provided by the invention are disclosed in the following more detailed description of specific embodiments of the invention.

## List of figures

[0015] In the following, some preferred embodiments of the invention will be explained in closer detail and with reference to the accompanying drawing, in which

Figure 1 shows a schematic, axonometric view of a lifting arrangement according to the invention, a part of its cover being removed;

Figure 2 shows a cross-sectional view of a device according to the lifting arrangement at point A-A of Figure 1;

Figure 3 shows a top view of a device according to Figure 1;

Figure 4 shows a detailed view of a suction and gripping unit at point B of Figure 2, the gripping members being in an open position.

Figure 5 shows a detailed view of a suction and gripping unit at point B of Figure 2, the gripping members being in a closed position.

Figures 6 to 8 show the operation of a device according to the invention, whereby the device is shown in Figure 6 to approach a bulk sack to be moved;

Figure 7 shows the setting of a lifting loop of a bulk sack in an upright position by the device; and

Figure 8 shows the device gripping the lifting loop of the bulk sack.

### Detailed description of preferred embodiments

[0016] The present figures do not show the lifting arrangement and the method for moving a bulk sack and the like products in a particular scale but the figures are schematic, illustrating the principles of the structure and operation of the preferred embodiments. The structural parts shown by reference numbers in the attached figures then correspond to the structural parts marked by reference numbers in this specification.

[0017] Although this specification describes the lifting arrangement in moving a bulk sack, in particular, utilizing the lifting arrangement is not restricted to such loads. Thus, all loads comprising gripping means which can be guided by an air flow and are comparable to the lifting loops presented in the following are movable in the same way with the present lifting arrangement.

[0018] The schematic, axonometric view of a preferred embodiment a lifting arrangement 1 according to Figure 1 illustrates the principal structural parts of the arrangement. In order to show the parts, part of the lifting arrangement cover has been omitted from the figure. Thus, such a lifting arrangement comprises at least one device 3 for generating an air current, the device being surrounded by side panels 2 on three sides in the figure. Apart from said side panels, the casing structure surrounding this device comprises a cover 4 and a bottom 5 seen in Figure 2. Figure 1 also shows a fastening device 6 mounted on a bearing in the casing structure, the lifting arrangement being arrangeable with such a device on an appropriate work machine, for instance on a telescopic handler. Such a fastening device known as such is, in some cases, replaceable with fastening members fixedly arranged in the casing structure and not separately shown here. The casing structure is particularly advantageous when the present lifting arrangement is utilized in a considerably unclean environment. However, it is not in any way obligatory for the operation of the lifting arrangement but the lifting arrangement may also be manufactured without such a casing. In such a case, the casing may be replaced by, for example, a support frame to which the

different components of the lifting arrangement can be attached.

[0019] The above device 3 for generating an air current comprises a suction device or a blower with which a sufficient air flow can be generated quickly and reliably. An example of such a device is a vacuum blower. It is also easy to dimension a vacuum blower to be suitable for the required speed and amount of air flow in each particular case.

[0020] Protruding from the bottom 5 of the lifting arrangement 1, there is a suction unit 7 with which the air current generated by the device 3 can be turned into a guidable air flow 8, compare Figure 7. The suction unit is tubular and preferably has, in this embodiment, a square cross-section. It is, of course, also feasible to manufacture the suction unit to have a round cross-section. What is essential is that it forms an air channel which extends through the bottom and through which an air flow directed from below the lifting arrangement substantially upwards is enabled. In connection with such a suction unit, at least one gripping unit 9 is arranged. The cooperation of the gripping unit and the suction unit allows a grip on a lifting loop 11 located on the bulk sack 10 and to be guided to the suction unit, as can be seen in Figures 6 to 8.

[0021] The bulk sacks 10 to be treated are mainly provided with four lifting loops 11, in which case it is advantageous to provide the present lifting arrangement 1 with one suction unit 7 per each lifting loop. So, the lifting arrangement has, in all of its four outer corners, suction units protruding from the bottom 5.

[0022] To guide the lifting loop 11 to the suction unit 7, an air flow 8 is, as mentioned, generated in the suction unit in accordance with Figure 7. For this purpose, the lifting arrangement 1 comprises the above-mentioned one or more devices 3 for generating an air current. To make individual controlling of the air current more efficient, such a device for generating an air current may be arranged in each suction unit separately. The simplest and most advantageous structure is, however, achieved by providing the lifting arrangement with a pressure equalization space 12. The one or more devices 3 for generating an air current are then connectable to this pressure equalization space. Negative pressure generated by the device is distributed in this pressure equalization space further to the suction units 7 in the lifting arrangement.

[0023] In the present embodiment, the pressure equalization space 12 is thus arranged in the lifting arrangement for instance by mounting an intermediate bottom 13 substantially parallel to the bottom 5 on the casing structure. Thus, firstly, the suction units 7 located at the bottom and penetrating it are in communication with the pressure equalization space that the bottom and the intermediate bottom define between them. Secondly, the at least one device 3 for generating an air current, mounted on the intermediate bottom, is also in communication with the pressure equalization space. In the embodiment

according to the figures, this device is mounted on the intermediate bottom outside the pressure equalization space. Naturally, the one or more devices for generating an air current may also be mounted in the pressure equalization space itself, as long as it is ensured that there are sufficient flow paths for the air flow.

**[0024]** It is, of course, feasible to make the lifting arrangement such that it comprises, instead of one pressure equalization space, two pressure equalization spaces 12 separate from each other in such a manner that each pressure equalization space is, in turn, arranged to distribute the negative pressure generated by the one or more devices 3 for generating an air current to suction units arranged in pairs in the lifting arrangement. In the most advantageous case, this is implemented such that the air flow is first directed at the suction units on the side of the work machine in the lifting arrangement, and subsequently to two suction units farther away from the work machine.

**[0025]** When it is desirable to control the air flow 8 of the suction unit 7 with more accuracy or even to prevent an air flow in its entirety, the suction unit can be provided with separate closing means. It is, however, simplest to control the air flow by arranging each gripping unit 9 to partly or completely close the suction unit that is located at the same point with it by guiding the gripping unit to said suction unit. When in communication with the suction unit, the gripping unit is smoothly guidable to the lifting loop 11 rising from the bulk sack 10 to the suction unit. On the other hand, a gripping unit being guided to the suction unit simultaneously forms, in the suction unit, a plug that hinders or even completely prevents an air flow. Then, the rest of the suction units in communication with the pressure equalization space 12 are subjected to greater total suction and therefore also a more efficient air flow.

**[0026]** In order to grip the lifting loop 11 rising from the bulk sack 10 to the suction unit, the gripping unit 9 comprises for instance substantially opposite pressing means 14 according to Figure 4. These pressing means are guidable into a first open position where they are far from each other and into an adjacent second closed position by turns, as shown in Figures 4 and 5. To implement such a change in the position, the pressing means are moved in the direction of the longitudinal axis of the suction unit 7, whereby the closed position is reached when the pressing means are guided farther away from the device 3 generating an air current. The transfer movement is guided by push arms 15 that are arranged in the opposite pressing means of the gripping units and are substantially parallel to the longitudinal axis of the suction unit. These push arms are substantially adjacent to each other when being guided to move in the direction substantially parallel to the longitudinal axis of the suction unit 7 by an actuator 16 influencing the push arms substantially simultaneously.

**[0027]** At their simplest, the push arms 15 are connected substantially rigidly to the actuator 16. In such a case,

the push arms are manufactured to be, to some extent, capable of elasticity relative to their longitudinal axis during their transfer movement. It is naturally feasible to arrange the push arms with bearings in the actuator guiding them. This reduces the torque that both the actuator and the push arms are subjected to and that stress them in long-term operation. One example of this type of bearing is shown in attached Figure 4, for example.

**[0028]** When moving from their open position towards the closed position, guided by the actuator 16 and the push arms 15, the pressing means 14 are facilitated to approach each other such that they are guided with opposite glide surfaces 17 positioned in the suction unit 7. Such glide surfaces form at least one wedge or a wedge-like surface positioned in the suction unit and converging towards a mouth 18 oriented towards the bulk sack. In an embodiment according to the attached figures, the suction units are substantially square, comprising parallel walls in pairs. In such an embodiment, the glide surfaces are provided on the inner surfaces of two opposite walls, for example by welding wedge pieces to the wall. The pressing means extending over the cross-section of the suction unit are thus supported against these opposite glide surfaces and move along them, guided by the actuator. When the pressing means is guided towards the mouth, the glide surfaces are thus arranged to guide the pressing means to be guided towards the closed position against each other.

**[0029]** Each pressing means 14 comprises, at its simplest, a substantially rectangular prismatic piece. When ending up in their closed position, such pieces contact each other only at the prism edge on the side of the mouth 18, while the opposite edge is pressed against the above-described glide surfaces 17. Due to the small contact surfaces, great local breaking forces are exerted on the gripping unit and the suction unit. To minimize such forces that deteriorate the operation of the lifting arrangement, the pressing means 14 is arrangeable to comprise a wedge-like piece which is formed of a plane surface 19 and an opposite slide surface 20. In accordance with Figure 4, for example, the slide surface of the pressing means becomes positioned against the glide surfaces of the suction unit in the substantially closed position of the pressing means. Correspondingly, the plane surfaces 19 of the pressing means are arranged to be oriented towards each other. Since the plane surfaces of these pressing means are intended to press not so much against each other but against the lifting loop 11 having been guided between them, the plane surface can be provided with a special outer surface increasing friction. These friction surfaces are not shown separately in this context as their structure is known as such.

**[0030]** When the pressing means 14 are guided between the first open position where they are far from each other and the adjacent second closed position, the return of the adjacent push arms 15 into their original position can be ensured by arranging a spring means 21 between them. By its pressing force, such a spring means guides

the push arms 15 continuously farther from each other, simultaneously preventing the push arms from buckling against each other. The spring means also serves to ensure that the pressing means do not interfere with the air flow 8 generated in the suction unit. Further, the spring member guides the pressing means against or towards a wall in the suction unit, preventing thus the lifting loop rising to the suction unit from getting between the pressing means and the suction unit wall.

**[0031]** The present lifting arrangement 1 operates in the following manner, for example. The lifting arrangement is mounted on a work machine via the fastening device 6 with which the lifting arrangement can be guided above the bulk sack 10, compare Figure 6. When the lifting arrangement is substantially above the bulk sack, the device 3 is started to generate an air current. Guiding the gripping units 9 positioned farther away from the work machine into their closed position causes the main air flow 8 to pass through the suction units on the side of the work machine, compare Figure 7. The air flow may then pass in the suction units individually, in pairs or, for example, in all suction units simultaneously. As a result of the air flow directed through the suction unit, the lifting loop 11 on the bulk sack rises upright, being guided to the suction unit 7 placed above it, as shown in Figure 7. When noticing that the lifting loop has adhered to the suction unit, the driver of the work machine may, if required, still lower the lifting arrangement nearer the upper surface of the bulk sack. After this, the driver guides the gripping unit in connection with the suction unit to move from its open position into its closed position, whereby the pressing means 14 of the gripping unit 9 press, on opposite sides, against the lifting loop 11, as shown in Figure 8.

**[0032]** The lifting arrangement 1 being now adhered to the bulk sack 10, the driver may carefully move the lifting arrangement above the bulk sack, sucking in this way lifting loops 11 one after the other to the suction unit 7, where they are gripped by the gripping unit 9.

**[0033]** When, subsequently, the lifting of the lifting arrangement 1 and the bulk sack 10 begins, the pressing means 14 of the gripping units 9 are subjected to a pulling movement in the direction of the bulk sack, transmitted by the lifting loops 11. As a result of this pulling movement, the pressing means press against the glide surfaces 17 guiding their movement. The glide surfaces approaching each other then force the pressing means towards each other, increasing the press against the lifting loops and ensuring that the bulk sack remains carried by the lifting arrangement.

**[0034]** The bulk sack 10 having been moved to a desired place, the driver guides the gripping units 9 back into their open position, whereby the spring means 19 between the push arms 15 simultaneously force the pressing means 14 to be detached from the lifting loops 11. After this, the lifting arrangement may be taken to the next bulk sack to be moved.

**[0035]** A person skilled in the art will find it obvious that,

as technology advances, the basic idea of the invention may be implemented in various ways. The invention and its embodiments are thus not restricted to the above examples but may vary within the scope of the claims.

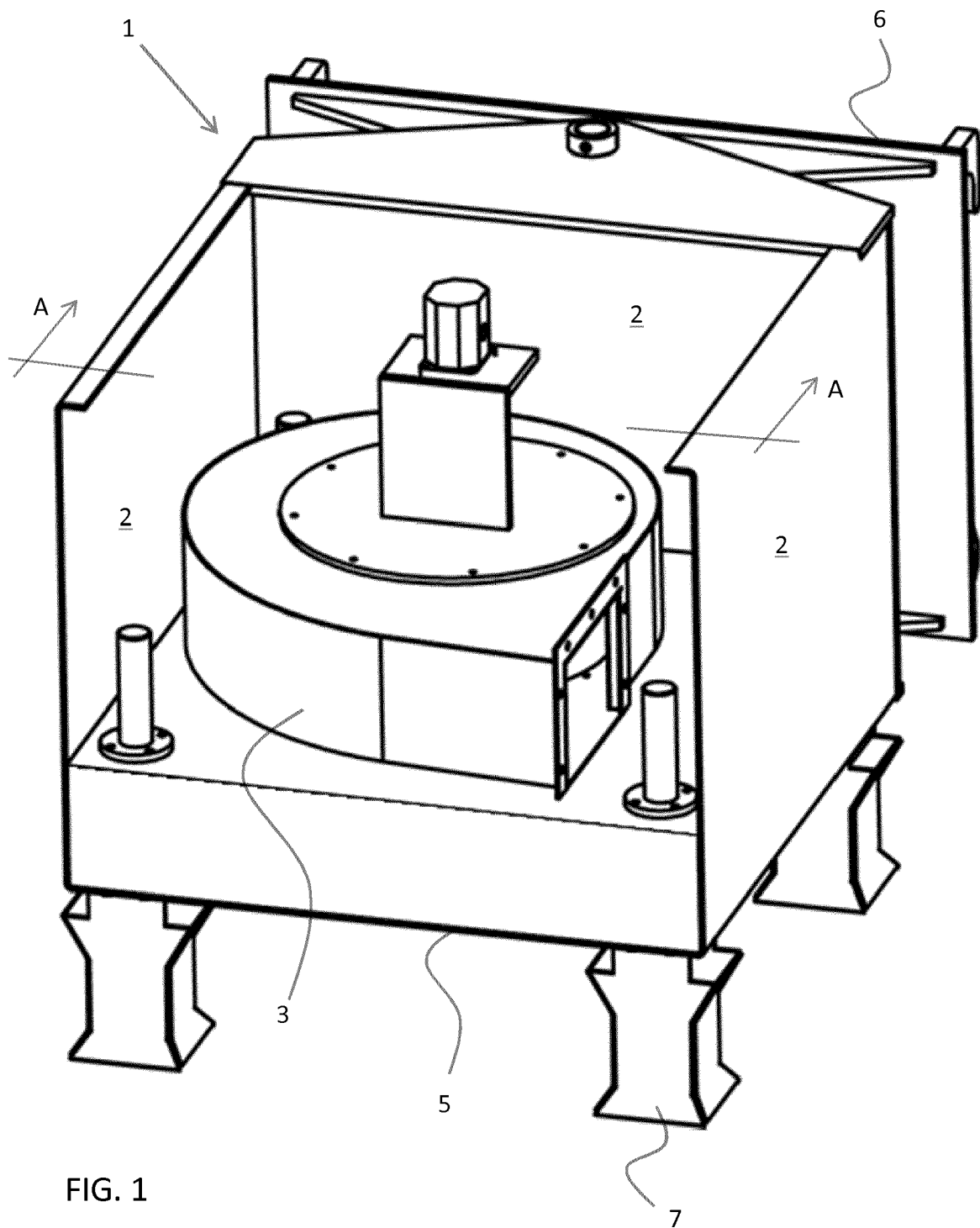
## Claims

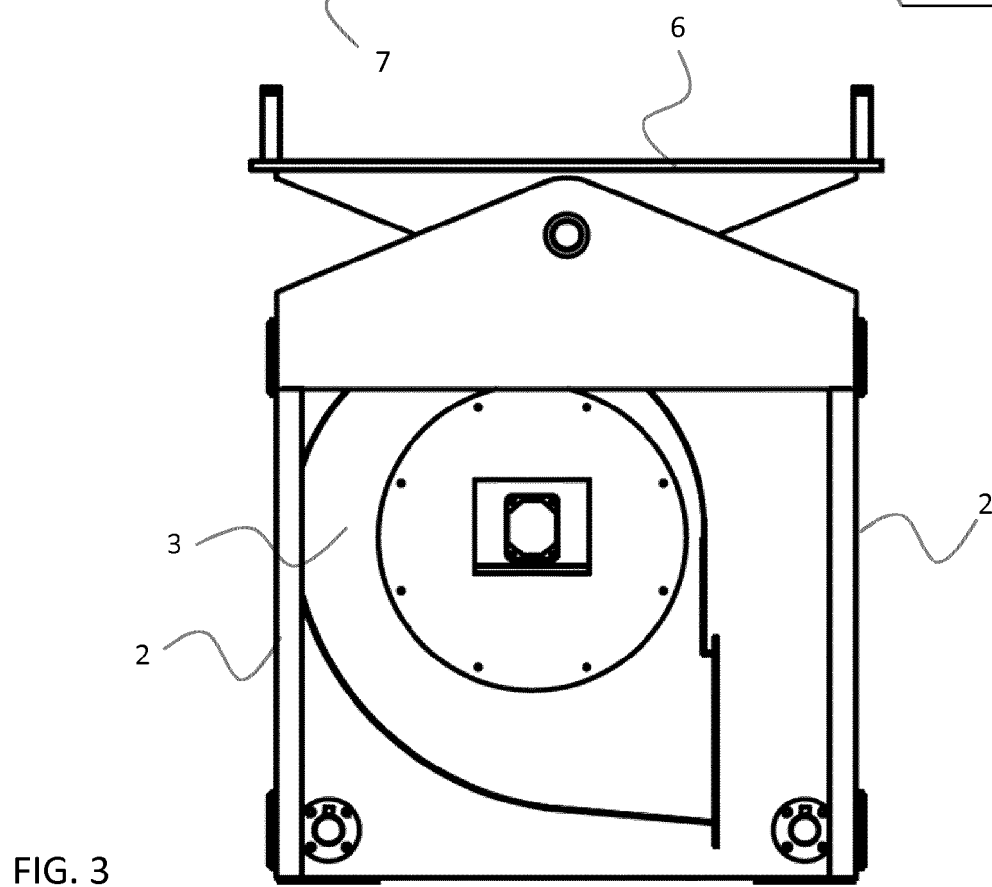
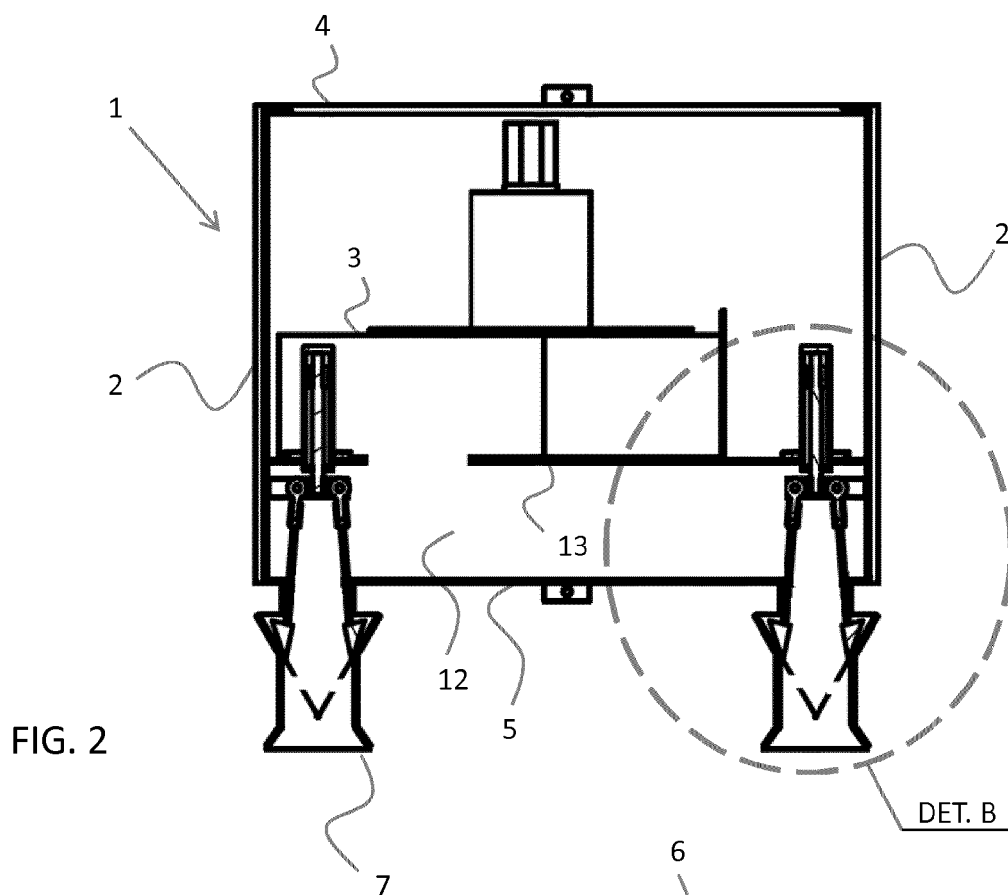
1. A lifting arrangement (1) for moving a bulk sack (10) or the like, **characterized in that** such a lifting arrangement (1) comprises
  - at least one device (3) for generating an air current;
  - at least one suction unit (7) for turning the air current generated by the device (3) into a guidable air flow (8); and
  - at least one gripping unit (9) for gripping a guidable lifting loop (11) located on the bulk sack (10) and to be guided to the suction unit (7).
2. A lifting arrangement (1) according to claim 1, **characterized in that** the lifting arrangement (1) comprises such a device (3) for generating an air current which influences each suction unit (7) separately.
3. A lifting arrangement (1) according to claim 1, **characterized in that** the lifting arrangement (1) comprises a pressure equalization space (12) for distributing negative pressure generated by the one or more devices (3) for generating an air current to the suction units (7).
4. A lifting arrangement (1) according to any one of the preceding claims, **characterized in that** the gripping unit (9) comprises opposite pressing means (14), the pressing means being guidable into a first open position where they are far from each other and into an adjacent second closed position by turns, whereby the change in the position is achieved when the pressing means (14) are moved in the direction of the longitudinal axis of the suction unit (7) in such a way that the closed position is reached when the pressing means are guided farther away from the device (3) generating an air current.
5. A lifting arrangement (1) according to claim 4, **characterized in that** the gripping unit (9) comprises push arms (15) arranged on the opposite pressing means (14) and being substantially parallel to the longitudinal axis of the suction unit (7) and adjacent to each other, the push arms being guidable to move in the direction substantially parallel to the longitudinal axis of the suction unit by an actuator (16) influencing them substantially simultaneously.
6. A method for moving a bulk sack (10) or the like, **characterized by** such a method comprising the fol-

lowing steps: guiding a lifting arrangement (1) above the bulk sack (10);  
 starting a device (3) for generating an air current to generate an air flow (8) through at least one suction unit (7) in the lifting arrangement; 5  
 achieving lifting of a lifting loop (11) on the bulk sack into an upright position by said air flow directed through the suction unit (7);  
 when the lifting loop is adhered to the suction unit, guiding a gripping unit (9) in connection with the suction unit to move from its open position into its closed position, whereby 10  
 pressing means (14) in the gripping unit (9) press against the lifting loop (11) on opposite sides, ensuring that the bulk sack remains carried by the lifting arrangement. 15

7. A method according to claim 6, **characterized by** generating the air flow (8) in each suction unit (7) of the lifting arrangement (1) separately. 20
8. A method according to claim 6 or 7, **characterized by** guiding negative pressure generated by the one or more devices (3) for generating an air current to a pressure equalization space (12), from which it is distributed to one or more suction units (7) in the lifting arrangement. 25
9. A method according to any one of claims 6 to 8, **characterized by** forming the gripping unit (9) of opposite pressing means (14), whereby 30  
 the pressing means are guided into a first open position where they are far from each other and into an adjacent second closed position by turns in such a way that 35  
 the change in the position is achieved when the pressing means (14) are moved in the direction of the longitudinal axis of the suction unit (7), and the closed position is reached when the pressing means are guided farther away from the device (3) 40  
 generating an air current.
10. A method according to claim 9, **characterized by** influencing the opposite pressing means (14) of the gripping unit (9) via push arms (15) being substantially parallel to the direction of the longitudinal axis of the suction unit (7) and adjacent to each other, whereby 45  
 the push arms are guided to move in the direction substantially parallel to the longitudinal axis of the suction unit by an actuator (16) influencing them substantially simultaneously. 50

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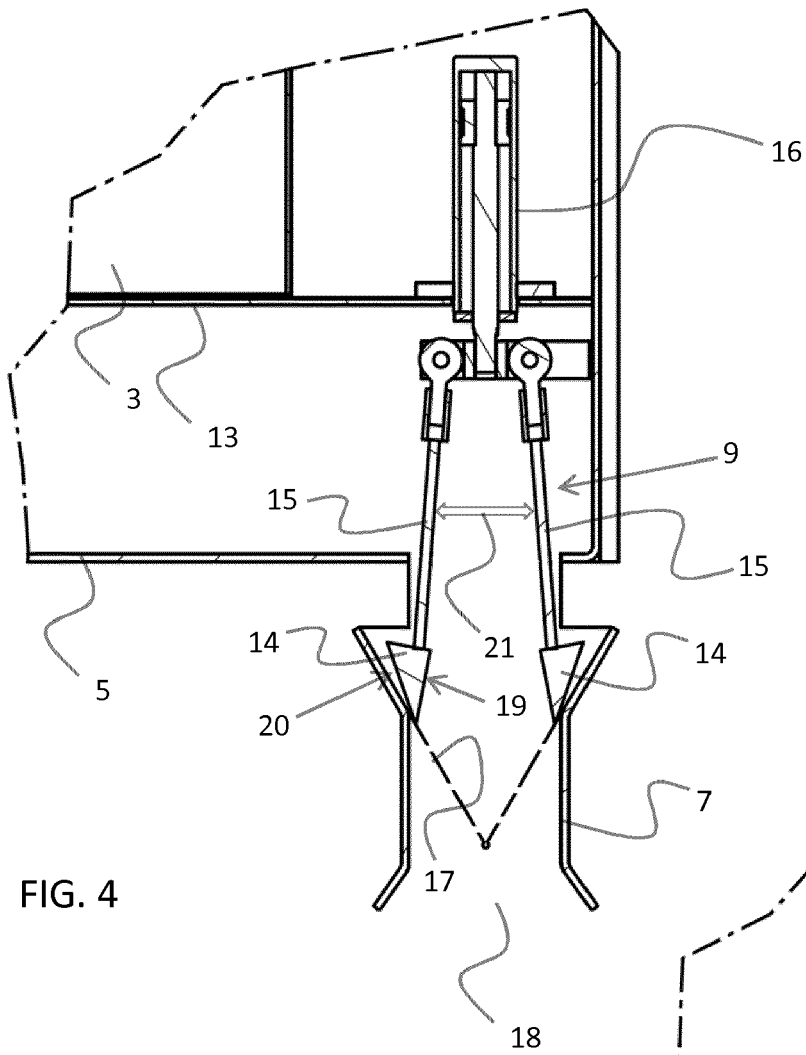


FIG. 4

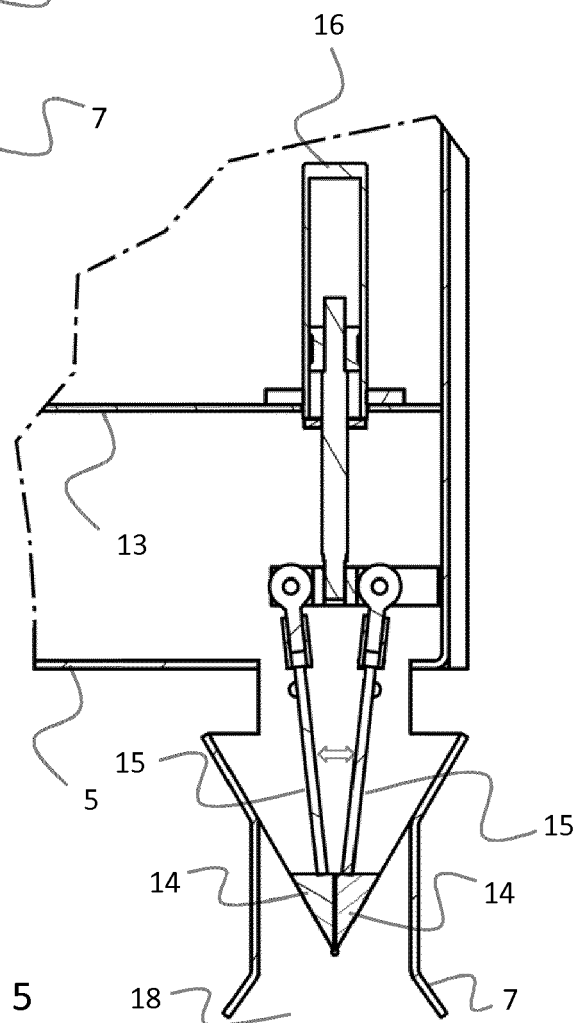


FIG. 5

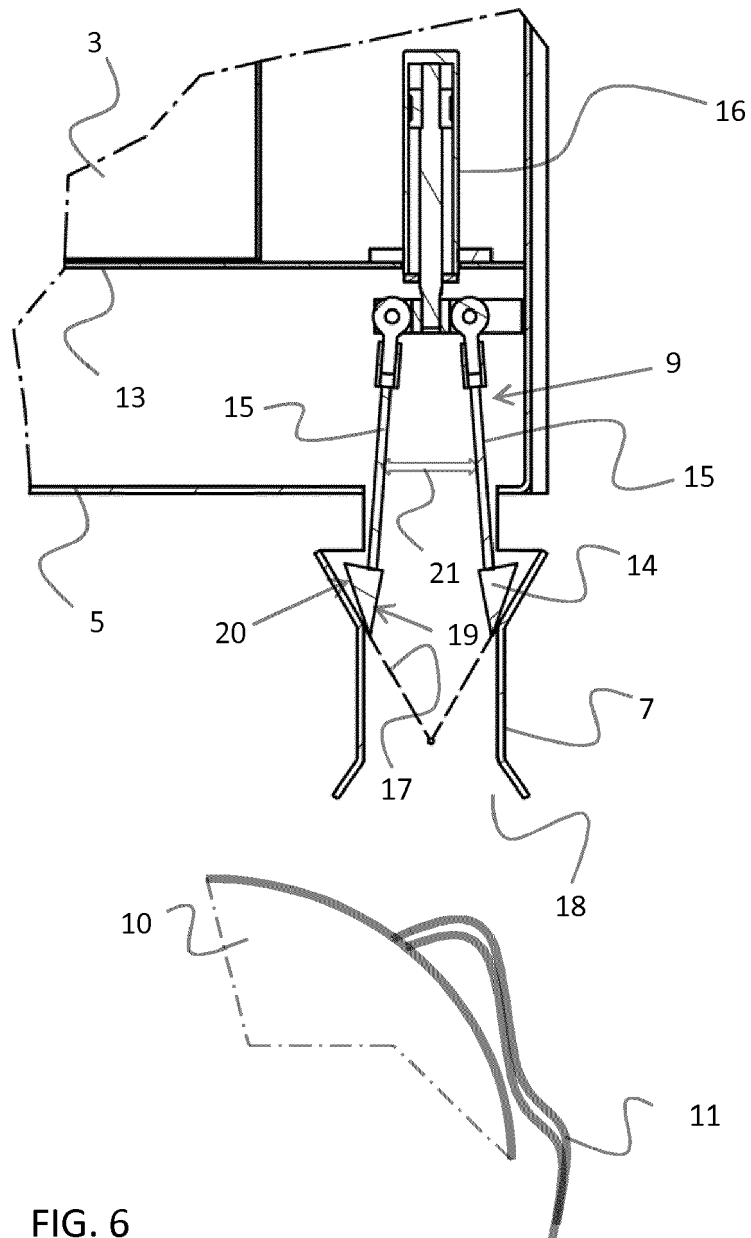


FIG. 6

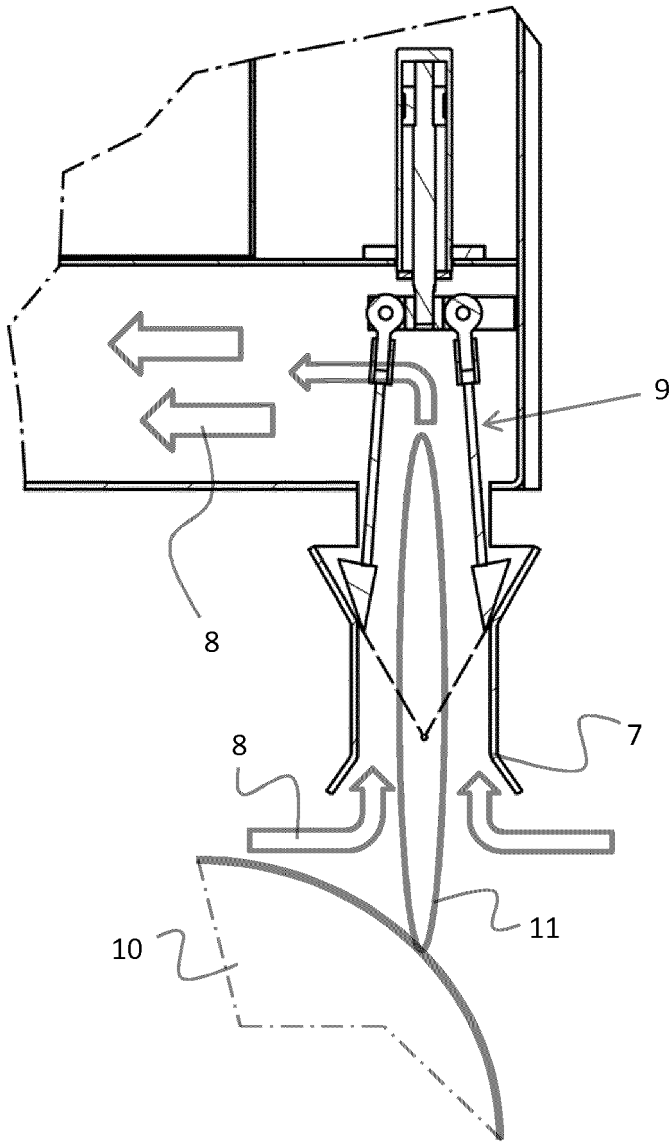


FIG. 7

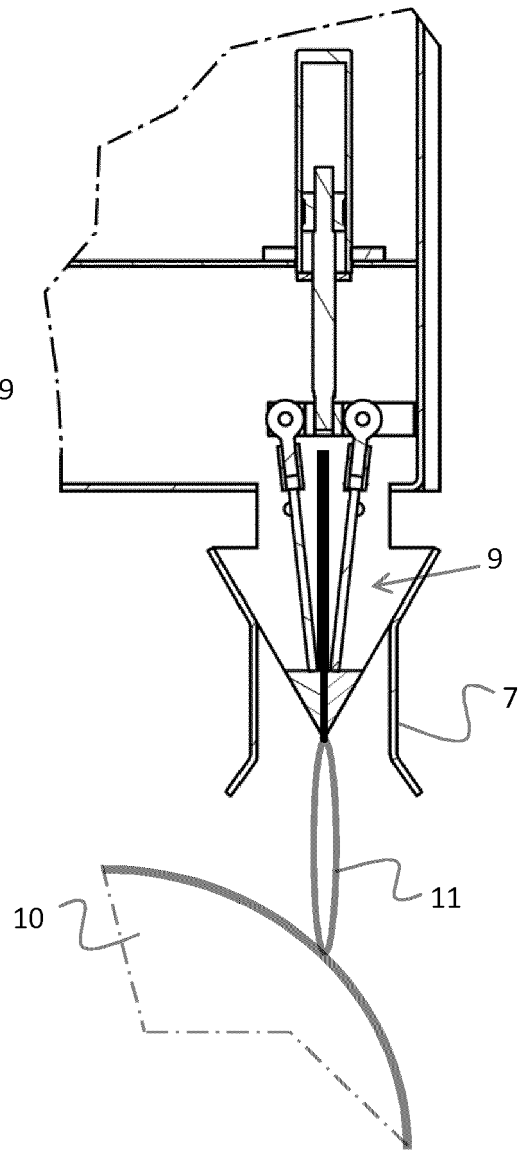


FIG. 8



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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                    |                                                                                                                                                                |                                                                                                                                                                                                                                                                              |                                         |
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**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 16 17 4311

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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