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(54) Apparatus for washing a refuse bin and corresponding method

(57) The invention relates to an apparatus for washing a refuse bin (10, 10'), which includes a wash chamber (12), in which at least one empty refuse bin (10, 10') is arranged to be washed, washing means (19.1 - 19.3) arranged to operate in the wash chamber in order to wash at least one refuse bin at the desired locations (15.1 - 15.7) by means of wash sprays (14.1 - 14.3), which wash means include at least one rotating wash element (25.1) arranged to move in the longitudinal direction of the refuse bin, in which there is a set of wash nozzles (27.1) for creating a wash spray, and a transfer mechanism (18, 20), by means of which the refuse bin is arranged to be moved into the wash chamber into the area of the effect of the wash means and out of the wash chamber. The wash nozzles of the rotating wash element are arranged to rotate relative to the wash element and asymmetrically relative to each other, in order to wash the collar part (15.1), internal walls (15.2), and bottom (15.7) of the refuse bin with a three-dimensional wash spray (14.1).

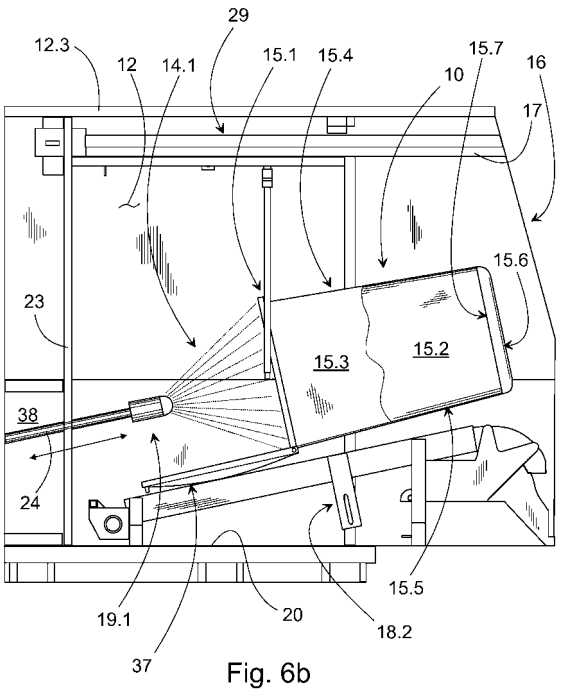

Fig. 6b

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Description

[0001] The present invention relates to an apparatus for washing a refuse bin, which includes

- a wash chamber, in which at least one empty refuse bin arranged to be washed,
- wash means arranged to operate in the wash chamber, in order to wash at least one refuse bin at the desired locations by means of wash sprays, which wash means include at least one rotating wash element, which is arranged to move in the longitudinal direction of the refuse bin, and in which there is a set of wash nozzles for creating a wash spray, and
- a transfer mechanism, by means of which the bin is arranged to be moved into the wash chamber into the area of the effect of the wash sprays and out of the wash chamber.

[0002] In addition, the invention also relates to a corresponding method.

[0003] Various refuse-bin washing apparatuses are known from the prior art, some, for example, arranged in vehicles. Refuse bins of this kind are washed using brushes and sprays. In addition to devices based on brushes, apparatuses based solely on sprays are also known. By means of washing apparatuses, refuse bins can be washed inside and out. Refuse bins for organic waste in particular require washing, as the waste collected in them adheres easily to the bin and their dirtying can create considerable detriments to hygiene and health.

[0004] However, several unsolved problems are associated with the apparatuses according to the prior art. For example, washing organic-waste bins is really challenging if an acceptable wash result is to be achieved. When organic waste is put into a bin, for example, dirt adheres particularly to the collar, mouth, and inside and outside of the bin, which when it dries can cause the collar to stick tightly shut. Known kinds of washing apparatus are able to satisfactorily wash the other parts of a bin, but particularly the wash result for the collar leaves much to be desired.

[0005] Another problem is caused by refuse bins of different sizes and shapes. It should be possible to use the same apparatus to achieve a faultless wash result, irrespective of the size and shape of the bin, because there may be even great variations in the sizes and shapes of bins on the route of a washing truck. It is especially precisely the variation in the shapes of the bins that has made it difficult to wash the collar of the bin, due to which the devices according to the prior art require different mechanisms for bins of different sizes and shapes. In turn, these factors make the device more complex and bring new stages to the washing process. In addition, it is not economically viable to have several wash trucks operating on the same route.

[0006] The cover washing solutions according to the prior art also leave much to be desired in terms of wash result. The cover of a bin dirties almost as much as the collar. The mechanisms for moving the bins have had complex constructions in the devices. Various kinds of hoists, which hang the bin in grabs, for instance, are known. In this case, the bin may act unpredictably during washing.

[0007] WO publication 2006/002475 and US patent application publication 2006/0042660 A1 can be referred to as the state of the art in bin washing. In both, a rotating wash-spray arrangement is used to wash the internal parts of the bin. In the solution according to the WO publication, a rotating wash head is on a telescopic arm, which moves inside the bin in its longitudinal direction and washes the bottom and side walls of the bin. However, the wash head in question is unable to wash the collar part of the bin and the internal surface of the cover, for which there must be dedicated separate nozzles, which are aimed at the washing locations in question. The solution according to the US publication uses a set of nozzles fitted to one arm, which create a tornado effect when they rotate.

[0008] The intention of the present invention is to create an apparatus that is more effective than previously for washing a refuse bin, by means of which the wash result is better when compared to apparatuses according to the prior art, and in which by means of a single rotating wash element several parts of the bin can surprisingly be washed and thus the number of functional wash elements can be minimized. The characteristic features of the apparatus according to the invention are stated in the accompanying Claim 1 and the features of the corresponding method are stated in Claim 12.

[0009] In the invention, the refuse bin is arranged to be washed using at least one rotating wash element, the washing nozzles of which are arranged to rotate relative to the wash element and asymmetrically relative to each other, in order to wash the collar part, internal walls, and bottom of the bin, more generally the inside of the bin, by means of a three-dimensional wash spray. The use of a wash element that rotates in several dimensions surprisingly achieves a powerful and comprehensive washing effect, so that mechanical scrubbing, for example, is not required at all and more washing locations in the bin can be washed using the same single wash element.

[0010] According to one embodiment, the rotating wash element is arranged, in one sub-stage of the wash, to wash the refuse bin from outside its mouth. Thus the rotating wash element washes the collar part and also the cover of the refuse bin particularly effectively. What is surprising and revolutionary in this relative to preconceptions is that the wash spray that rotates in several dimensions need not be inside the bin, or even on the level of its mouth, but that instead a wash spray that acts from outside the bin has in fact the most effective wash effect. A three-dimensional wash spray that beats on the collar area and inner surface of the cover of the bin will wash not only the inner surface of the cover,

but also the entire collar area of the bin, from the inside of the bin to its end inner corners. In addition, the angle of contact between the washing spray formed by the three-dimensionally rotating wash spray and the part of the bin being washed varies during the wash. Thus the wash spray strikes the collar part of the bin at several varying angles from a single position attached with respect of the bin, which for its part increases the effectiveness of the wash effect in detaching dirt.

[0011] In one embodiment, there can be at least two rotating wash sprays next to each other. The distance between the wash sprays can then be, for example, 450 mm - 800 mm, more specifically 550 - 700 mm. By means of such an arrangement, it is surprisingly possible to wash even two refuse bins at a time, mainly entirely, or alternatively one large refuse bin, which both wash nozzles wash. The wash nozzles wash not only the collar part but also the interior of the bin, so that the same rotating wash spray can wash several bin parts. Thus the constructional solutions of the apparatus are made simpler and the number of moving parts requiring maintenance is reduced.

[0012] According to one embodiment, during washing the refuse bin is arranged to be on its side at a slight downward tilt in the direction of the rotating wash elements. The slight downward tilt can be implemented in such a way that the mouth of the bin is at a lower position than the bottom. The refuse bin will then be in an advantageous position in many ways. Now all the washing fluid and dirt will be certain to flow out of the bin. On the other hand, the internal surface of the bin will also be flushed by the washing fluid flowing from the bottom towards the mouth. In addition, the refuse bin can rest on one side entirely on the conveyor device. This can be the side to which the cover of the refuse bin is hinged. The cover of the refuse bin will then be certain to remain open and not to close, for example, during washing.

[0013] Other advantages and additional embodiments of the invention are described hereinafter in connection with examples of applications.

[0014] The invention, which is in no way restricted by the embodiments described in the following, is described in greater detail with reference to the accompanying drawings, in which

Figure 1	shows one embodiment of the apparatus according to the invention, seen from the rear of the truck,
Figure 2	shows the apparatus in connection with the front wall of the wash chamber,
Figure 3	shows the right-hand side of the wash chamber, seen at an angle from the rear of the truck,
Figure 4	shows the left-hand side of the wash chamber, seen at an angle from the rear of the truck,
Figure 5	shows the internal wash nozzles in greater detail,
Figures 6a and 6b	show rough schematic drawings of rear and side views of a bin being washed,
Figures 7a and 7b	show rough schematic drawings of the position of the rotating wash nozzle, relative to the collars of differently sized bins, and
Figures 8a and 8b	show schematic drawings of a three-dimensional wash spray created by rotating wash-spray means, inside differently sized bins.

[0015] Figures 1 - 5 show views from different directions of one embodiment of an apparatus according to the invention for washing refuse bins. Fitted to the apparatus are washing means 19.1 - 19.3, for example nozzles with ancillary means, by means of which wash sprays 14.1 - 14.3 are produced to wash the desired locations 15.1 - 15.7 of at least one refuse bin 10 at a time (Figures 6a and 6b). The washing means 19.1 include at least one rotating wash element 25.1, arranged to move in the longitudinal direction of the refuse bin, in which there is a set of wash nozzles 27.1 for creating a wash spray 14.1. The apparatus is fitted, for example, inside a wash chamber 12 fitted to a truck 11, in which the washing means 19.1 - 19.3 operate during washing.

[0016] According to a first embodiment, the wash chamber 12 with the apparatus can be installed permanently on the chassis of the truck 11. According to a second embodiment, the chamber 12 with the apparatus can also be of a module type. In that case, the wash container can be dropped off from the chassis of the truck 11, so that it can be left in place, where it can act as a permanent wash station. The truck 11 is then released for some other use.

[0017] Figure 1 shows an embodiment of the apparatus according to the invention, seen from the rear of the truck 11. The wash chamber 12 can be a space that is otherwise closed, but to which there is access through an opening 16 in the rear wall 13 of the truck 11, through which a bin 10 can be moved into and out of the wash chamber 12. The opening 16 can be closed by means of a door, a rear rolling shutter 17, which prevents water and hot steam from splashing out of the otherwise closed wash chamber 12. In Figures 1 - 5, the slatted rolling shutter 17 is in the raised position, so that it is inside the wash chamber, against the roof 12.3 of the wash chamber 12. Instead of being slatted, the rear shutter can also be of a fabric, in which case it will be flexible and can be moved in guides at the edges between the arrangement covering the opening 16 in the rear wall 13 and the roof 12.3 of the wash chamber 12. By means of the rear shutter 17, the wash chamber 12 is made sufficiently tight, i.e. hermetic. It allows bins to be washed without worry, for example, in built-up areas at a sufficiently high pressure and using a hot medium, even in the vicinity of people, buildings, and car parking.

[0018] Inside the wash chamber 12 are fitted bin 10 handling means, for example, a conveyor mechanism 18 that acts as moving means, and washing means 19.1 - 19.3 together with their support and moving elements. At least some of the washing means 19.1 - 19.3 can be arranged to move inside the chamber 12. The movement of the means 19.1

- 19.3 can take place relative to the chamber 12 and/or the bin 10. The washing means 19.1 - 19.3 and the bin 10 moving means 18 are arranged in the wash chamber 12 in such a way that an empty bin 10 can be washed from both inside and outside.

[0019] In the case according to the embodiment, the bin 10 is moved using a bin lift 18. On the conveyor 18, the already empty bin 10 is run into the wash chamber 12 into the area of effect of the wash sprays 14.1 - 14.3 for the washing of the bin and also out of it once the washing has ended. The bin lift 18 can be formed of guides 18.1, 18.2 fitted in connection with the floor 20 of the wash chamber 12 and in the vicinity of both side walls 12.1, 12.2 (Figures 2 - 4). A cradle 20, arranged to move in the longitudinal direction of the truck 11 and in this case also to some extent in its vertical direction, is fitted between the guides 18.1, 18.2. In the cradle 20, there are grab means 21 for securing the bin 10 to the cradle 20. The grab means can be formed, for example, of pneumatic suction cups 21. The cradle 20 is shaped to some extent like a gun carriage, so that the bin 10 can rest on one side mainly in its entirety on the cradle 20.

[0020] The wash means are formed of moving sparge pipes 28, to which a set of wash nozzles 17.2, 27.3 are fitted, arranged in connection with both side walls 12.1, 12.2 and the roof 12.3 of the wash chamber. By means of an external-washing gantry 19.2, 19.3, the outside of the refuse bin 10 is washed on at least three sides 15.3, 15.4. The wash nozzles 27.3 in the roof 12.3 are carried by flexible pipes 36 hanging from the pipe 28. An implementation without pipes is also possible, as shown in Figure 6a. The pipes 36 allow the nozzles 27.3 to swing freely when the roof pipe 28 is moved.

[0021] The side nozzles 27.2 are integrated directly into the side pipes 28. The wash nozzles 27.2, 27.3 are at a distance from each other in the vertical pipes 28. According to one embodiment, the distances can be, for example, 150 - 250 mm, more particularly 200 - 220 mm, for example 210 mm. One example of a commercial supplier of the gantry nozzles 27.2, 27.3 is the Spraying Systems Co. The roof and side pipes 28 can form a construction joined together at the ends, in which case they will move in the wash chamber 12 on the same line the whole time. It will then be sufficient for there to be guides 29 fitted close to the walls 12.1, 12.2 at the ceiling 12.3 of the wash chamber 12 for the pipe structure 28. The pipe structure 28 can be chain-driven 22'. This solution is surprisingly simple in construction and functional.

[0022] According to one embodiment, the location of the vertical pipes 28 forming the external-washing gantry can also be altered in the direction of the width of the wash chamber 12. In that case, for example, one of the vertical pipes can be run from a position next to the wall 12.2 of the wash chamber 12 to the vicinity of the side wall of a narrow bin and back again to next to the wall 12.2 of the wash chamber 12.

[0023] There is also a moving and also surprisingly rotating wash-nozzle arrangement 19.1 fitted to the front wall 23 of the wash chamber 12, for washing the bin 10 on the inside 15.2, 15.7 and in connection with its open end 15.1, i.e. its mouth 15.1. The use of a wash-nozzle head 19.1 that rotates in several dimensions for washing both the collar 15.1 and also the internal parts 15.2, 15.7 of the bin 10 is ingenious, because nowadays the size and shape of the bins on the route of a wash truck 11 can vary very greatly. The use of a rotating nozzle head 19.1 simplifies both the washing process and the construction of the device. Now the arrangement 19.1 includes two nozzle heads 25.1, 25.2 at a distance from each other, which can be seen in Figures 2 and 5. The wash-nozzle heads 25.1, 25.2 rotate. The rotating motion can be caused by the pressurized washing fluid discharging from the nozzles. One example of a commercial supplier of such an internal wash nozzle 25.1, 25.2 is Belondi. Reference can be made more generally to a rotating wash-spray arrangement, which is formed of one or more rotating wash-spray heads 25.1, 25.2.

[0024] Figure 5 shows the wash-nozzle head 25.1, 25.2 in greater detail. The wash-nozzle head 25.1, 25.2 can be formed, for example, from four nozzles 27.1, which are of a rounded shape, for example, a spherical nozzle head 25.1, 25.2 on a circular cap 26. The term segment can also be used instead of a cap 26. The circular cap 26 rotates in the wash element 25.1 around its centre point (the arrows from the cap 26). In addition, the actual nozzle head 25.1, 25.2 also rotates around its own axis of rotation (arrows). Thus the wash nozzles 27.1 of the wash element 25.1 rotate relative to the wash element 25.1. In such an arrangement, the rotating wash element 25.1 and the rotating wash nozzles 27.1 fitted to it are arranged on their own rotation axes that differ from each other. Through the arrangement only a few nozzles 27.1 are used to achieve a mainly fully spatial three-dimensional wash spray 14.1, which permits an effective washing effect irrespective of the size of bin, and by means of which several washing locations inside and outside a bin 10, 10' can be washed using the same washing element 19.1. More generally, there can be, for example, from two to four nozzles 27.1 to each wash head 25.1, 25.2.

[0025] The nozzle heads 25.1, 25.2 creating the rotating wash sprays 14.1 can be in telescopic arms 24. The arms 24 can enter the wash chamber 12 through its front wall 23. If the nozzle heads 25.1, 25.2 are in connection with the front wall 23, the arms 24 are arranged to be retractable, i.e. when the wash elements 25.1, 25.2 are outside the bin 10, they are essentially in the front part of the truck 11, in a machinery compartment 38 (Figure 6b) between the cab and the wash chamber 12. The truck 11 then becomes advantageously short, because its effective load space can be exploited very efficiently. In the machinery compartment 38, there are means for pressurizing and heating the washing fluid and for producing power to drive the moving parts of the apparatus. In the apparatus according to the embodiment, there can be, for example, one water pump for washing the bin 10. One example of a supplier of this is Pratissoli. Of course, there can be several water pumps.

[0026] Figure 2 shows somewhat more details of the apparatus according to the invention in connection with the front wall 23 of the truck 11 while Figure 3 shows the apparatus seen from the right-hand side and Figure 4 shows the left-hand side of the apparatus seen at an angle from the rear. As can be seen from the figures, the cradle 20 can be chain-driven, for which purpose the guides 18.1, 18.2 are equipped with sprockets 22.1 - 22.3 to permit the movement of the chain 22. At the end of the wash chamber 12 next to the front wall 23 there can be support 35 for supporting the cover 37 of the bin 10. In addition, in the end there can be stops 30, which prevent the cover 37 from rising during washing, because the outer surface of the cover is washed from beneath.

[0027] The path of the bin 10 in the wash chamber 12 can slope slightly downwards. In the washing position, the bin 10 will then be on its side sloping slightly downwards in the direction of the wash nozzles 14.1, so that its mouth 15.1 is lower than its bottom 15.6. The sloping position is achieved, for example, by means of a difference in height in the guides 18.1, 18.2. The bin 10 will then rest on one side for the whole time on its cradle 20, and will not need to be particularly supported. The side on which the bin 10 rests on the cradle 20, is the side 15.5 of the bin 10 to which the cover 37 is hinged. In this way the cover 37 of the refuse bin 10 will remain open due to its own weight. The forward slop of the bin 10 need not necessarily be especially great, an angle of even 10 - 20 degrees being sufficient.

[0028] In the vicinity of the front wall 23 of the wash chamber 12, there can be positioning means for setting the position of the bin 10 in the wash chamber 12. According to one embodiment, the positioning means can be formed of, for example, at least one inductive sensor 31, which can be used to stop the bin 10 at the right location for washing (Figure 3). Stopping the bin at the right point is important because the same apparatus is used to wash bins of several different sizes and shapes. The inductive sensor 31 can detect, for example, the metal of the bin lift. Using an inductive sensor 31 brings certainty to location detection taking place under difficult conditions, such as those in the dark and wet wash chamber 12 before, during, and after washing. In principle, the positioning means can be formed from means based on other principles, such as a photoelectric cell.

[0029] In Figure 5, the internal wash nozzles 25.1, 25.2 are extended into the wash chamber 12, so that their arms 24 too are visible. The angle of protrusion of the arms 24 relative to the rear wall 23 of the wash chamber 12 can be of the same order of magnitude as the slope of the guides 18.1, 18.2. The arms 24 will then be more or less parallel to the longitudinal direction of the bin 10, i.e. to the line between the mouth 15.1 and the bottom 15.7. In the front wall 23 of the wash chamber 12 there can be a combined panel 33 for the feed-throughs for the nozzle arms 24, in which there can also be disinfectant nozzles 34. The distance between the wash heads 25.1, 25.2 can be, for example, 450 - 800 mm, particularly 550 - 700 mm, for example 650 mm (d4 in Figure 7b).

[0030] The position of the refuse bin 10, 10' and the wash elements 25.1, 25.2 relative to each other can be altered, for example, country- or customer-specifically. This will permit the washing of refuse bins 10, 10' irrespective of the bin size. According to one embodiment, the position of the wash heads 25.1, 25.2 relative to each other and to the wash chamber 12 and to the bins it is wished to wash in it can be adjusted in such a way that the device can be used to wash a desired range of bins, in which there can be bins that differ from each other even greatly in size and shape. For this the angle of the arms 24 in the panel 33 can be altered, as can be protrusion of the wash heads 25.1, 25.2 into the wash chamber 12 and the position relative to the bins being washed can be altered. In fact, the position in the wash chamber 12 of the washing means 19.1, 19.2 equipped with rotating wash heads 25.1, 25.2 can be set quite freely, which allows, for example, the panel 33 to be adapted to each arrangement.

[0031] Another way to adapt the device for different sizes of bins, which can be applied along with or even instead of altering the position of the arms 24, is alterations to the bin lift 18. For example, if a non-standard bin does not fit the attachments of the bin lift 18, the grab spikes 39 (Figures 1 and 3) in the bin lift 18, which position themselves under the collar 15.1 of the bin 10, can be moved laterally, for which purpose there are grooves in the transverse beam of the grab spikes. If the spikes 39 coincide, for example, with a reinforcing rib of the collar 15.1 of the bin 10, then by moving them laterally suitably out of the way, so that the spike 39 will come under the collar 15.1.

[0032] Some other examples of adapting the device to differ bin sizes include the shaping of the grab spikes 39 of the bin lift 18 according to the use (customer-specific grab spikes), or moving the lift's 18 suction cups 21 according to the shape of the bins being washed. The bin lift 18 can also be stopped earlier in the wash chamber 12, i.e. the bin 10 is not taken as deep into the wash chamber 12 as normally. A set of nozzles, which direct the washing sprays to exceptional locations in the bin, can also be added later to the wash chamber 12, which has been made surprisingly unobstructed thanks to the rotating wash sprays 25.1, 25.2.

[0033] Figures 6a and 6b show rear and side views of a rough schematic drawing of a bin 10 being washed in the apparatus. The washing can take place in stages. The consecutive stages can be, for example, the internal and external washing of the bin 10 and the external washing of the cover 37. The stages can also partly overlap, or they can even be performed entirely simultaneously, for example, the internal and external washing. In addition, in the time in between the mesh filter can be washed.

[0034] In connection with the internal washing of the bin 10, the collar part 15.1 of the bin 10 and the internal surface of the cover 37 (pointing upwards in Figure 6b), which have been problematic, can also be washed.

[0035] The following is a description of the different washing programs of the apparatus, of which there are two in this

case. In the method according to the invention, in order to wash a refuse bin 10, the desired location 15.1 - 15.7 of at least one refuse bin 10 are washed by wash sprays 14.1 - 14.3 in the wash chamber 12.

[0036] In connection with each wash, the bin lift 18 is run in the guides 18.1, 18.2 out from the rear opening 16 of the wash chamber 12 (unless it is already there, for example, after the washing of a bin in the same wash point). The cradle 20 then drops quite close to the ground and the bin 10 can be attached to it, without it having to be lifted, for example. The bin 10 is moved against the suction cups 21, which adhere to the side 15.5 of the bin 10 with the cover 37. Using the cradle 20 of the bin lift 18, at least one open and already empty bin 10 is run cover 37 first into the wash chamber 12, into the area of effect of the wash sprays 14.1 - 14.3. In addition, the bin 10 is run in on a slight downward slope. Thus the cover 37 can be washed on both sides and does not cover the outer wall 15.5 of the bin 10.

[0037] The first program to be described is a so-called quick wash. Once the rear shutter 17 has descended, and the bin 10 has been run lying on its side on the cradle 20 to close to the front wall 23 (this is detected by the sensor 31, which is set to detect, for example, the cradle 20 of the bin lift 18), a three-dimensional wash spray 14.1, formed by the wash head 25.1 comes from the front wall 23 of the wash chamber 12, begins to wash the inside 15.2, 15.7 of the bin 10. The nozzle head 25.1 begins to protrude from the minus position outside the bin 10 (direct distance, for example, 300 - 700 mm, more particularly 400 - 600 mm, for example 500 mm from the collar 15.1 of the bin 10) into the bin 10, moved by an operating device, for example, a telescopic hydraulic arm 24. Once it reaches the internal limit, i.e. the nozzle head 25.1 is at a distance from the bottom 15.7 of the bin 10, the internal washing of the bin 10 stops and the external washing starts.

[0038] Thanks to the three-dimensional wash spray 14.1, the nozzle head 25.1 need not necessarily even go to the bottom 15.7 of the bin 10, but instead its extreme position inside the bin 10 can be, for example, 300 - 700 mm, more particularly 400 - 600 mm, from the bottom 15.7 of the bin 10. The wash elements 25.1, 25.2 return outside the mouth 15.1 of the bin 10, without washing being on. The external wash gantry 19.2, 19.3 washes the bin 10 backwards and forwards, for example, moving for about 10 seconds in the guides 29 in the roof 12.3. After that, cover washing starts. Cover washing takes place at the same time as the bin 10 moves towards the rear opening 16 of the wash chamber 12.

[0039] The second program can be a so-called normal wash. Correspondingly to the quick wash, the wash-nozzle head 25.1 forming a three-dimensional wash spray 14.1 begins to wash the interior 15.2 of the bin 10 once the rear shutter 17 has descended. The wash-nozzle head 25.1 starts from the minus position outside the bin 10 and protrudes inside the bin 10, moved by the hydraulic-cylinder arm 24. Once it reaches the internal limit, the wash-nozzle head 25.1 stops in place for about two seconds and washes the bottom 15.7 of the bin 10. After this, the wash-nozzle head 25.1 moves back to the minus position outside the bin 10 and washes the interior of the bin 10 while it is moving.

[0040] While it is outside the bin, at least one three-dimensionally rotating wash-nozzle head 25.1 further washes the collar 15.1 of the bin 10. This situation is shown in Figure 6b. This position can be the extreme position of the wash-nozzle head 25.1, in which case its rod 24 is at least partly retracted inside the machinery compartment 38. One example of the location of the wash-nozzle head 25.1 when washing the collar 15.1, in the longitudinal direction of the truck 11 can be at a distance of about 500 mm, more generally 300 - 900 mm from the collar 15.1 of the bin 10 outside the bin 10. The nozzle head 25.1 need not necessarily be positioned relative to the cross-section of the bin 10 right in the centre of the bin 10. Because the sizes of bin washed using the apparatus vary, the nozzle head 25.1 is surprisingly positioned in such a way that its position suits all bin sizes and the collars of all sizes of bin are made faultlessly clean, irrespective of the size and shape of the bin. Examples of the position of the nozzle head 25.1, 25.2 relative to different bin sizes are described in the following.

[0041] With reference to Figures 7a and 7b, different distance data are given when washing bins of different dimensions. For example, when washing the 120-1 bin according to Figure 7a, the distance d_1 of the nozzle head 25.1 from the front wall 15.4 of the bin is nearly nothing. In that case, the nozzle head 25.1 can be at nearly its farthest distance from the front wall 15.4 of the bin 10. In the horizontal direction (d_2) the nozzle head 25.1 can be more or less on the centre line of the bin. The distance d_3 depends on the manufacturer of the bin.

[0042] In the case of a 240-1 bin, which is a basic bin for organic waste, the nozzle head 25.1 can be more or less at the centre point of the bin.

[0043] Figure 7b shows a 600-1 bin 10', which is the most widely-used 4-wheeled bin. In it the nozzle heads 25.1, 25.2 are in the centre of the bin 10' vertically (d_1). Horizontally, the distance (d_2) of the nozzle heads 25.1, 25.2 from the side wall of the bin 10' can be, for example, about 200 mm. The distance (d_3) of the nozzle heads 25.1, 25.2 from the rear wall 15.5 (i.e. the wall, to which the cover 37 is attached) of the bin 10' can be, for example, about 350 mm.

[0044] After internal washing and collar washing, the internal washing of the bin 10 stops and the external washing starts. The external wash gantry 19.2, 19.3 washes the bin 10 backwards and forwards for about 10 seconds. After the given wash time, the external washing ends and the rear shutter 17 rises, after which the washing of the cover 37 starts. The washing of the inside of the cover 37 takes place at the same time as the bin 10 moves towards the rear wall 13 of the wash chamber 12 and is performed surprisingly using the same wash head 25.1, by means of which the interior of the bin 10 was washed. The washing of the external surface of the cover 37 is performed by a separate wash nozzle gantry, which can be fixed or moving. The external wash gantry for the cover 37 is located in connection with the floor

20 of the wash chamber 12, between the guides 18.1, 18.2 (not shown). Finally, in both washes the bin lift 20 is run automatically out of the wash chamber and the washed bin 10 is detached from the suction cups 21 of the lift 20. By means of the invention, the cover 37 too is made very clean.

[0045] It is also possible to accelerate the wash event in such a way that the internal and external washing of the bin 10 take place simultaneously. The wash programs can be the aforementioned short and normal washes, but the total wash times will be shortened radically, because the external washing and internal washing are activated to operate simultaneously. Thus the apparatus can include two pumps for feeding the washing fluid, one for the internal-washing elements 25.1, 25.2 and the other for the external-washing gantry 19.2, 19.3.

[0046] Next is a description in greater detail of the washing of the internal parts of the bin 10 and particularly of precisely the collar 15.1. In known refuse-bin washing apparatuses there has been no washing that gets the collar 15.1 really clean, nor a functional washing of the internal surface of the cover 37. In the apparatus according to the invention, the washing of the internal surface of the collar and cover 37 is surprisingly performed using the same rotating wash-spray head 25.1, 25.2 as the internal washing of the bin 10. This is possible, because the internal-wash-nozzle head 25.1, 25.2 moves in a rotating manner and washes the bin 10 with pressurized-water sprays 14.1, for example, at 85 bar/150 1/min. More generally, the pressure used can be, for example, 50 - 120 bar, but in the pilot stage studies it was also observed that a pressure of more than 100 bar no longer significantly improves the wash result. Utilizing such high pressures makes it possible for the wash water to circulate and clean sufficiently well.

[0047] The circulation and cleaning apparatus can be, for example, one that is, as such, known. One example of this is coarse filtering that is initially performed using a mesh filter, which is followed by fine filtering, in which several sand filter beds are used. According to one embodiment, in the sand filtering there can be, for example, three quartz-sand layers, in which the crystal sizes are, for example, 3 - 5 mm, 2 - 3 mm, and 1 - 2 mm. Before them, there can be a hydro-anthracite filter layer, in which the crystal size can be, for example 1,4 - 2,5 mm. Using a cleaning system of this kind the wash water is clarified and at the same time microparticles are filtered out of it, so that high-pressure nozzles 27.1 can be used in the rotating wash elements 25.1, 25.2.

[0048] The path of the internal-wash nozzle 25.1, 25.2 in the longitudinal direction of the truck 11 in the case according to the embodiment is, for example, 1000 mm. The nozzle 25.1, 25.2 goes deep inside the bin 10 washing the internal surfaces 15.2 and bottom 15.7 of the bin 10 (for example at 400 - 600 mm from the bottom 15.7 of the bin 10). The collar 15.1 and the internal surface of the cover 37 are cleaned when the pressurized-water sprays 14.1 of the wash elements 25.1, 25.2 spray the collar 15.1 at a suitable alignment. More particularly, the location of the rotating wash nozzle 25.1, 25.2 is then surprisingly outside the bin 10 and its mouth 15.2. In that case, the wash sprays 14.1, or at least most of them will strike the collar 15.1 of the bin 10 at several angles. Because in a single three-dimensionally rotating wash head 25.1, 25.2 there can be, for example, four nozzles 27.1, which are arranged asymmetrically relative to each other, and because the nozzles 27.1 are being moved in two dimensions whereby they have two axes of rotation, the angle of contact of the sprays 14.1 with the collar 15.1 and internal surfaces 15.2, 15.3 of the bin 10 have various angle values, which make the washing effect of the spray 14.1 particularly effective, for example, when compared to a tornado spray known from the prior art. Besides the changing angle of contact, the wash spray 14.1 washing the collar part 15.1, internal walls, and bottom 15.7 of the refuse bin 10, 10' is three dimensional. In addition, such a wide-effect three-dimensional wash spray 14.1 permits the spray 14.1 to form a beam to enter the collars of bins of different sizes, so that the same one spray arrangement can be used to wash bins of several different sizes, without the wash elements 25.1, 25.2 having to be changed in between. When it strikes the collar 15.1 at several angles the power of the pressurized water is especially effective in detaching dirt in the collar 15.1 of the bin 10. The rotating motion of the nozzles 25.1, 25.2 further enhances the efficiency of the wash result.

[0049] The angle of contact α between the wash sprays 14.1 formed by the wash head 25.1, 25.2 with the collar 15.1 can be preferably at a slight slant rather than completely perpendicular. Taking into account the small difference of direction between the spray nozzles 27 and their rotational motion, the angle of contact α can vary even greatly during the wash. The applicant has made an important and even surprising observation, according to which when the sprays 14.1 strike the collar 15.1 of the bin 10 at too low an angle, the collar 15.1 wash result is not satisfactory. On the other hand, it has also been observed that a wash spray that strikes the collar 15.1 at too steep an angle will bounce straight back and will not achieve the desired wash result. A wash spray 14.1 that strikes the collar 15.1 directly at a changing spray angle will ensure the best wash result.

[0050] The apparatus for moving the wash elements 25.1, 25.2 and the water hoses are protected in the pump compartment 38 in the front part of the truck 11. In addition to the wash elements 25.1, 25.2, only the combined moving rod/water pipe 24 of the nozzle head 25.1, 25.2 enter the wash chamber 12. Thus there are no structures in front of the wash sprays 14.1 to hinder the wash, while in addition the construction remains simple.

[0051] In the apparatus according to the embodiment, it is possible to wash at one time, for example one large bin (size 600 - 1100 1) or two smaller bins (size 120 - 330 1). When washing a smaller bin, only one wash-nozzle head 25.1, 25.2 is used while in the case of a larger bin both wash-nozzle heads 25.1, 25.2 are used. By means of one and the same apparatus according to the invention, it is surprisingly possible to wash the collars of bins that differ from each

other even greatly in physical dimensions. The washing of bins differing in size can even be performed consecutively, without the wash elements 25.1, 25.2 having to be changed in between. One and the same apparatus can be used to wash, for example, the bin sizes 120 - 1100 1, the physical dimensions of which bins differ from each other greatly. Besides an organic-waste bin, it is quite as possible to also wash other bins, for example, dry-waste bins and collection bins for recycling material. The bins can be for the collection of household, commercial, or industrial wastes, which the invention in no way restricts.

[0052] Figures 8a and 8b show cross-sections of bins 10, 10' and the wash elements 25.1, 25.2 rotating inside them. The figures illustrate excellently the three-dimensional wash spray 14.1 created by means of the rotating wash elements 25.1, 25.2, which washes the bin 10, 10' in several dimensions. The three-dimensional wash spray 14.1 is formed of a spherical surface, the size of which is greater than a hemisphere, but which can remain conically truncated at the mouth 15.1 of the bin 10, 10', as shown by the figures. As can be seen from the figures, the collar part 15.1 of the bin 10, 10' is washed by the wash spray 14.1 already at the stage when the wash head 25.1, 25.2 moving in the longitudinal direction of the bin 10, 10' is still inside the bin 10, 10'. The fact that this makes the wash more effective by expanding the angle of contact of the wash spray 14.1, also consequently shortens the time required for washing.

[0053] It must be understood that the above description and the related figures are only intended to illustrate the present invention. The invention is thus in no way restricted to only the embodiments disclosed above or stated in the Claims, but many different variations and adaptations of the invention, which are possible within the scope on the inventive idea defined in the accompanying Claims, will be obvious to one versed in the art.

Claims

1. Apparatus for washing a refuse bin (10, 10'), which includes

- a wash chamber (12), in which at least one empty refuse bin (10, 10') arranged to be washed,
- wash-spray means (19.1 - 19.3) arranged to operate in the wash chamber (12), in order to wash at least one refuse bin (10, 10') at the desired locations (15.1 - 15.7) by means of wash sprays (14.1 - 14.3), which wash means (19.1) include at least one rotating wash element (25.1), which is arranged to move in the longitudinal direction of the refuse bin (10, 10'), and in which there is a set of wash nozzles (27.1) for creating a wash spray (14.1), and
- a transfer mechanism (18, 20), by means of which the refuse bin (10, 10') is arranged to be moved into the wash chamber (12) into the area of the effect of the wash means (19.1 - 19.3) and out of the wash chamber (12),

characterized in that the wash nozzles (27.1) of the rotating wash element (25.1) are arranged to be rotatable relative to the wash element (25.1) and asymmetrically relative to each other, in order to wash the collar part (15.1), internal walls (15.2), and bottom (15.7) of the refuse bin (10, 10') with a three-dimensional wash spray (14.1).

2. Apparatus according to Claim 1, **characterized in that** the rotating wash element (25.1) and the rotating wash nozzles (27.1) fitted to it are arranged on axes of rotation differing from each other.

3. Apparatus according to Claim 1 or 2, **characterized in that** the rotating wash element (25.1) is arranged to wash the collar part (15.1) of the refuse bin (10, 10') from outside of the refuse bin (10, 10').

4. Apparatus according to Claims 1 - 3, **characterized in that** the perpendicular distance of the wash element (25.1) to the collar (15.1) of the bin (10, 10') is 300 mm - 700 mm, more particularly 400 mm - 600 mm.

5. Apparatus according to any of Claims 1 - 4, **characterized in that** two rotating wash elements (25.1, 25.2) are fitted to the wash chamber (12) at a distance (d_4) from each other, in order to wash the refuse bin (10, 10') independently of the size of the bin.

6. Apparatus according to Claim 5, **characterized in that** the distance (d_4) between the rotating wash elements (25.1, 25.2) is, for example, 450 mm - 800 mm, in particular 550 mm - 700 mm, and the distance (d_3) from the front wall (15.5) of the refuse bin (10, 10') is, for example, 200 mm - 500 mm, in particular 300 mm - 400 mm.

7. Apparatus according to any of Claims 1 - 6, **characterized in that** the rotating wash elements (25.1, 25.2) are arranged on telescopic arms (24), for which a feed-through (32) is fitted in the front wall (23) of the wash chamber (12), and which arms (24) are arranged, when retracted, to be mainly in the compartment (38) in front of the wash chamber (12).

8. Apparatus according to any of Claims 1 - 7, **characterized in that**, in connection with washing, the refuse bin (10, 10') is arranged to be on its side at a slight forward slope towards the direction of the wash elements (25.1, 25.2), so that the mouth (15.1) of the bin (10, 10') is in a lower position than the bottom (15.6).

9. Apparatus according to any of Claims 1 - 8, **characterized in that**, in the wash chamber (12), the refuse bin (10, 10') is arranged to lie on its side (15.5), to which its cover (37) is hinged, on a transfer mechanism (18, 20), by means of which the cover (37) of the refuse bin (10, 10') is arranged to remain open by its own weight.

10. Apparatus according to any of Claims 1 - 9, **characterized in that** an external-washing gantry (19.2, 19.3) is fitted to the wash chamber (12), in order to wash at least partly the outside of the refuse bin (10, 10').

11. Apparatus according to any of Claims 1 - 10, **characterized in that** the relative positions of the refuse bin (10, 10') and the wash elements (25.1, 25.2) to each other are arranged to be variable, in order to permit refuse bins (10, 10') to be washed irrespective of the size of bin.

12. Method for washing a refuse bin (10, 10'), in which method

- at least one empty refuse bin (10, 10') is moved into a wash chamber (12) and into the area of effect of wash-sprays (14.1 - 14.3),
- in the wash chamber (12) the desired locations (15.1 - 15.7) of at least one refuse bin (10, 10') are washed by at least one rotating wash spray (14.1) that moves in the longitudinal direction of the bin (10, 10'),
- the washed refuse bin (10, 10') is moved out of the wash chamber (12),

characterized in that the collar part (15.1), internal walls (15.2), and bottom (15.7) of the refuse bin (10, 10') are washed by at least one three-dimensional wash spray (14.1).

13. Method according to Claim 12, **characterized in that** the wash spray (14.1) is used to wash the collar part (15.1) of the refuse bin (10, 10') from outside of the refuse bin (10, 10').

14. Method according to Claim 12 or 13, **characterized in that** the collar part (15.1) of the refuse bin (10, 10') is washed by a wash spray (14.1), the angle of contact of which with the collar (15.1) of the bin (10, 10') changes during washing.

15. Method according to any of Claims 12 - 14, **characterized in that** the refuse bin (10, 10') is supported on one of its sides (15.5) against a transfer mechanism (18, 20), which side is the side (15.5) to which the cover (37) is hinged to the refuse bin (10, 10').

16. Method according to any of Claims 12 - 15, **characterized in that** the collar part (15.1) of the refuse bin (10, 10') is washed by two rotating wash sprays (14.1) arranged at a distance (d_4) to each other, in order to wash the collar part (15.1) of the refuse bin (10, 10') independently of the size of the bin.

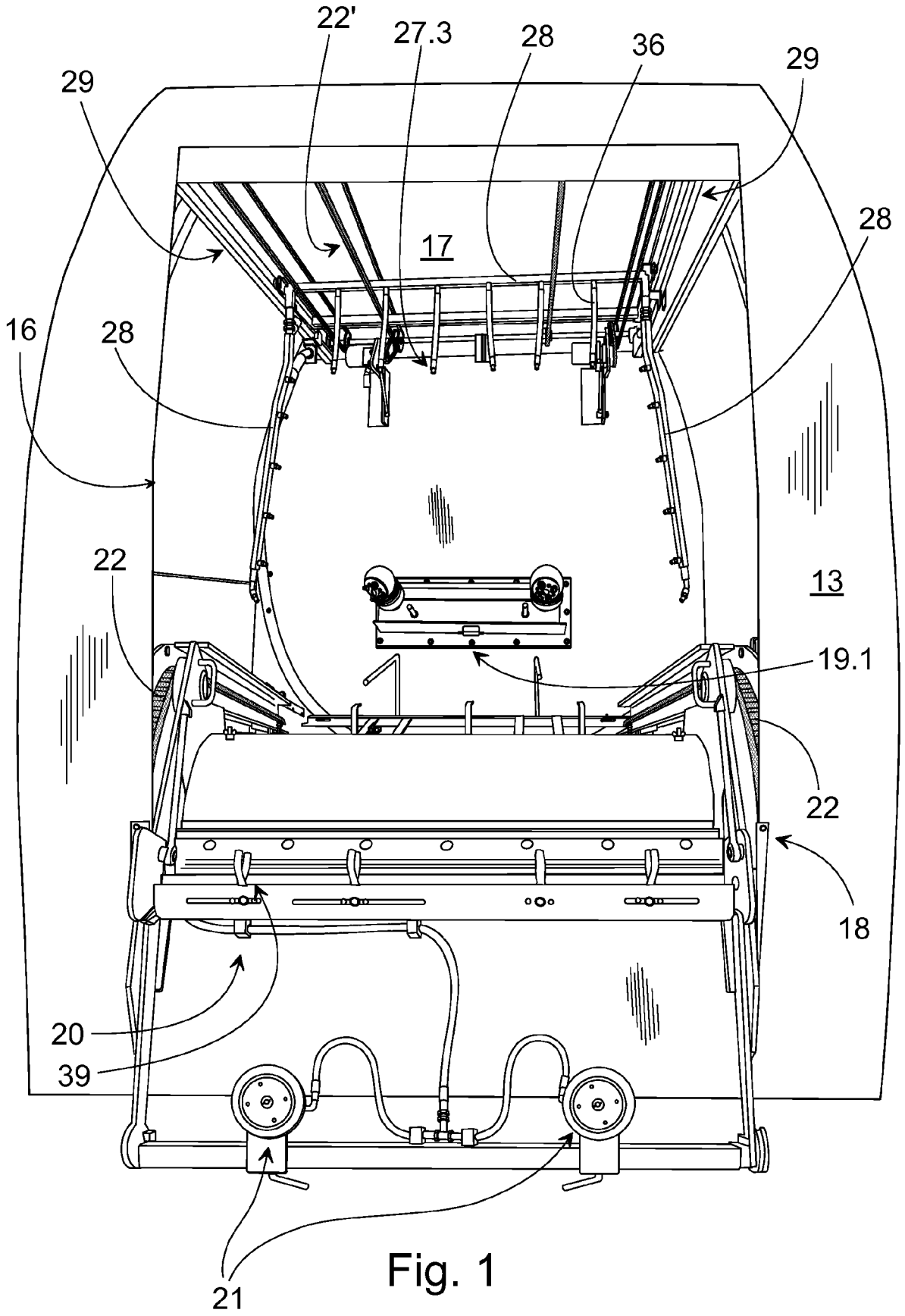
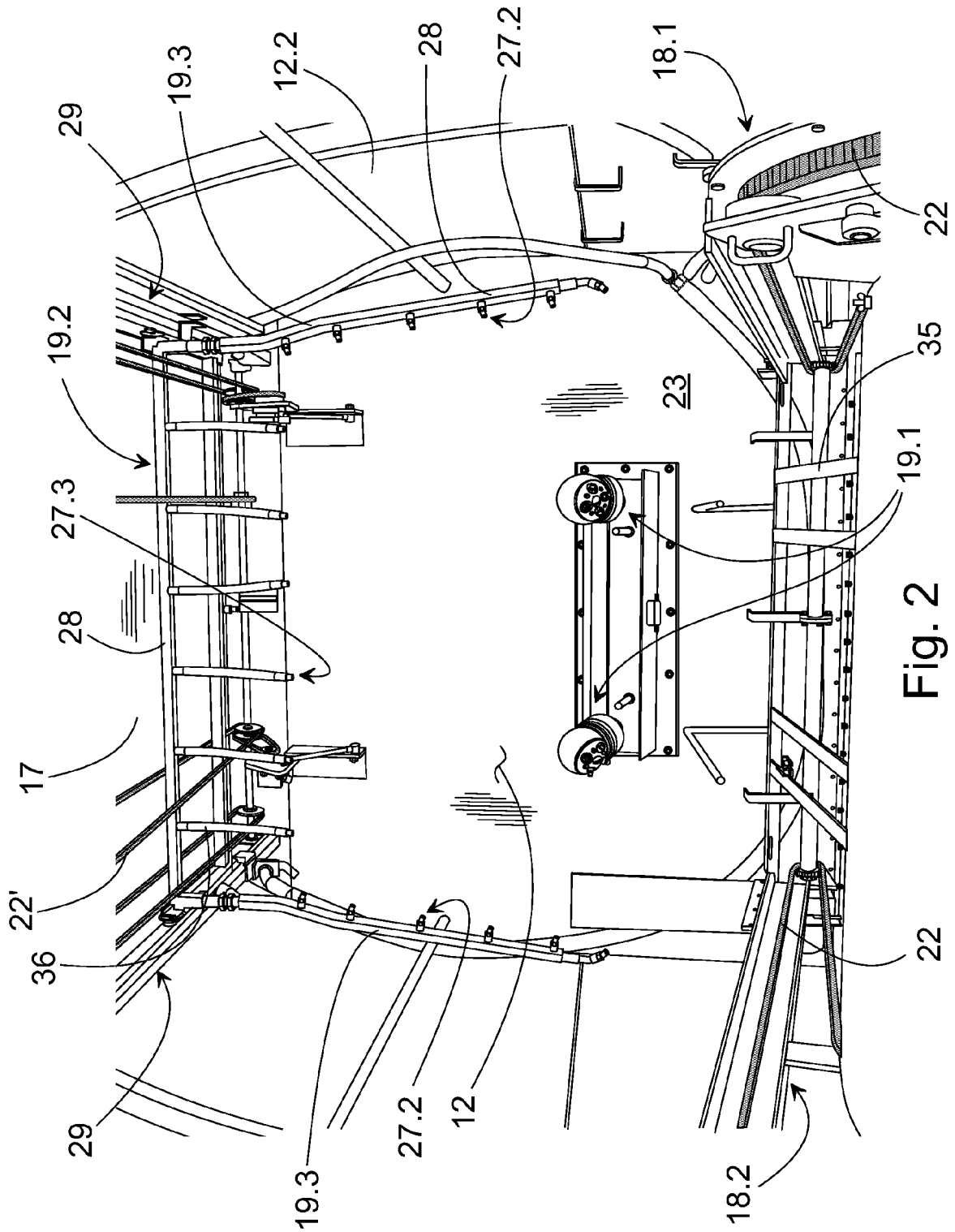


Fig. 1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19.3
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Fig. 2

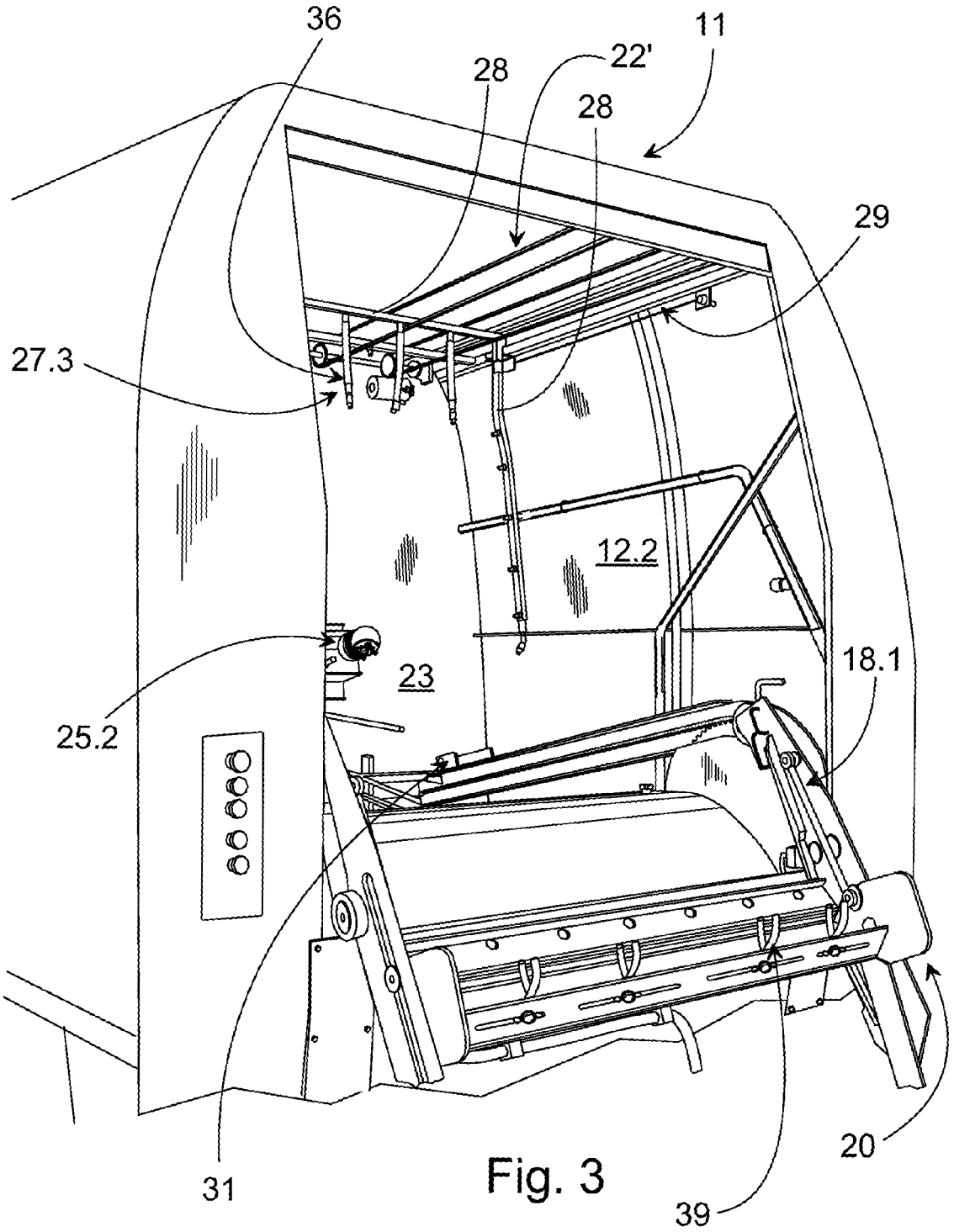


Fig. 3

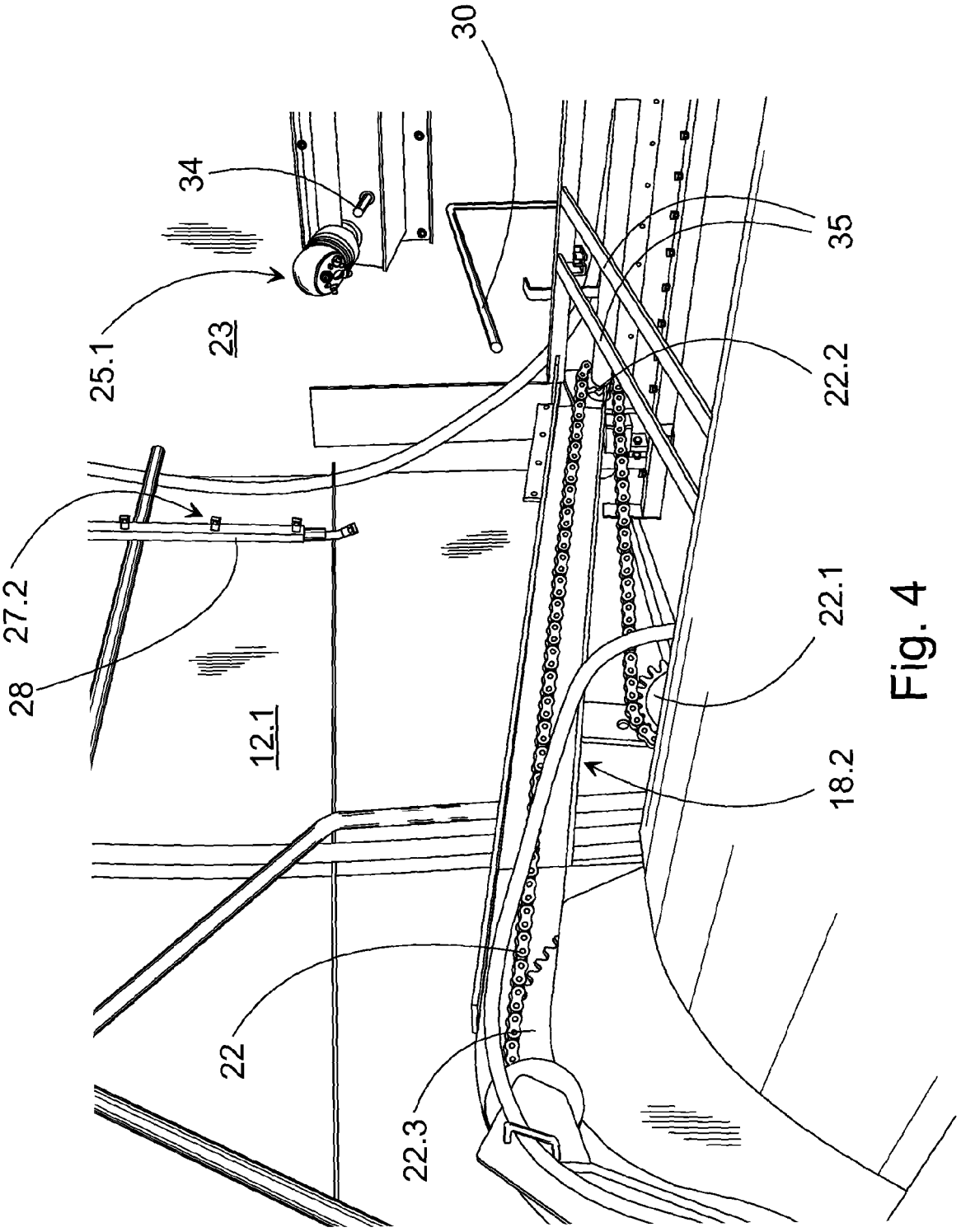


Fig. 4

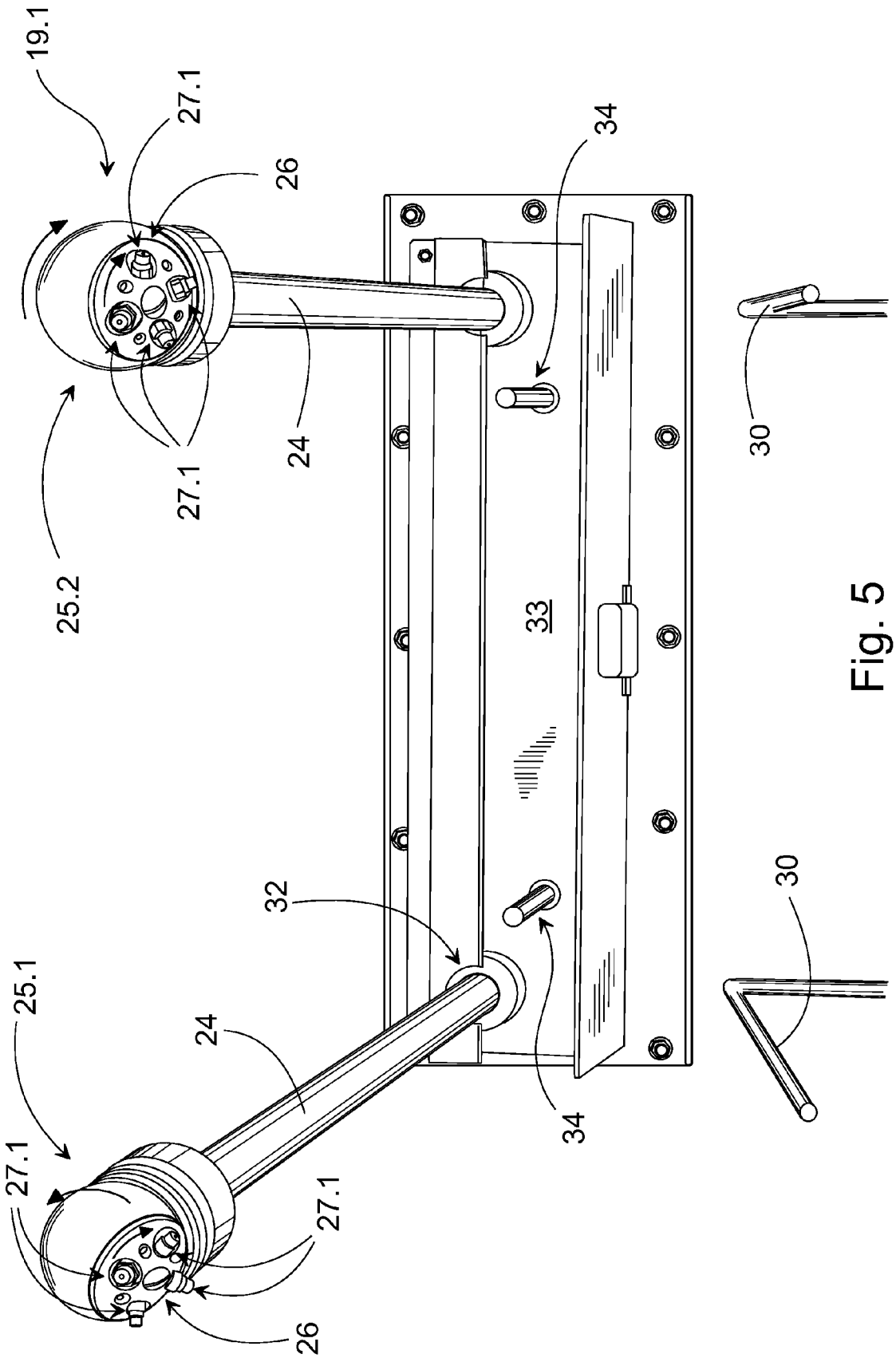
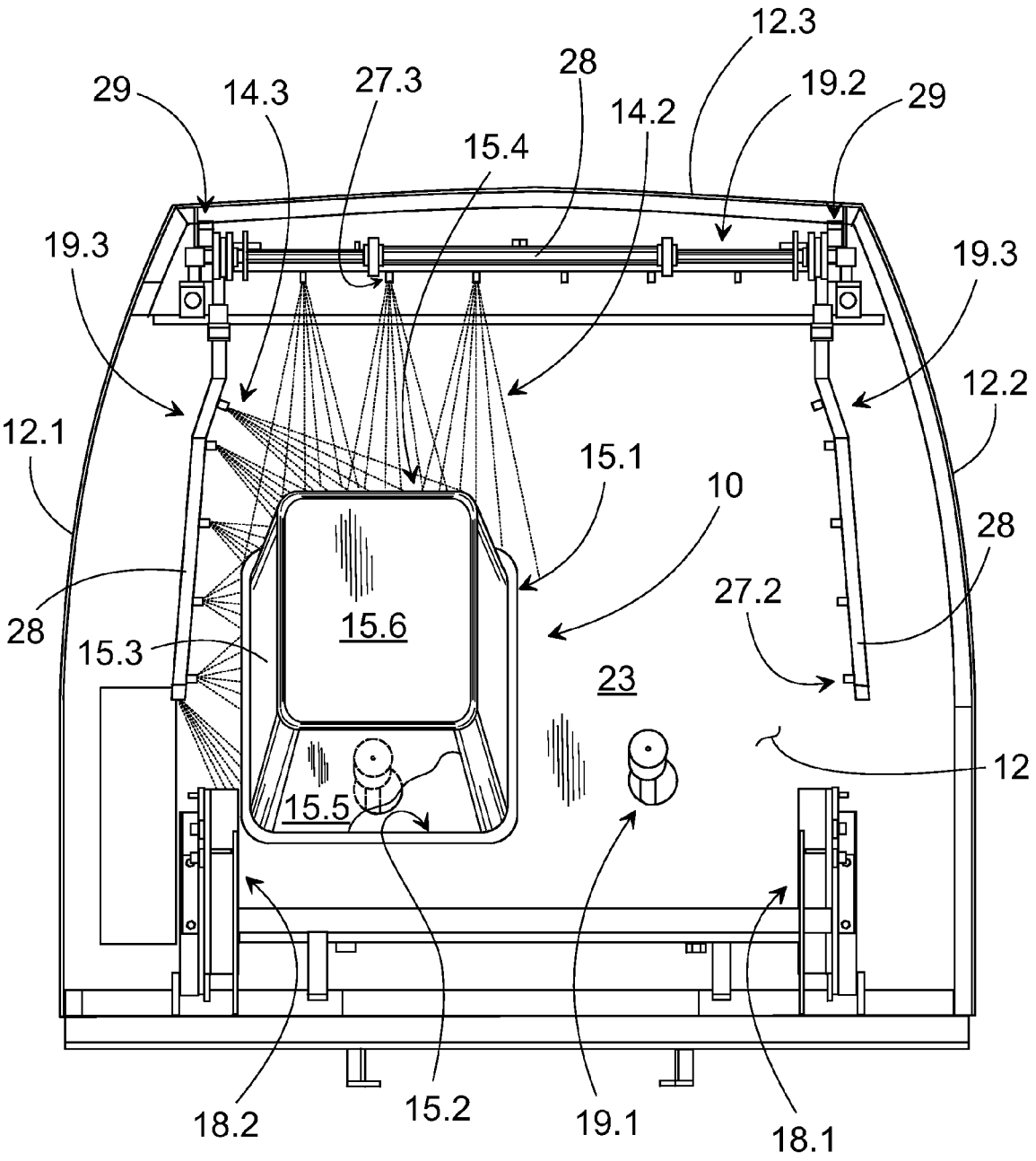


Fig. 5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15.1
10
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15.6
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12
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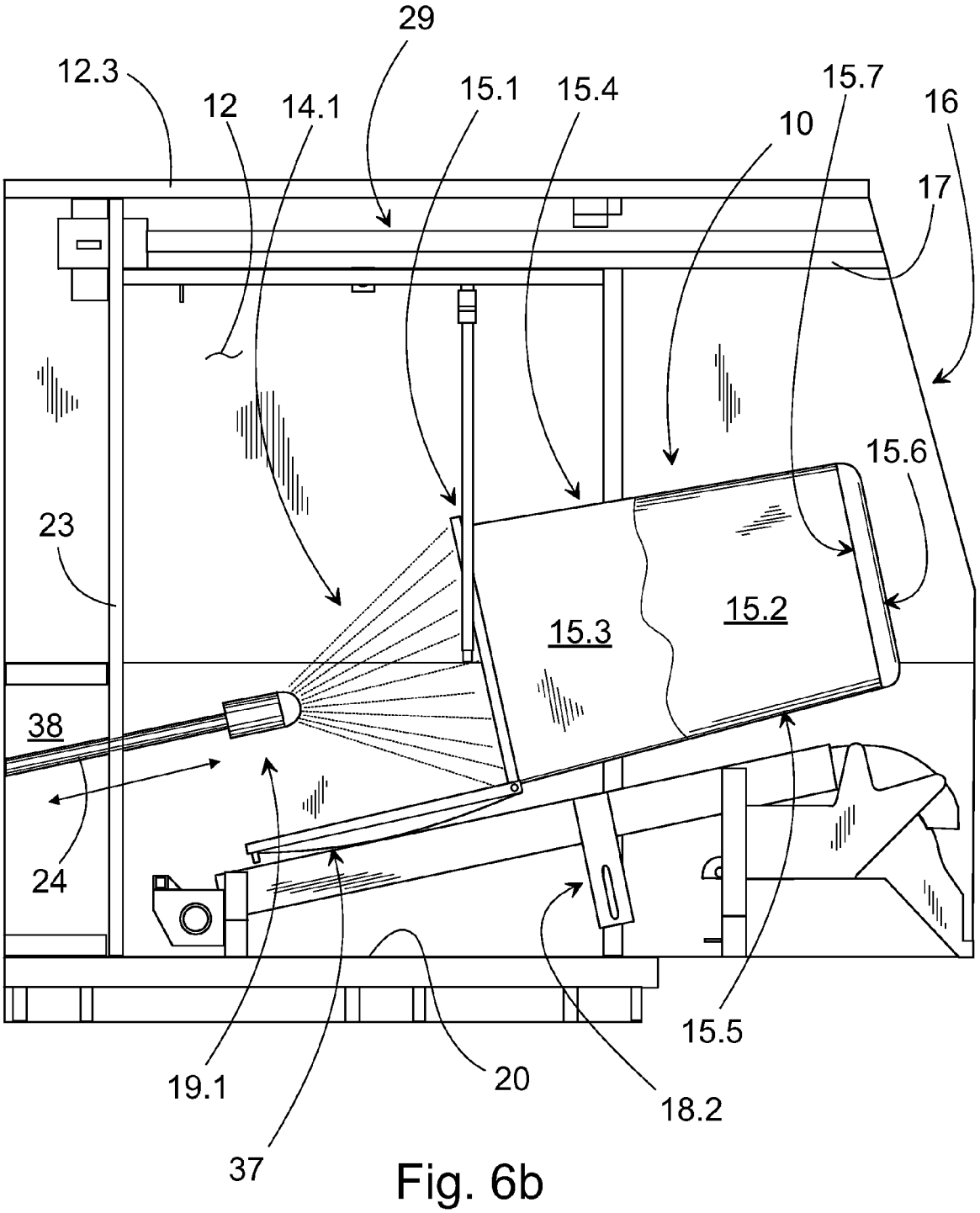
19.1
18.1

Fig. 6a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15.2
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15.5
19.1
20
18.2
37

Fig. 6b

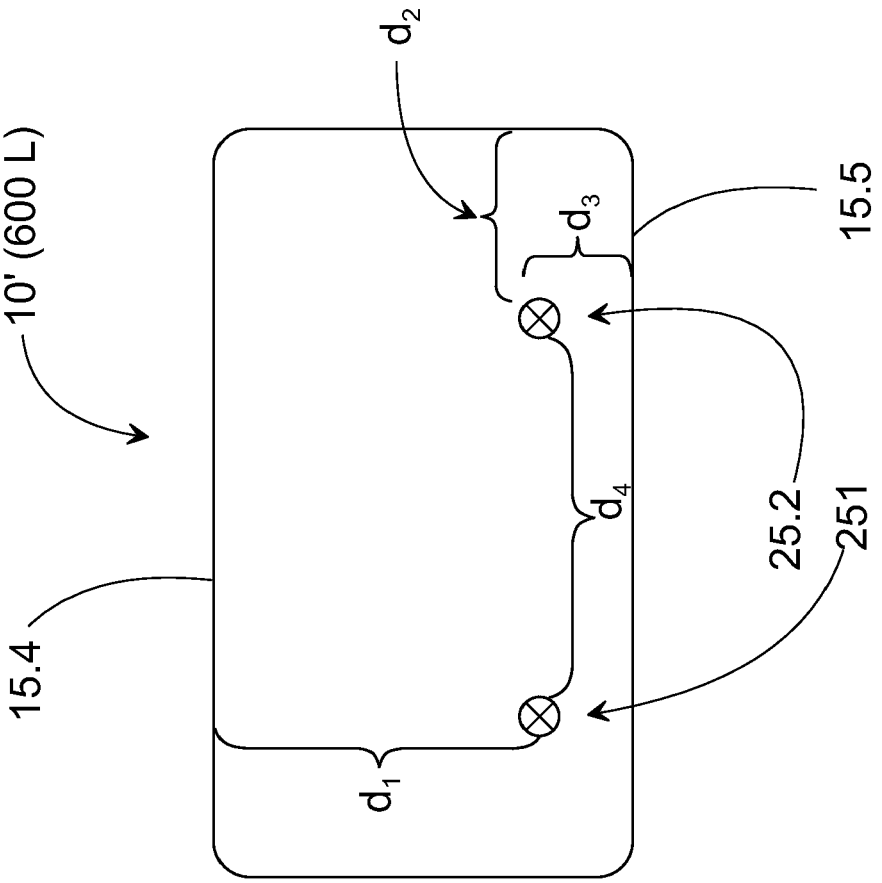

Fig. 7b

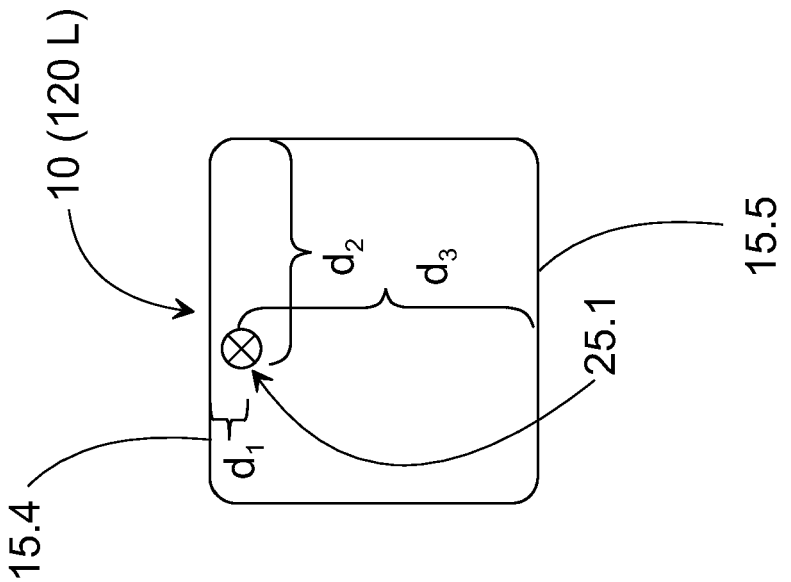

Fig. 7a

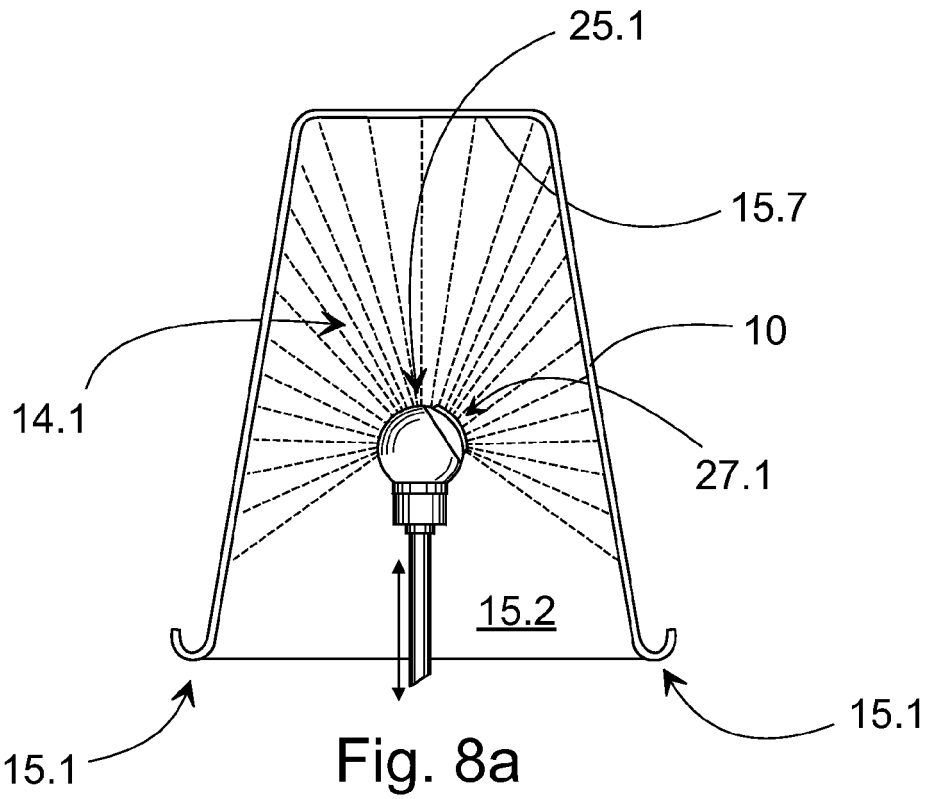

Fig. 8a

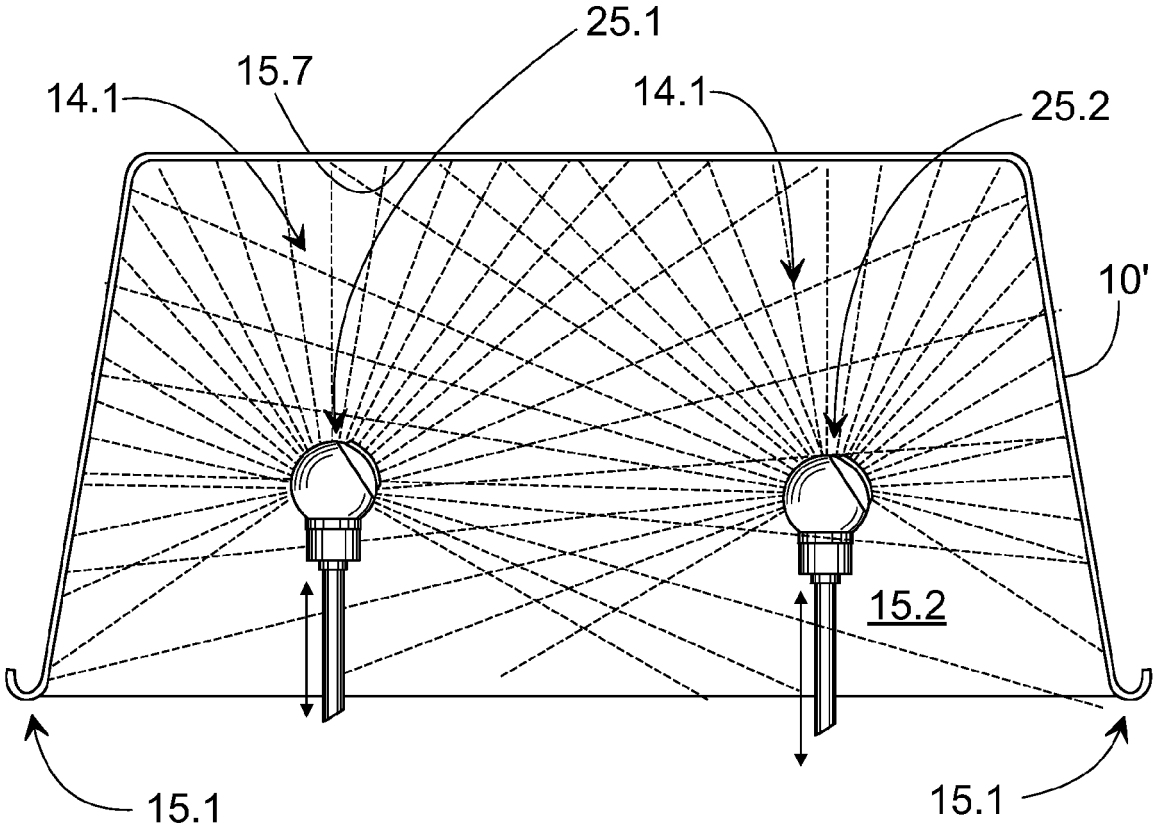

Fig. 8b

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 08 15 2108

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	WO 2006/099680 A (GENETECH PTY LTD) 28 September 2006 (2006-09-28) * page 8, line 18 - page 12, line 19 * * page 13, line 16 - page 14, line 15 * * figures 1-5 *	1-4,8, 10,12-15 5-7,9	INV. B65F7/00
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	27 May 2008	Smolders, Rob

CATEGORY OF CITED DOCUMENTS

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27-05-2008

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