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(72) Inventors:
• **Hartman, Maxim Wilhelmus Josefus**
7323 KT Apeldoorn (NL)
• **Niessen, Deonicius Johannes**
8251 NB Dronten (NL)

(74) Representative: **'t Jong, Bastiaan Jacob**
Inaday Patent B.V.
Hengelsestraat 141
7521 AA Enschede (NL)

(71) Applicant: **Geesink B.V.**
8305 AG Emmeloord (NL)

(54) **DEVICE FOR EMPTYING GARBAGE BINS INTO A COLLECTING CONTAINER OF A GARBAGE TRUCK**

(57) The invention relates to a device for emptying garbage bins into a collecting container of a garbage truck, said device comprising:

- a mounting frame for mounting to the tailgate and collecting container of the garbage truck;
- at least one lifting frame having holding means for holding a garbage bin and sensor means for detecting the presence of a garbage bin within the reach of the holding means, which at least one lifting frame is arranged to the mounting frame and movable parallel to a center plane between a first, bin receiving position and a second, bin emptying position, in which a garbage bin is lifted up and turned over such that the garbage is emptied into the tailgate and collecting container of the garbage truck;
- a controller for reading the sensor means, for actuating the holding means to hold a garbage bin detected by the sensor means and for actuating the at least one lifting frame to move from the first position to the second position and back to the first position; and

- barrier means arranged on both sides of the at least one lifting frame and on opposite sides of the center plane to prevent a person from stepping sideways into a danger zone, which is defined by the envelope of the at least one lifting frame holding a garbage bin being moved between the first position and the second position wherein the barrier means comprise on each side of the center plane a monitoring sensor, which monitoring sensor monitors a corresponding monitoring area extending in at least a monitoring plane, which monitoring area extends outside of the danger zone; and wherein the controller reads both monitoring sensors in order to stop movement, in particular movement towards the first position, of the at least one lifting frame when an object is detected within the monitoring area.

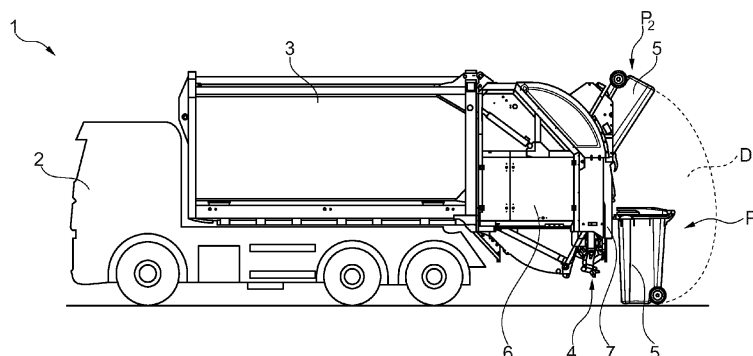


Fig. 1

Description

[0001] The invention relates to a device for emptying garbage bins into a collecting container of a garbage truck, said device comprising:

- a mounting frame for mounting to the collecting container and tailgate of the garbage truck;
- at least one lifting frame having holding means for holding a garbage bin and sensor means for detecting the presence of a garbage bin within the reach of the holding means, which at least one lifting frame is arranged to the tailgate and movable parallel to a center plane between a first, bin receiving position and a second, bin emptying position, in which a garbage bin is lifted up and turned over such that the garbage is emptied into the tailgate of the garbage truck;
- a controller for reading the sensor means, for actuating the holding means to hold a garbage bin detected by the sensor means and for actuating the at least one lifting frame to move from the first position to the second position and back to the first position; and
- barrier means arranged on both sides of the at least one lifting frame and on opposite sides of the center plane to prevent a person from stepping sideways into a danger zone, which is defined by the envelope of the at least one lifting frame holding a garbage bin being moved between the first position and the second position.

[0002] Such a device is known from for example US 5004392, which discloses mechanical barrier means formed as arms, which are pivotably arranged to the mounting frame. A switch detects when the arms are pivoted in a horizontal position such that the arms physically prevent a person from stepping sideways into the danger zone. If the switch is actuated the automatic control of the at least one lifting frame by the controller is allowed.

[0003] A disadvantage of these mechanical barrier means is that also the operator is prevented from stepping sideways into and out of the danger zone even when no danger is present at the specific moment. This occurs for example when the operator brings a garbage bin towards the at least one lifting frame or when the operator takes a garbage bin from the at least one lifting frame.

[0004] The danger is mainly present when the lifting frame has a garbage bin in the second position to empty the bin into the tailgate of the garbage truck, high in the air, and then moves the garbage bin back towards the ground, towards the first position. When someone is walking into the danger zone, said person could get seriously injured.

[0005] Another disadvantage of the mechanical barrier means according to the prior art, is that when the arms are in the horizontal position, the length of the garbage truck is increased. A garbage truck typically has already

a large length behind the rear axles due to the mounted device for emptying garbage bins into a collecting container of a garbage truck. This causes the back of the truck to swing out, when the truck makes a turn. With the mechanical arms in horizontal position even further increasing the length behind the rear axles, the maneuverability of the truck is further decreased.

[0006] It is an object of the invention to reduce or even remove the above-mentioned disadvantages.

[0007] This object is achieved with a device according to the preamble, which device is characterized in that the barrier means comprise on each side of the center plane a monitoring sensor, which monitoring sensor monitors a corresponding monitoring area extending in at least a monitoring plane, which monitoring area extends outside of the danger zone; and

wherein the controller reads both monitoring sensors in order to stop movement, in particular movement towards the first position of the at least one lifting frame when an object is detected within the monitoring area.

[0008] With the device according to the invention, the barrier means are provided by monitoring sensors, which are read by the controller. So, if the controller controls the at least one lifting frame from the second position downwards to the first position and the controller detects with the monitoring sensors that an object passes the monitoring area into the danger zone, the motion of the at least one lifting frame is stopped immediately, such that possible harm to a person or object by a descending lifting frame with garbage bin is prevented.

[0009] By using monitoring sensors there is no mechanical barrier present, such that, depending on the status of the at least one lifting frame, an operator can easily move sideways from and towards the device. So, if the at least one lifting frame is without any garbage bins and waiting in the first position, the operator is allowed to step in sideways into the danger zone with a garbage bin and position the garbage bin in the holding means. When the garbage bin is emptied and the at least one lifting frame returns into the first position, the operator may take the garbage bin and step sideways outside of the danger zone.

[0010] This increases the comfort for the operator as there are no longer mechanical barrier means present which restrict the movements of the operator around the device according to the invention.

[0011] The use of monitoring sensors is also of benefit for the length of the garbage truck. As no physical parts provide any longer the barrier means, the barrier means will no longer have any impact on the length of the garbage truck, which swings out, when the garbage truck makes a turn.

[0012] In an embodiment of the device according to the invention the normal vector of the monitoring plane has a directional component parallel to the normal vector of the center plane.

[0013] Preferably, the normal vector of the monitoring plane is parallel to the normal vector of the center plane.

[0014] When the device is installed on a garbage truck, the center plane will be parallel to the longitudinal plane of the garbage truck. The longitudinal plane is the vertical plane, which divides the truck through the longitudinal axis into the left side and the right side of the truck.

[0015] The monitoring plane will thus in use be parallel to the center plane or at least diverge from the center plane and away from the truck. Preferably, the monitoring plane is in use vertical, but could also be somewhat tilted, but certainly not horizontal.

[0016] In a preferred embodiment of the device according to the invention the monitoring sensor comprises at least two spaced apart proximity sensors, such as an ultrasonic sensor or a laser sensor, each proximity sensor having a detection direction positioned in the monitoring plane and wherein the detection directions of the at least two spaced apart proximity sensors are parallel.

[0017] Using two spaced apart proximity sensors, the outline of a mechanical barrier arm is mimicked. Proximity sensors typically have a limited range in which the sensors can detect the presence of an object. This range could preferably be adjusted to a distance suitable to detect sideways entrance into the danger zone.

[0018] Preferably, the distance between the detection directions of the two most spaced apart proximity sensors of the at least two spaced apart proximity sensors is at least 10 centimeters.

[0019] In yet another preferred embodiment of the device according to the invention the monitoring sensor comprises a radar or lidar device, which monitors any proximity within the monitoring area.

[0020] Radar techniques, which are also used in lidar, have the ability to scan a more or less sector shaped area and detect whether an object is present in said sector shaped area. Radar techniques also allow to measure the distance between the object and the sensor and this allows to set a maximum detection distance, which is of advantage to tune the sensor to the size of the danger zone.

[0021] In a further embodiment of the device according to the invention the monitoring area is a 3D shaped area.

[0022] The 3D shaped area allows for the controller to "see" an object approaching the danger zone. This allows for the controller to take precautionary measures, such as already reducing the speed of the movement of the at least one lifting frame.

[0023] The invention also relates to a combination of a garbage truck having a collecting container and a device according to the invention, wherein the device is mounted with the mounting frame to the tailgate, and wherein the center plane is parallel and preferably coincides with the longitudinal plane of the garbage truck.

[0024] The longitudinal plane of the garbage truck is the vertical plane through the longitudinal axis of the truck, which splits the truck in the left side and the right side.

[0025] A further embodiment of the combination according to the invention, comprises further at least one

garbage bin, which garbage bin is held by the holding means of at least one lifting frame.

[0026] These and other features of the invention will be elucidated in conjunction with the accompanying drawings.

[0027] Figure 1 shows a schematic side view of an embodiment of a combination according to the invention.

[0028] Figure 2 shows a perspective view of an embodiment of the device according to the invention.

[0029] Figures 3A and 3B show a schematic side and top view of the device according to figure 2.

[0030] Figures 4A and 4B show a schematic side and top view of a second embodiment of the device according to the invention.

[0031] Figure 1 shows a schematic side view of an embodiment of a combination 1 according to the invention. The combination 1 has a garbage truck 2 with a collecting container 3 and a device 4 for emptying garbage bins 5 into the tailgate 6 and collecting container 3 of the garbage truck.

[0032] The device 4 has a mounting frame 6 to which two lifting frames 7 with holding means 8 are arranged. The holding means 8 are provided with known clamping means to grab a garbage bin 5 as well as a sensor, such as a switch, to detect whether a garbage bin 5 is positioned within the reach of the respective holding means 8.

[0033] Figure 1 shows one of the lifting frames 7 in the lower, first position P1 and the other lifting frame 7 in the upper, second position P2. The envelope of both lifting frames holding a garbage bin 5 being moved between the first position P1 and the second position P2 form the danger zone D.

[0034] Figure 2 shows that on either side of the lifting frames 7 with holding means 8, a pair of proximity sensors 9, 10 are provided, which each border a monitoring area 11.

[0035] As shown in figures 3A and 3B, the proximity sensors 9, 10 each have a detection direction R, which are in this embodiment spaced apart and parallel to each other, such that a monitoring area 11 is bordered by the two proximity sensors 9, 10 of the pair.

[0036] The monitoring areas 11 extend on either side and outside of the danger zone D, such that when an object or person moves sideways, in the direction S, into the danger zone D, the proximity sensors 9, 10 will detect the person and the controller could act accordingly, more particularly by stopping the movement of the two lifting frames 7.

[0037] The device according to the invention has a controller, which controls all movements of the device according to the invention, such as the holding of a garbage bin 5, the movement of each lifting frame 7 as well as other movements of the device, and the controller monitors different sensors in the device and the status of control buttons on a control panel. Such general control of the device is known from the prior art.

[0038] Figure 3B shows the center plane C to which the two monitoring areas extend parallel.

[0039] Figures 4A and 4B show a second embodiment of a device 20 according to the invention. On either side of the danger zone D, a radar or lidar sensor 21 is provided. The sensor 21 provides a 3D shaped monitoring area 22 with an opening angle α in the vertical plane and an opening angle β in the horizontal plane.

[0040] As shown in top view in figure 4B, one side of the monitoring area 22 is parallel to the danger zone D, while the opposite side diverges from the danger zone D. As a result a cone shaped monitoring area 22 is provided, which allows for early detection if a person moves in the direction S towards the danger zone D. This allows for the controller to anticipate on a possible entry of the danger zone D and for stopping the lifting frames.

Claims

1. A device for emptying garbage bins into a collecting container of a garbage truck, said device comprising:

- a mounting frame for mounting to the collecting container of the garbage truck;
- at least one lifting frame having holding means for holding a garbage bin and sensor means for detecting the presence of a garbage bin within the reach of the holding means, which at least one lifting frame is arranged to the mounting frame and movable parallel to a center plane between a first, bin receiving position and a second, bin emptying position, in which a garbage bin is lifted up and turned over such that the garbage is emptied into the tailgate and collecting container of the garbage truck;
- a controller for reading the sensor means, for actuating the holding means to hold a garbage bin detected by the sensor means and for actuating the at least one lifting frame to move from the first position to the second position and back to the first position; and
- barrier means arranged on both sides of the at least one lifting frame and on opposite sides of the center plane to prevent a person from stepping sideways into a danger zone, which is defined by the envelope of the at least one lifting frame holding a garbage bin being moved between the first position and the second position

characterized in that

the barrier means comprise on each side of the center plane a monitoring sensor, which monitoring sensor monitors a corresponding monitoring area extending in at least a monitoring plane, which monitoring area extends outside of the danger zone; and wherein the controller reads both monitoring sensors in order to stop movement, in particular movement towards the first position

tion of the at least one lifting frame when an object is detected within the monitoring area.

2. Device according to claim 1, wherein the normal vector of the monitoring plane has a directional component parallel to the normal vector of the center plane.
3. Device according to claim 2, wherein the normal vector of the monitoring plane is parallel to the normal vector of the center plane.
4. Device according to any of the preceding claims, wherein the monitoring sensor comprises at least two spaced apart proximity sensors, such as an ultrasonic sensor or a laser sensor, each proximity sensor having a detection direction positioned in the monitoring plane and wherein the detection directions of the at least two spaced apart proximity sensors are parallel.
5. Device according to claim 4, wherein the distance between the detection directions of the two most spaced apart proximity sensors of the at least two spaced apart proximity sensors is at least 10 centimeters.
6. Device according to any of the claims 1 - 3, wherein the monitoring sensor comprises a radar or lidar device, which monitors any proximity within the monitoring area.
7. Device according to claim 6, wherein the monitoring area is a 3D shaped area.
8. Combination of a garbage truck having a collecting container and a device according to any of the preceding claims, wherein the device is mounted with the mounting frame to the collecting container, and wherein the center plane is parallel and preferably coincides with the longitudinal plane of the garbage truck.
9. Combination according to claim 8, further comprising at least one garbage bin, which garbage bin is held by the holding means of at least one lifting frame.

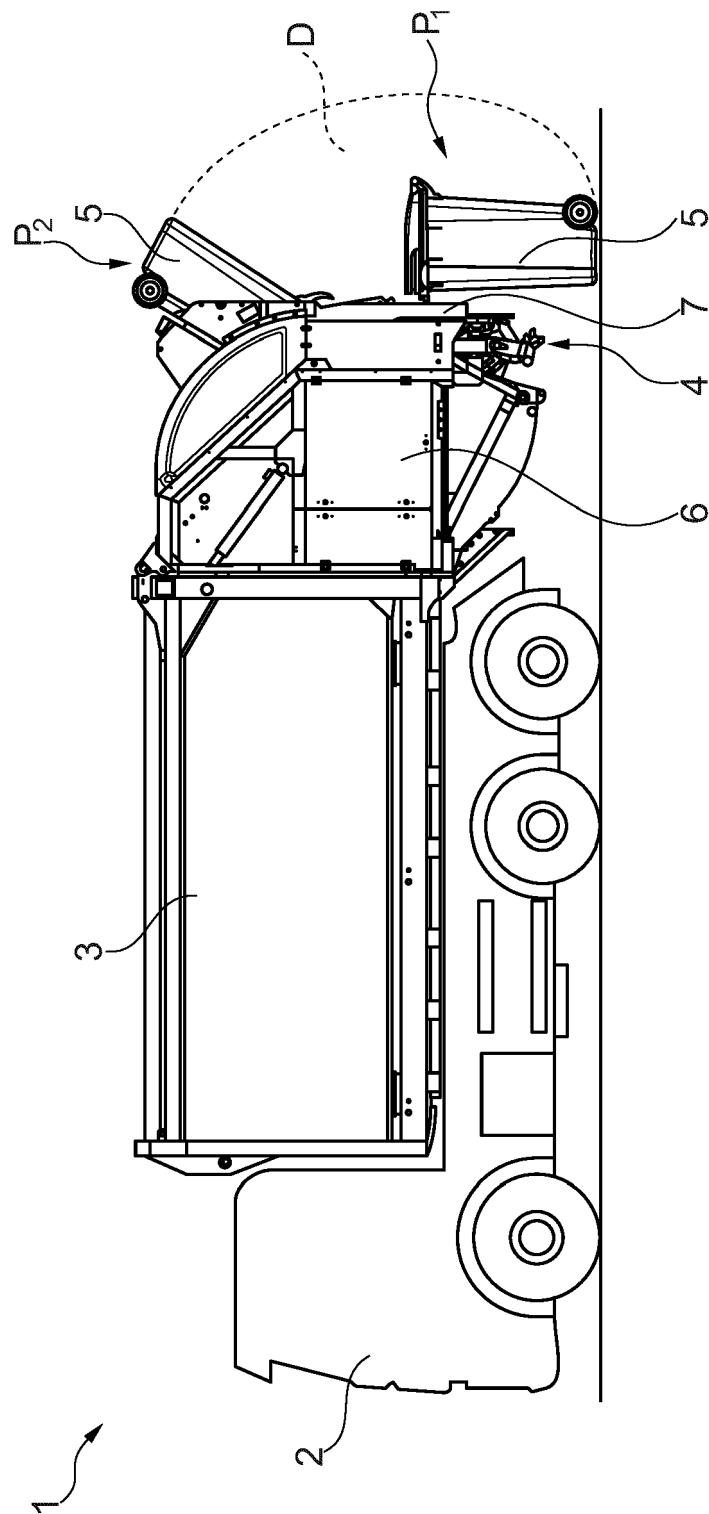


Fig. 1

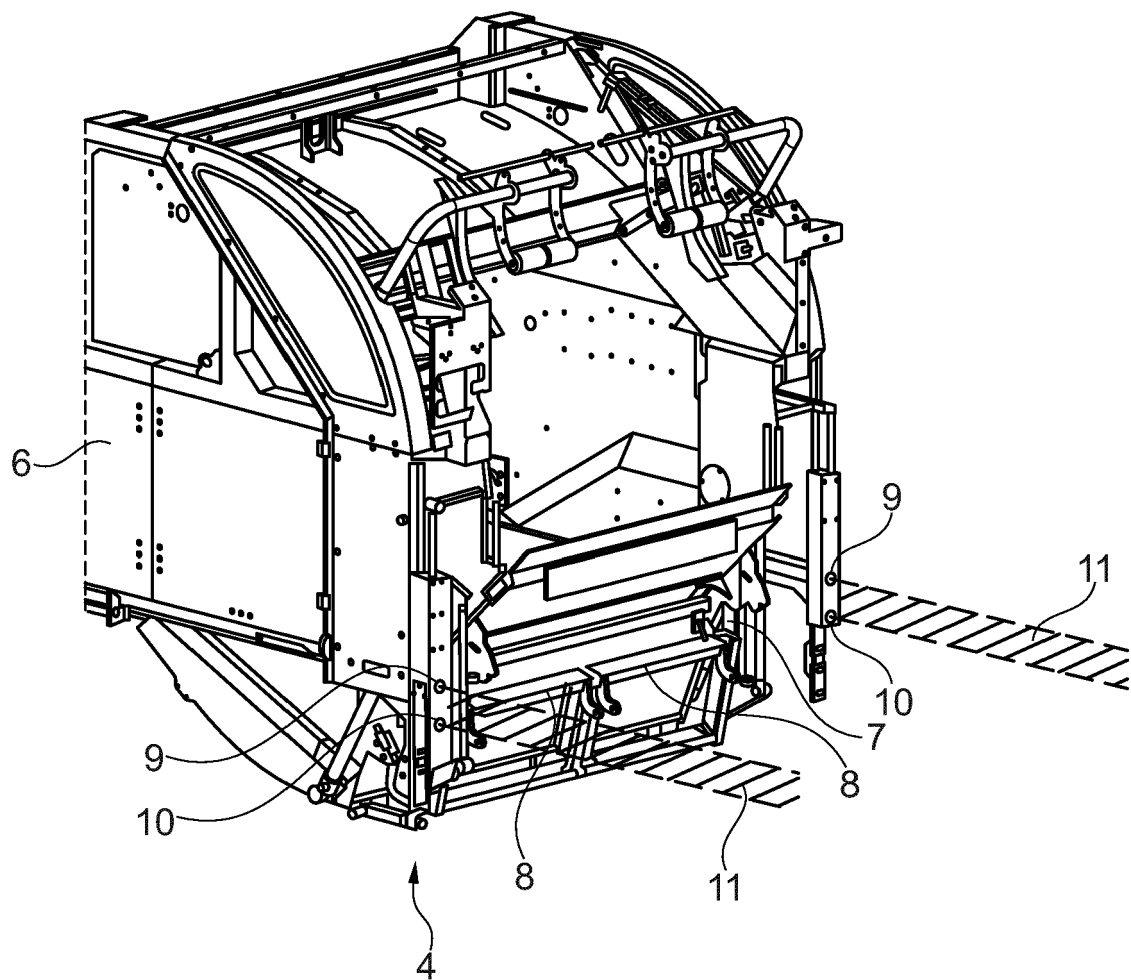


Fig. 2

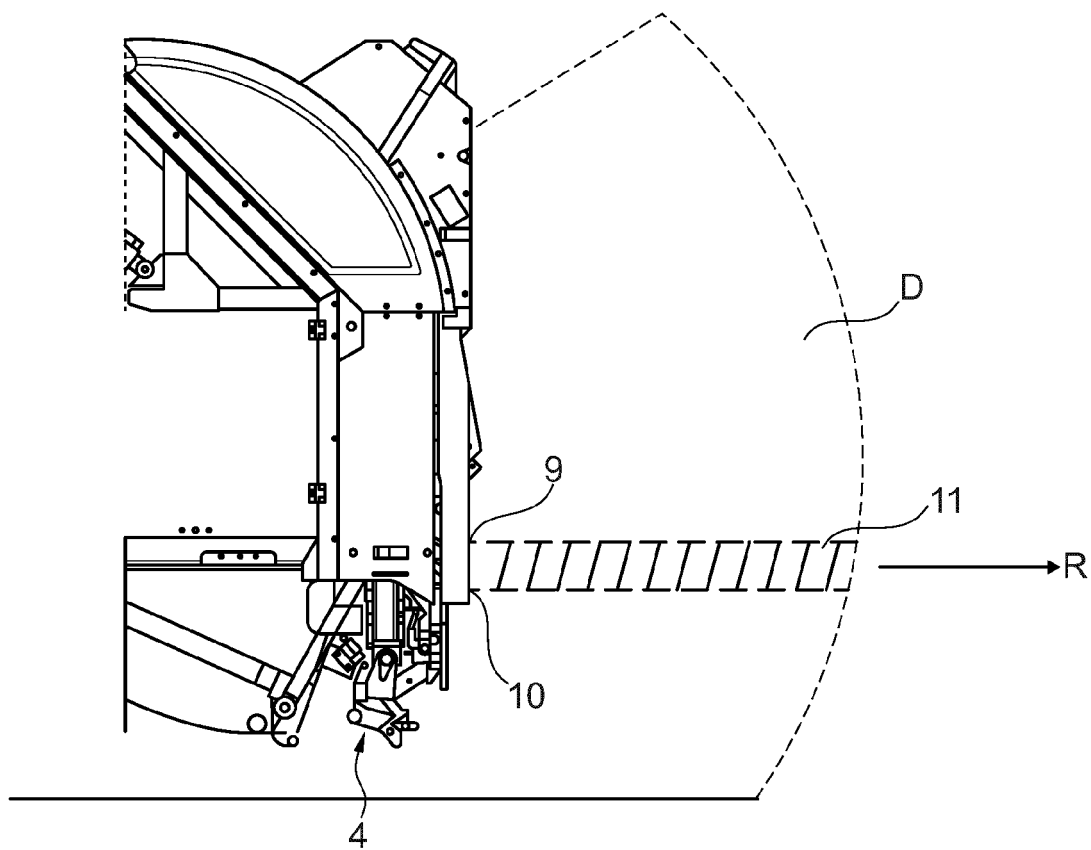


Fig. 3A

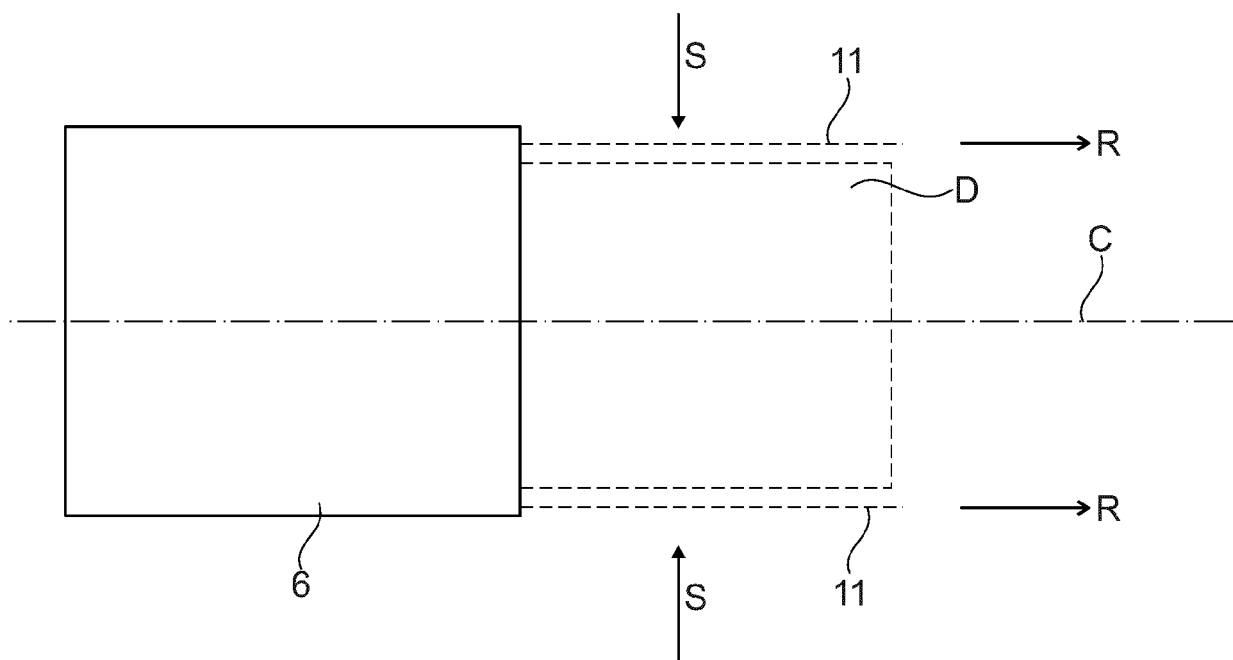


Fig. 3B

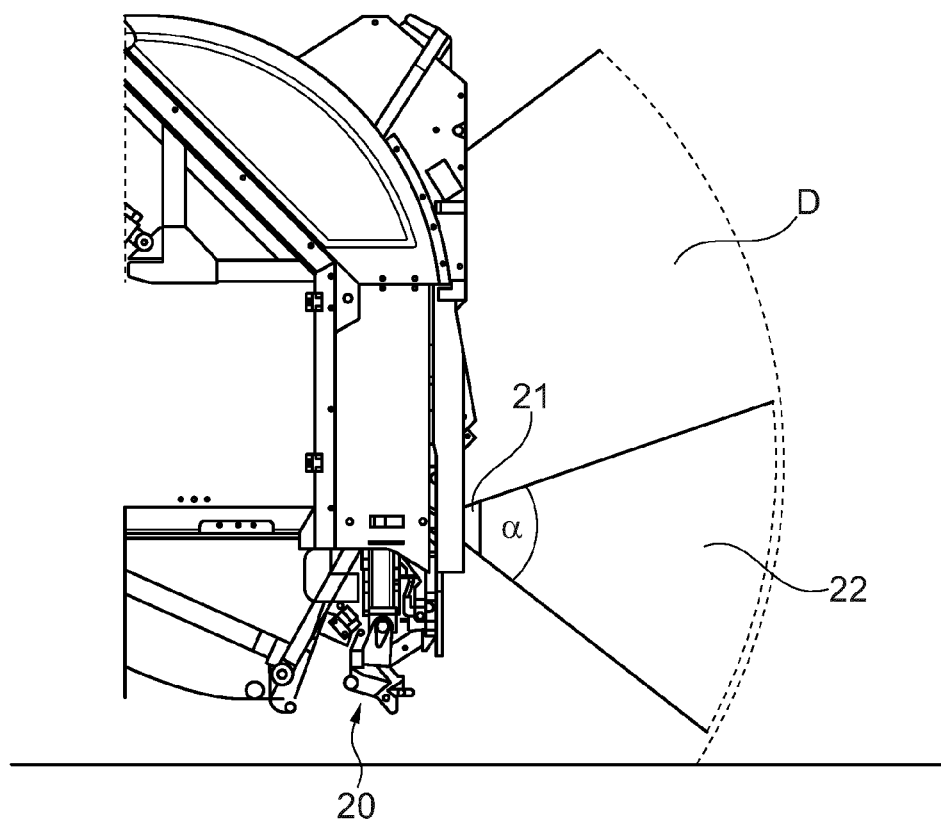


Fig. 4A

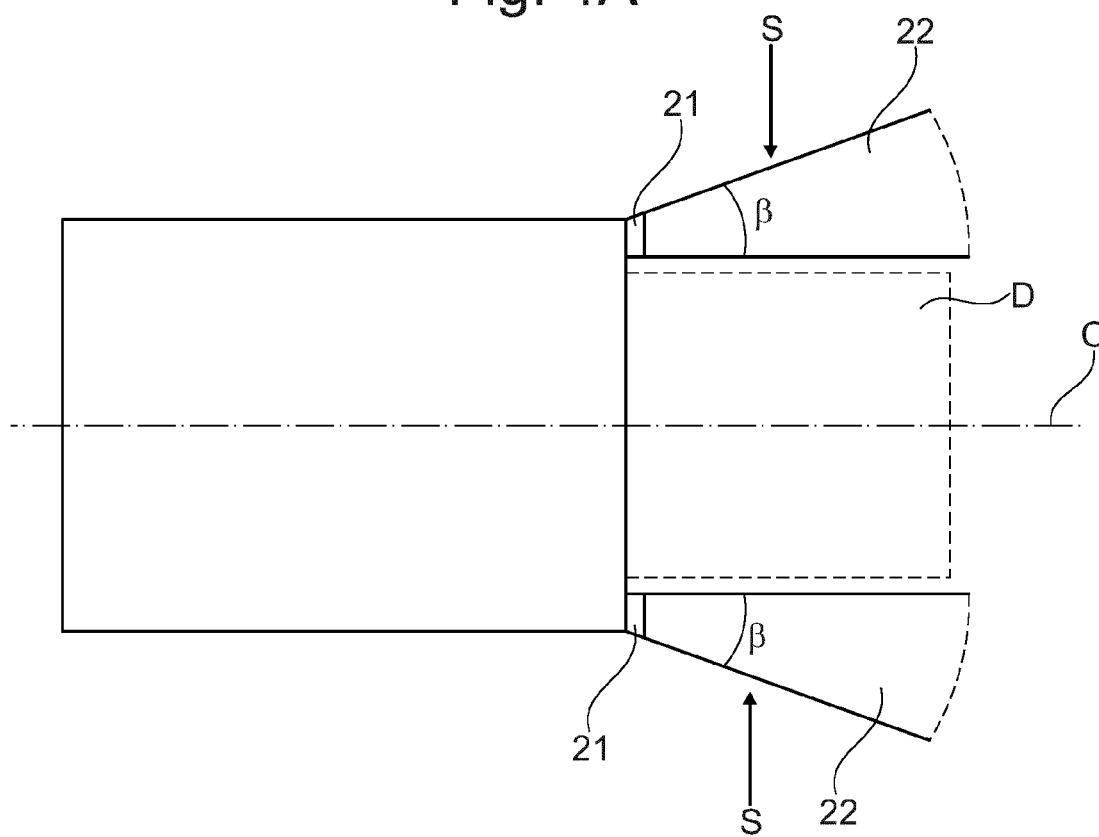


Fig. 4B



EUROPEAN SEARCH REPORT

Application Number

EP 22 17 0598

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X	EP 0 818 402 A1 (GEESINK BV [NL]) 14 January 1998 (1998-01-14)	1-5, 8, 9	INV. B65F3/02
A	* column 4, line 1 - column 5, line 19; figures 1-4 *	6, 7	
X	US 2021/325529 A1 (KOGA JEFFREY [US] ET AL) 21 October 2021 (2021-10-21)	1-7	
A	* paragraphs [0055], [0082]; figure 12b *	8, 9	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65F
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 10 October 2022	Examiner de Miscault, Xavier
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 17 0598

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