(19) Europäisches Patentamt
European Patent Office
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(11) **EP 2 325 045 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.05.2011 Bulletin 2011/21

(51) Int Cl.:
B60P 1/54 *(2006.01)*

(21) Application number: **10173399.6**

(22) Date of filing: **19.08.2010**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
BA ME RS

(30) Priority: **25.08.2009 FI 20095874**

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(54) **Lifting device for a vehicle and a corresponding arrangement in a vehicle**

(57) The invention relates to a lifting device for a vehicle, in which vehicle (30) there is a load space (12), a cab (16) for the driver, as well as the elongated chassis (11) of the vehicle (30) in the centre under the load space (12), and in which the lifting device (14) has an operating position and a transport position. The lifting device (14) includes

- hoist attachments (13) comprising a column structure (23) attached to the chassis (11) of the vehicle, between the cab (16) and the load space (12),
- a hoist base (17) arranged to be attached to the upper end of the hoist attachments (13), located at least partly on top of the cab (16),
- a set of booms (34) supported on the hoist base (17), for lifting a load into the load space (12), and
- a swivel base (17.3) with rotary operating devices, for rotating the set of booms (34).

The said set of booms (34) is arranged to be folded transversely, in order to fit the lifting device (14) into the transport position.

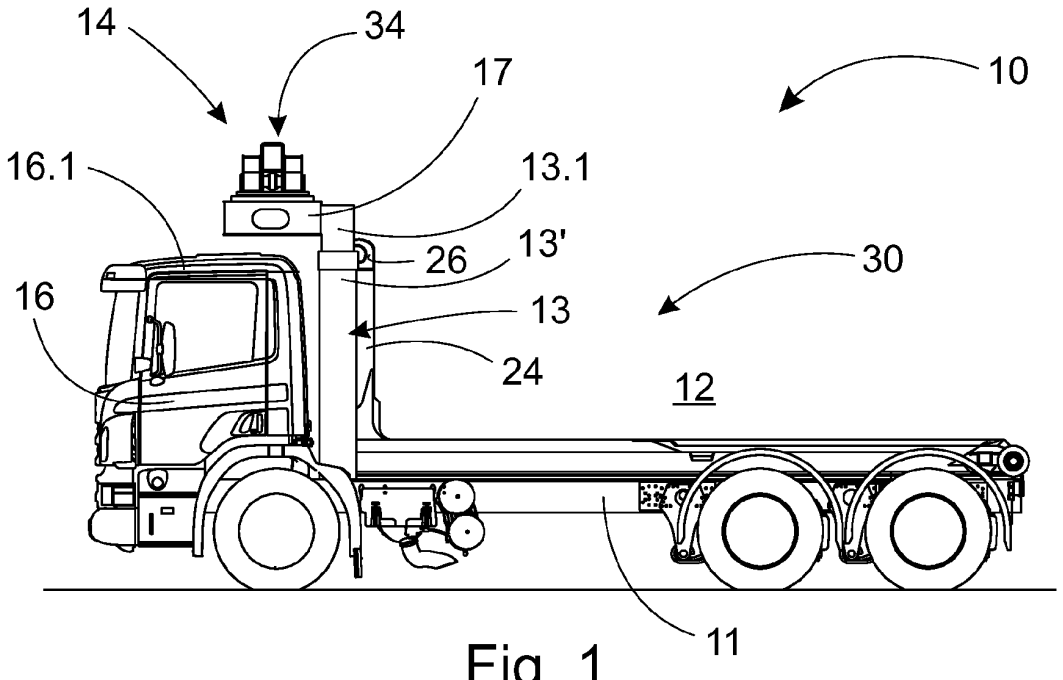

Fig. 1

EP 2 325 045 A1

Description

[0001] The present invention relates to a lifting device for a vehicle, in which the lifting device has an operating position and a transport position, and the lifting device includes hoist attachments secured to the chassis of the vehicle, a hoist base arranged to be secured to the hoist attachments and located at least partly on top of the cab, a set of booms for hoisting a load into the load space, as well as a swivel base, in which the set of booms is arranged to fold. The invention also relates to a corresponding arrangement in a vehicle.

[0002] All lifting devices in vehicles must meet the provisions of road traffic legislation. The most important restrictions are the maximum permitted vehicle width, generally 2550 mm, and the maximum permitted vehicle height, 4200 mm (FI). In addition, limits are set for the length of a vehicle, the rear overhang, and many other dimensions, which also affect the construction of a lifting device. Many of the lifting devices presently in use have a dead area close to the hoist base, which decreases the maximum lifting capacity.

[0003] In known truck lifting devices the lifting device (hoist) is generally installed either in front of or behind the bed. The lifting device requires either a flatbed or a roof that can be opened. The lifting device must be large enough to be able to extend over essentially the entire length of the bed (typically 6 - 10 m). In some cases, the vehicle is equipped with both a tail lift and a separate fork-lift truck, which is able to lift itself onto the vehicle. This arrangement is extremely expensive. In the case of large hoists, the weight of the lifting device is a real problem, because it reduces the effective load-carrying capacity. Normally, a hoist with booms does not wear in use, but is subject to wear from road vibrations and, for instance, the pivot pins must be changed at regular intervals.

[0004] Application publication DE 2165867 discloses a moveable lifting device at the side of a truck or trailer, which is attached to the middle of the vehicle's chassis with the aid of a single slider tube. When the hoist is slid out, it rotates through 90°, so that the column protrusion of the lifting device rotates into a vertical position. Some other hoists are disclosed in publications GB 1,178,365, DE 2208645, and CN 2637291Y. None of these can be fitted to vehicles according to existing standards, at least without losing ground clearance or load height, because the support structures protrude considerably either under the chassis, or else between it and the load space.

[0005] Application publication DE 2205583 discloses a lifting device differing from those above, in which there is a pivot bearing, with a swivel base part in it, on a laterally moveable base. In this solution, the lifting device is at the back of the load space, so that it takes part of the maximum length of the load space.

[0006] Lifting devices that come partly on top of the vehicle are also known from the prior art, but they have the problem that a tilt-cab cannot be used with them in the same vehicle and the lifting devices are of a considerable size and weight. A hoist located between the cab and the load space normally occupies 800 - 1200 mm of length.

[0007] The present invention is intended to create a simple and light-construction lifting device for a vehicle, which has none of the drawbacks of the prior art. The characteristic features of the lifting device according to the invention are stated in the accompanying Claim 1 and the characteristic features of the arrangement in the accompanying Claim 10.

[0008] This intention can be achieved with the aid of a lifting device for a vehicle, in which the lifting device has an operating position and a transport position and the lifting device includes hoist attachments, comprising a column structure attached to the vehicle's chassis between the cab and the load space. In addition, the lifting device includes a hoist base arranged to be attached at the upper end of the hoist attachments, and located at least partly on top of the cab, a set of booms supported on the hoist base for lifting a load into the load space, as well as a swivel base with rotation operating devices for rotating the set of booms. The set of booms is arranged to be retracted and folded transversely, in order to fit the lifting device into the transport position. The vehicle, in which the lifting device is arranged to be installed, includes a load space, a cab for the driver, and the elongated chassis of the vehicle in the middle under the load space.

[0009] According to one embodiment, the column structure of the lifting device includes stanchions at a distance from each other, attachment means at the bottom ends of the column structure for attaching the stanchions to the chassis beams located at a distance from each other in the vehicle's chassis, and a cross beam of the column structure for connecting the stanchions.

[0010] The column structure can include at least one cross beam on the upper part of the stanchions, on which cross beam the hoist base is supported. The stanchions are preferably telescopic. In its simplest form, the hoist base is pivoted to a stanchion, and is preferably elongated and supported over its entire length, i.e. the entire width of the vehicle, on a cross beam between two stanchions, the swivel base being located at one end, i.e. close to one side of the vehicle. The set of booms can then exploit the full maximum width. The stanchions can also be installed at a slant, which is particularly necessary in rear-loader vehicles.

[0011] The swivel base is preferably fitted to the hoist base asymmetrically, relative to the transverse direction of the vehicle, thus allowing the booms to be as long as possible. This achieves a good reach. The set of booms is preferably arranged to retract and fold transversely into the transport position, to become essentially the same length as the width of the vehicle. Generally, the retracted hoist does not increase wind resistance, because the skip and/or load are higher.

[0012] According to one embodiment, the swivel base

can rotate limitlessly. In the swivel base, there can be a multi-channel medium element permitting rotation.

[0013] The set of booms preferably includes at least a vertical boom and a folding boom, as well as operating devices driving them. In the lifting device according to the invention, the folded lifting device does not suffer from vibration while being transported.

[0014] The front wall of the skip can always be unbroken. No transport or loading slot is required for the set of booms. The hoist base supported by the telescopic arms is sufficiently high in operation. According to one embodiment, the hoist attachments include locking devices for locking the lifting device into the operating position.

[0015] The assembly and opening of the set of booms can easily be automated, because the hoist is at a safe height and the driver or bystanders cannot be injured.

[0016] The lifting device can also be permanently fixed in the front part of the skip or load space, for example, in a waste compressor.

[0017] The arrangement according to the invention includes a lifting device like the aforementioned and the cab of the vehicle is arranged to rotate between the service and driving positions, around a transverse axis in front of the cab.

[0018] The vehicle according to the arrangement can include a hook device for handling load spaces. In hook devices, the hoist takes up no longitudinal space at all, or else very little, because the hoist attachments fit at the sides of the engine or other backward-protruding structures. Longitudinal space is often required for the engine and transmission, especially in vehicles equipped with short cabs, in which case the hoist attachments will fit into this length and the hoist will require no additional length at all.

[0019] According to one embodiment, the vehicle's load space can be a flatbed or a box-type load space equipped with an openable roof.

[0020] Other embodiments and advantages of the invention are described hereinafter in connection with examples.

[0021] In the following, the invention is described using examples and with reference to the accompanying figures, which show some lifting devices according to the invention.

Figure 1	shows a side view of a lifting device in a truck, in the transport position, with the lift- ing device lowered,
Figure 2	shows a vehicle equipped with the lifting device of Figure 1, with a load on it,
Figures 3a-3d	show the various stages of getting the lifting device ready for use,
Figure 4	shows a side view of the reach of the lifting device,
Figure 5	shows a side view of the lifting device of Fig- ure 4 in the operating position, with a high load,
Figure 6	shows a top view of the lifting device,
Figure 7	shows a top view of the reach of the lifting device,
Figure 8	shows an embodiment of the lifting device, in which there is a waste compressor at the rear of the load space,
Figure 9	shows an embodiment of the lifting device, in which the vehicle includes a rotating tilt cab,
Figure 10	shows a cross-section of the hoist attachments of the lifting device, seen from the rear of the vehicle,
Figure 11	shows the lifting device, seen from the side of the vehicle, in the transport position,
Figure 12	shows the pivot between the folding boom and vertical booms of the lifting device,
Figure 13	shows an embodiment of the lifting device, seen from the rear of the vehicle,
Figure 14	shows a top view of the hoist base of the lift- ing device, seen without the booms.

[0022] The following reference numbers are used in Figure 1 - 14: truck (generally, vehicle) 30, vehicle's chassis 11, cab 16, its roof 16.1, load space 12, and lifting device 14. In the examples in the figures, in the truck 30 there is a hook device 22, in which the hook 26 is located in front of the load space 12.

[0023] In Figure 1, the hoist attachments 13, i.e. preferably telescopic stanchions 13', in each of which there is a telescopic arm 13.2 according to Figure 10 and an operating device, preferably a hydraulic cylinder, driving it, are attached to the chassis 11 of the vehicle 30. There are preferably two stanchions 13' at a distance D from each other and the stanchions 13' are connected at their upper ends by a cross beam 13.1. The stanchions 13' and the cross beam 13.1 are arranged to form the column structure 23 according to Figure 10, for supporting the set of booms 34 on the chassis beams forming the chassis 11 of the vehicle 30. The dimension D is directly the distance between the chassis beams of the vehicle, which can be 1,0 - 1,8 m. The upper ends of the telescopic stanchions 13' can be secured with the cross beam 13.1 (shown by the broken lines in Figure 7), which is arranged to carry the hoist base 17 of the lifting device 14.

[0024] Figure 2 shows a vehicle 30, equipped with the lifting device 14, in which there is a load space 12 on top of the chassis 11. The set of booms 30 is essentially arranged to be able to be retracted and folded transversely into the transport position and to be raised from the transport position to the operating position. According to the figure, the height H of the lifting device when in the transport position is noticeably low, so that the highest point of the vehicle 30 and the load space 12 is the roof 12.1 of the load space. Thus, when in the transport position, the lifting device 14 always meets the provisions of road traffic legislation. The lifting device's height H is

0,4 - 1,2 m, preferably 0,5 - 0,8 m.

[0025] PCT publication WO 2008/139035A1 discloses a side lifting device, the mechanism of which can, with small alterations, be utilized in a lifting device of an entirely different type, which the present invention represents. The lifting device is preferably of the type disclosed in the PCT publication, in which two vertical booms 36 according to Figures 3c and 3d are pivoted on the swivel base 17.3 of Figure 3 through a pivot 40, and a telescopic folding boom 20 is pivoted to them. The lengths of the booms of the foldable set of booms 34 can now be adapted to the vehicle's 30 maximum width S shown in Figure 6, which gives directly much better reaches than the side lifting device according to the prior art.

[0026] The main components of the lifting device 14 according to Figures 3c - 5 are a hoist base 17, at least one two-part vertical boom 36 and a folding boom 20 with a telescopic arm 38. The hoist base 17 carries the swivel base and its rotating device. By means of special solutions, these have been made low and able to be fitted inside the hoist base. In addition, the lifting device 14 includes operating devices 19 driving the vertical booms 36 and an operating device 15 driving the folding boom. The operating devices can be, for example, hydraulic cylinders, or corresponding operating devices. For example, the lifting device 14 can be operated with the aid of the vehicle's hydraulics. The lifting device can include pressure accumulators, which preserve the pressure energy of the movements of the lifting device, for later use.

[0027] The hook device 24 and its hook 26, seen in Figures 1, 3a, and 3b, fit between the hoist attachments 13. The overall length of the vehicle does not increase at all, or the effect of the lifting device on the length is very small. The lifting device is designed to exploit the unused space inside the external dimensions of the vehicle, so that it does not alter the overall dimensions of the vehicle. Thus, it does not take space away from other important parts, such as the load space.

[0028] The support legs (not shown) can be placed in many ways, either as separate components at the side of the chassis, or underneath it. Another possibility is to place a support leg, which operates telescopically, at the side of a stanchion, pivoted to its upper end, so that it is folded out at an angle and onto the ground by a telescopic arm. Trapezoidal arms can be used to easily achieve the desired path of motion laterally.

[0029] The lifting device 14 according to Figures 3a - 3d is typically used in the following stages. In the initial stage, the lifting device 14 is in the transport position according to Figure 3a, in which the stanchion 13' is short and the lifting device's 14 set of booms 34 is folded. The lifting device 14 is raised with the aid of the telescopic stanchions 13', according to Figure 3b.

[0030] In Figure 3c, the set of booms 34 is rotated with the aid of the swivel base 17.3 of the hoist base 17, so that the folded set of booms 34 can open. The swivel base 17.3 can be multi-channel and rotating. When the set of booms 34 opens, the vertical booms 36 are raised from on top of the hoist base 17 by using an operating device 19. At the same time, the folding boom 20 is rotated by the operating device 15 around a pivot 66, when the folded boom 20 rotates in relation to the vertical booms 36 out from between the vertical booms 36. A telescopic extension 38, at the end of which a suitable work device, for example, a lifting hook, can be situated, then extends from the folded boom 20. In Figure 3d, the set of booms 34 is fully extended. The vertical booms 36 can be used within wide limits, without striking the load space 12.

[0031] According to Figure 4, in connection with a flatbed, or without a load, the lifting device 14 can be used when the telescopic stanchion 13' is lowered. When using a load space 12 with a high front wall, the lifting device 14 must be raised, according to Figure 5.

[0032] According to Figure 6, the lifting device 14 exploits the full width S of the vehicle 30, so that even a long load space can be easily covered. In other words, in the transport position, the lifting device 14 is essentially fitted to the width S of the vehicle. Here, the word essentially means that, in the transport position, the length of the lifting device is at most the width S of the vehicle. Thus, the length of the lifting device in the transport position is at most 2550 mm, but at least 1,5 m, in order to achieve the required reach. The lifting device can move into the transport position, for example, by using its own hydraulic cylinders. Figures 10 and 13 show rear views of the lifting device in the transport position.

[0033] In the lifting device, one or more telescopic extensions 38 can be used in the folding boom 20. In Figure 7, the folding boom 20 includes two telescopic extensions 38. With the aid of the telescopic extensions, a good reach, but nevertheless also a compact size and light weight, can be obtained for the lifting device. According to Figure 7, the lifting device 14 reaches anywhere within the broken-line circles 42 drawn by the point of the set of booms 34 around its pivot point 40 on the swivel base 17.3. The lifting device 14 can be used to lift goods to be loaded from any direction whatever around the vehicle 30.

[0034] A particularly advantage of the invention is precisely the excellent reach of the lifting device, i.e. the lifting device has no dead areas close to the hoist base. Thus, the lifting device can lift a heavy load right at the bottom of the hoist base. The set of booms need be opened only slightly from the transport position for it to have lifting capacity. With the aid of the lifting device, a vehicle can be loaded rapidly, as the lifting device is immediately ready for use once the set of booms has been opened into the operating position, i.e. extended. Bringing the lifting device into the operating position preferably takes less than half a minute.

[0035] The lifting device can be controlled, for example, using wireless remote control, or control means arranged in connection with the vehicle. The lifting device according to the invention can be used preferably in connection with trucks, but can also be used in loader trac-

tors, or similar transport machines, in which there is a need to lift goods from the ground into a load space.

[0036] Figure 8 shows an embodiment of the arrangement according to the invention, in which a waste compactor 44 is attached to the rear of the load space 12. With the aid of the lifting device 14, even garbage bins in difficult places can be easily lifted into the waste compactor 44, without unnecessary reversing of the vehicle 30.

[0037] Thanks to the telescopic stanchion 13', a cab 16 pivoted around a transverse axis 16.2 in front of the vehicle 30 can be rotated in the arrangement normally to the maintenance position and back again to the driving position, according to Figure 9, without removing the lifting device 14. While the cab is being tilted, the lifting device is raised by extending the telescopic stanchions upwards.

[0038] According to Figure 10, the stanchions 13' belonging to the hoist attachments 13 form, together with the cross beam 13.1, a column structure 23 forming a support structure with the shape of an inverted U. The support structure is attached to the chassis beams 21 forming the chassis of the vehicle 30, with the aid of side plates 25 belonging to the attachment means 98. The chassis beams 21 are at a distance D from each other, which also determines the distance of the stanchions 13' from each other. Thanks to the support structure, the lifting device can be securely attached to the chassis of the vehicle and space will remain between the stanchions 13' of the support structure for the engine, gearbox, or other similar structures 88, shown by the broken lines, extending above the vehicle's chassis.

[0039] Sufficient space remains between the hoist attachments 13 for the hook device 24, shown by broken lines. The hook device is often bent slightly towards the rear part of the vehicle, so that a light additional cross beam 13.3, which further strengthens the support structure, can also be placed between the hoist attachments. The additional cross beam 13.3 can extend inside the stanchions 13'. The figures also show how the operating devices 31 for raising the lifting device to the operating position are installed inside the telescopic hoist attachments 13. The operating devices can be, for example, hydraulic cylinders. In the jacket of a hydraulic cylinder 31, there can be a locking hole 90, which rises as the telescopic arms 13.2 are extended, until it finally locks into the upper position with the aid of locking elements 92. The locking elements 92 and the locking hole 90 form together locking means 91, which are preferably pneumatic. The hoist base 17 is attached to the cross beams 13.1 with the aid of pins 84. The pins 84 are supported by sleeves 86. Figure 14 shows a top view of the attachment of the hoist base to the cross beams. The cross beam 13.1 is welded securely to the telescopic arms 13.2.

[0040] According to Figure 10, it is essential that the set of booms 34 is attached to the hoist base 17 with the aid of the swivel base 17.3 asymmetrically transversely, to one end of the hoist base 17. This allows the booms 34 to be as long as possible and gives the best reach possible for the lifting device. The swivel base can be attached to the hoist base on either the driver's side or the mate's side, depending on the requirements and place of use.

[0041] According to Figures 11 - 13, the vertical booms 36 are each attached to a lug on the swivel base 17.3 of the hoist base 17 with the aid of the pivot 64 of Figure 13. The folding boom 20 is attached to the boom base 65 with the aid of the pivot 64 and to the vertical boom 36 with the aid of the pivot 66. The operating devices, preferably hydraulic cylinders 19, which are each attached at the lower end with the aid of a pivot 48 to the swivel base 17.3 of the hoist base 17, operating the vertical boom 36, are attached to the same pivot shaft. No bending moments at all act on the set of booms 34. The vertical booms 36 are stressed mainly by only tensile moments and torque.

[0042] The construction of the pivot 66 is shown in greater detail in Figure 12. In this case, the vertical booms 36, the folding boom 20, and the operating devices 19 are attached to the same pivot shaft. The structure of the set of booms 34 is stiffened by the fact that the vertical booms 36 are secured to each other with the aid of a sleeve 70, the ends of which are locked by pins 72 to the side plates of the vertical booms 36. With the aid of spacer pieces 74 and a ball bearing 76, the entire structure can be pressed tightly together with the aid of a single bolt 78. The folding boom 20 is secured to the sleeve 70 by a sleeve 80.

[0043] The booms 20 and 36 of the set of booms 34 are preferably box-type structures, in order to achieve sufficient torsional stiffness. The side plates of the box are continued, in order to form protection for the operating devices 19 and 15. The operating devices 19 and 15 are preferably hydraulic cylinders.

[0044] According to Figure 13, the pivot 64 is located eccentrically relative to the axis of rotation of the hoist base 17. This provides 'free of charge' a reach with 180° rotation. Figure 13 shows an embodiment of the lifting device equipped with a rotating device. Here, the box construction of the hoist base 17 is clearly visible. The hoist base 17 includes a rotatable swivel base 17.3 and its rotation devices. A slewing ring 82 with internal toothing is installed on top of the hoist base 17. In this example, a Rollix (FR) slewing ring with internal toothing, model 07.0573.00 is used. This is driven by a separate angle transmission and reduction gear 68. The slewing ring is by nature a low structure, compared to the pin bearings. Figure 13 also shows a connector permitting full rotation, for example, Gautier/Duff-Norton Group (USA), model MC612K. The pressurized oil lines for the hydraulic cylinders operating the booms are run through such a connector. The hydraulic and control units of the swivel base are shown by the reference number 94. The swivel base 17.3 preferably includes a multi-channel medium connector permitting rotation.

Claims

1. Lifting device for a vehicle, in which vehicle (30) there is a load space (12), a cab (16) for the driver, as well as the elongated chassis (11) of the vehicle (30) in the centre under the load space (12), and in which the lifting device (14) has an operating position and a transport position, and the lifting device (14) includes

   - hoist attachments (13) comprising a column structure (23) attached to the chassis (11) of the vehicle, between the cab (16) and the load space (12),
   - a hoist base (17) arranged to be attached to the upper end of the hoist attachments (13), located at least partly on top of the cab (16),
   - a set of booms (34) supported on the hoist base (17), for lifting a load into the load space (12), and
   - a swivel base (17.3) with rotary operating devices, for rotating the set of booms (34),

   in which the said set of booms (34) is arranged to be folded transversely, in order to fit the lifting device (14) into the transport position.

2. Lifting device according to Claim 1, **characterized in that** the column structure (23) of the lifting device (14) includes stanchions (13') at a distance from each other, attachment means (98) at the lower end of the column structure (23) for attaching the stanchions (13') to the chassis beams (21) at a distance from each other, belonging to the chassis (11) of the vehicle (30), and a cross beam (13.1, 13.3) of the column structure (23), for connecting the stanchions (13').

3. Lifting device according to Claim 1 or 2, **characterized in that** the column structure (23) includes at least one cross beam (13.1) in the upper part of the stanchions, on which cross beam (13.1) the hoist base (17) is carried.

4. Lifting device according to Claim 2 or 3, **characterized in that** the stanchions (13') are telescopic.

5. Lifting device according to any of Claims 1 - 4, **characterized in that** the swivel base (17.3) is fitted to the hoist base (17) asymmetrically, relative to the transverse direction of the vehicle (30).

6. Lifting device according to any of Claims 1 - 5, **characterized in that** the set of booms (34) is arranged to fold into the transport position to become essentially a size that is the width of the vehicle (30).

7. Lifting device according to any of Claims 1 - 6, **characterized in that** the set of booms (34) includes at least one vertical boom (36) and a folding boom (20), as well as the operating devices (15, 19) operating them.

8. Lifting device according to any of Claims 1 - 7, **characterized in that** the swivel base (17.3) is arranged to be limitlessly rotatable.

9. Lifting device according to Claim 8, **characterized in that** the swivel base (17.3) includes a multi-channel medium connector permitting rotation.

10. Lifting device according to any of Claims 1 - 8, **characterized in that** the hoist attachments (13) include locking means (91) for locking the lifting device (14) in the operating position.

11. Arrangement for a vehicle, **characterized in that** the arrangement includes a lifting device (14) according to any of Claims 1 - 10 and the cab (16) of the vehicle (30) is arranged to rotate between service and driving positions, around a transverse axis (16.2) in front.

12. Arrangement according to Claim 11, **characterized in that** the vehicle (30) includes a hook device (20) for handling load spaces (12).

13. Arrangement according to Claim 11 or 12, **characterized in that** the vehicle's (30) load space (12) is a flatbed, or a box-type load space equipped with an openable roof.

14. Arrangement according to Claims 11 - 13, **characterized in that** the vehicle (30) includes a waste compactor.

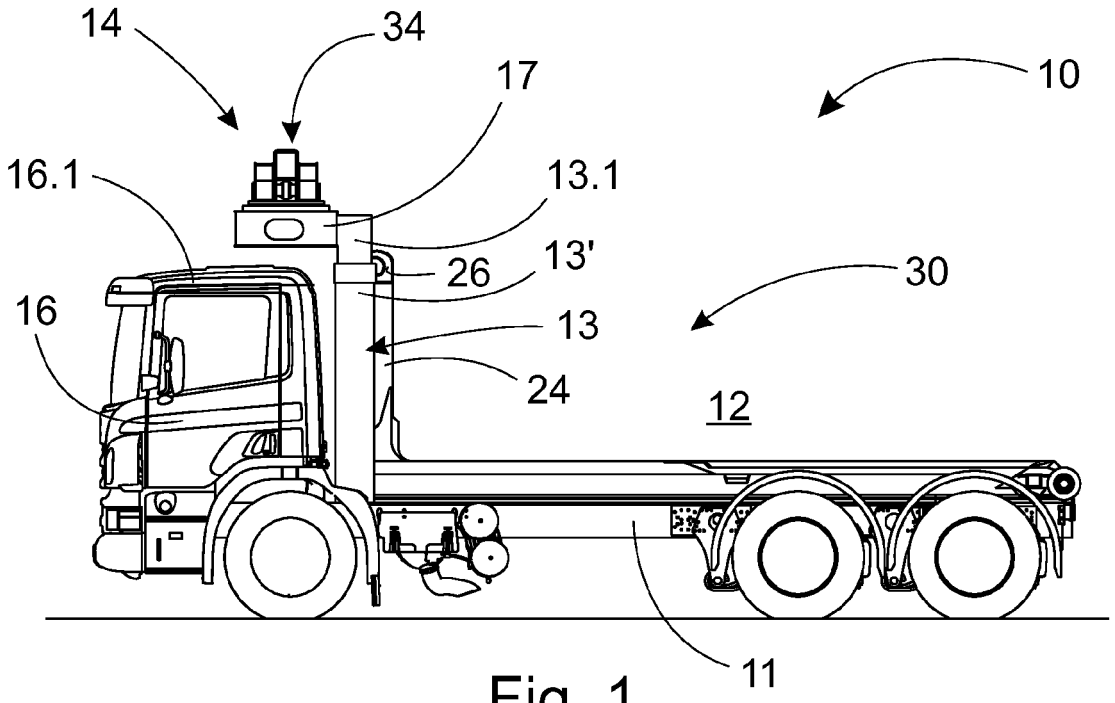
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Fig. 1

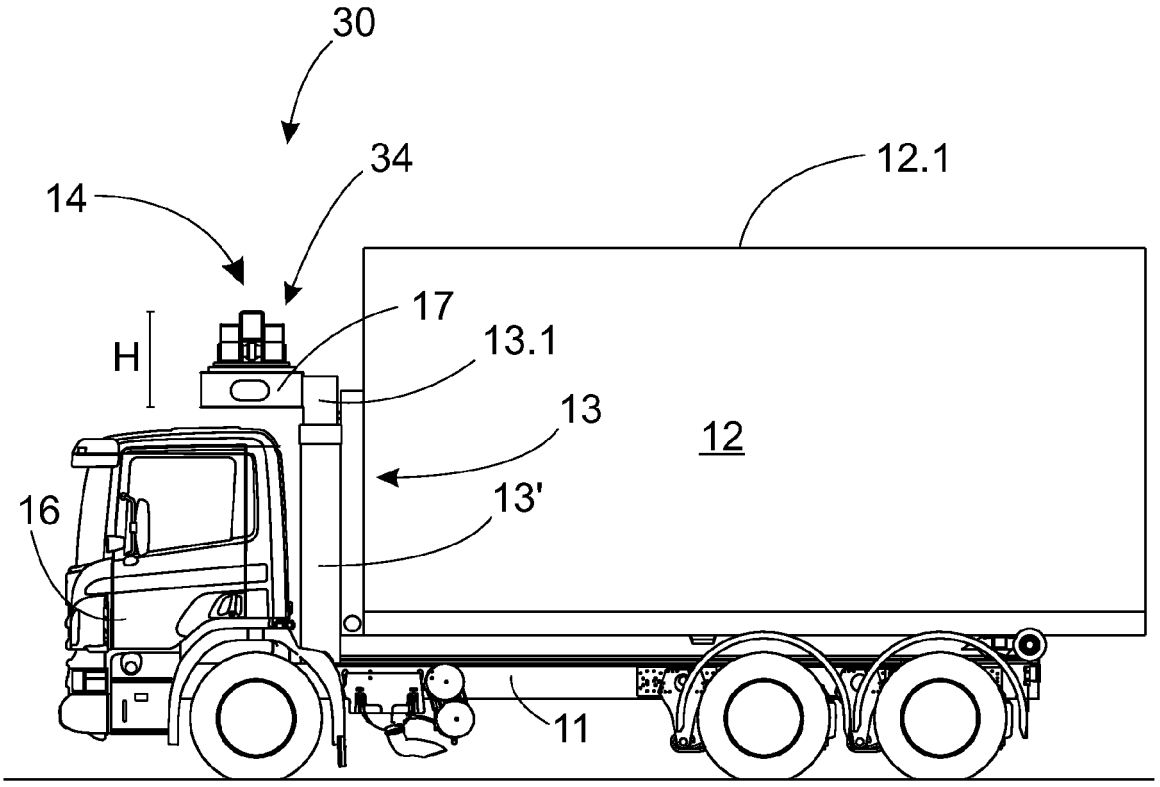
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Fig. 2

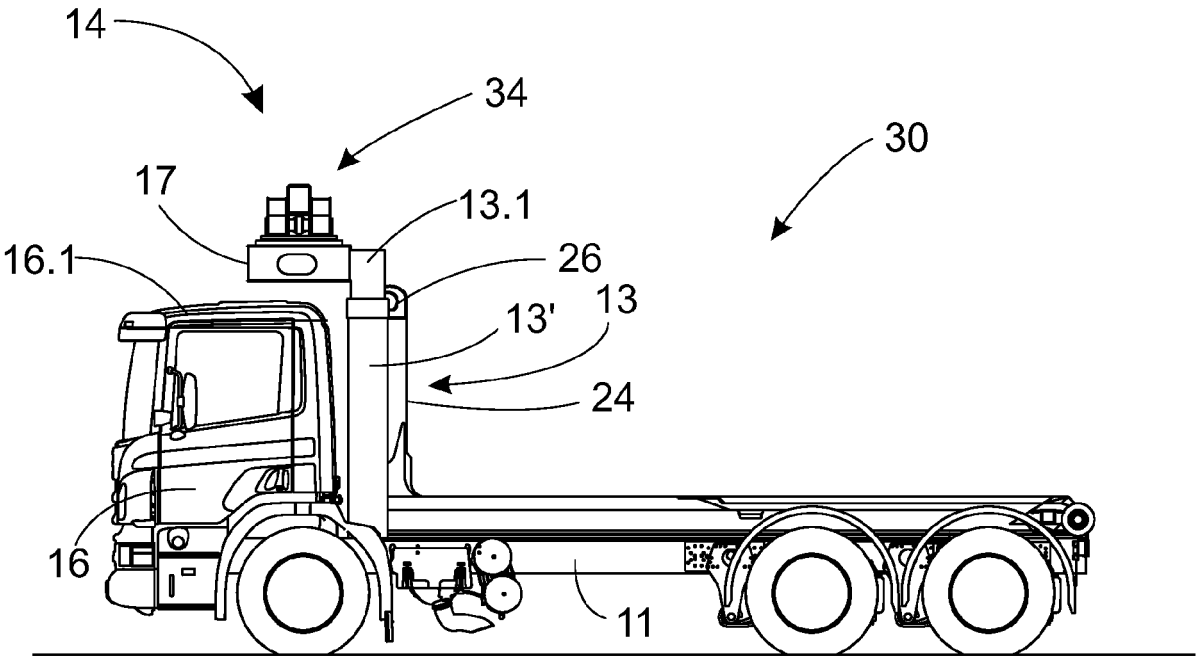
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Fig. 3a

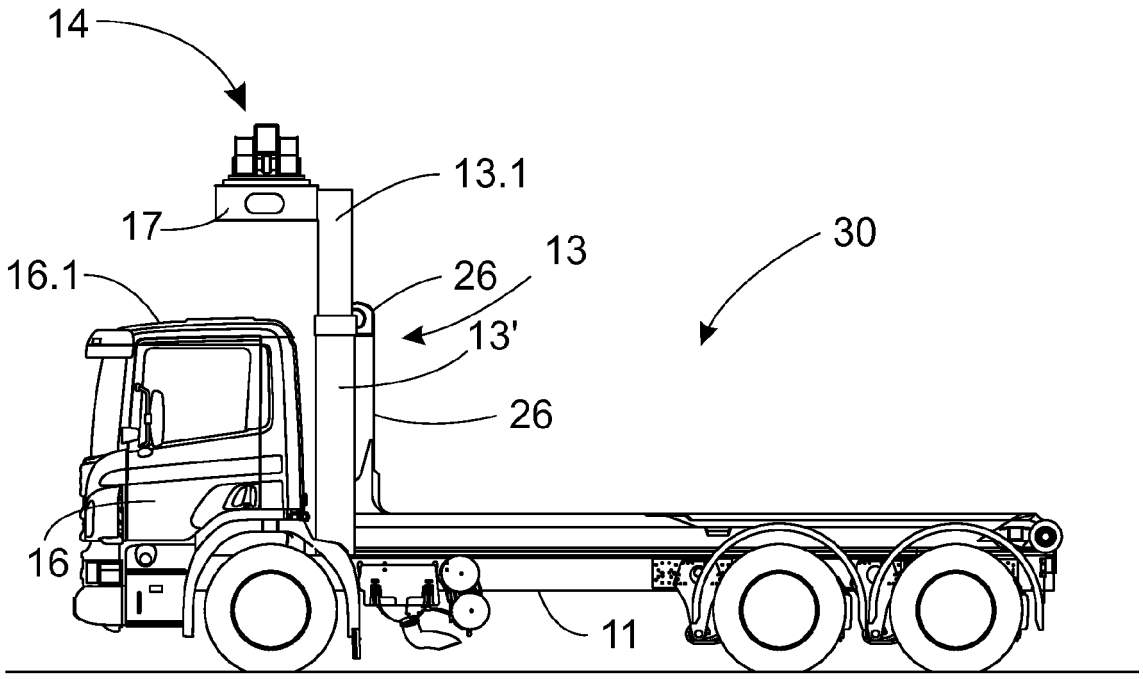
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Fig. 3b

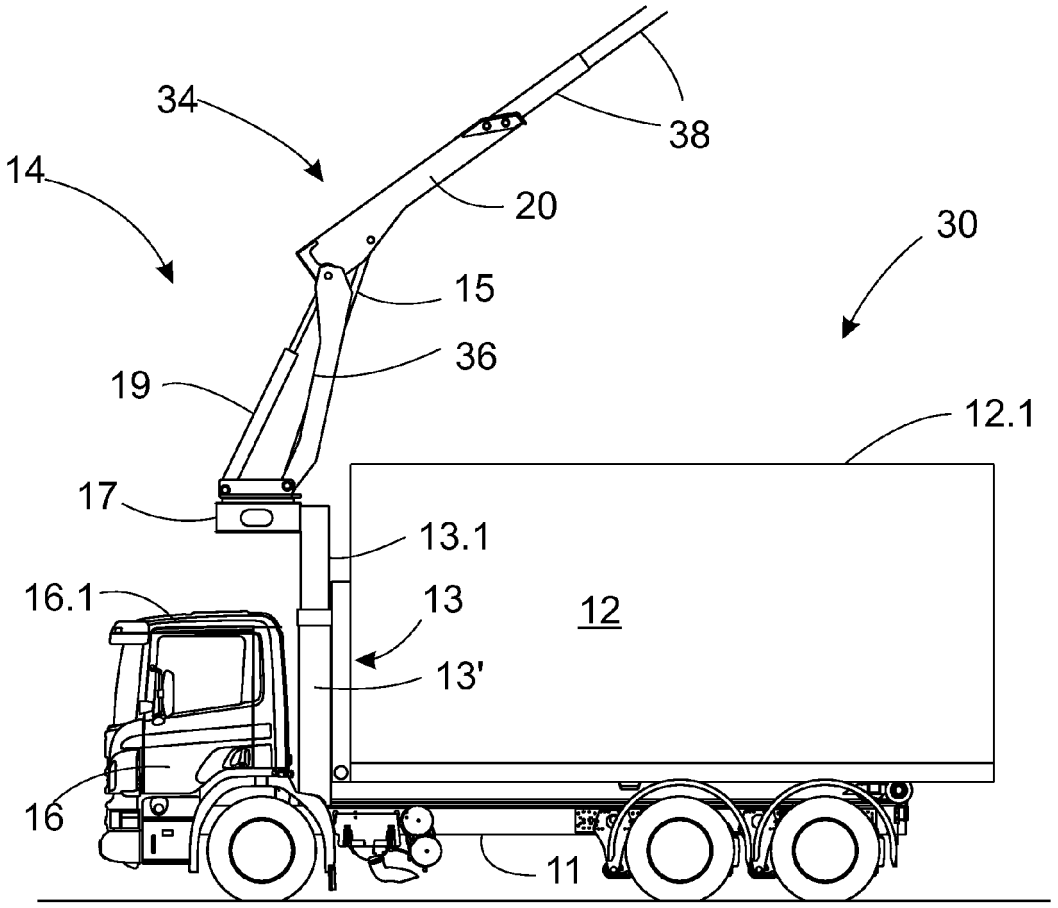
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Fig. 3c

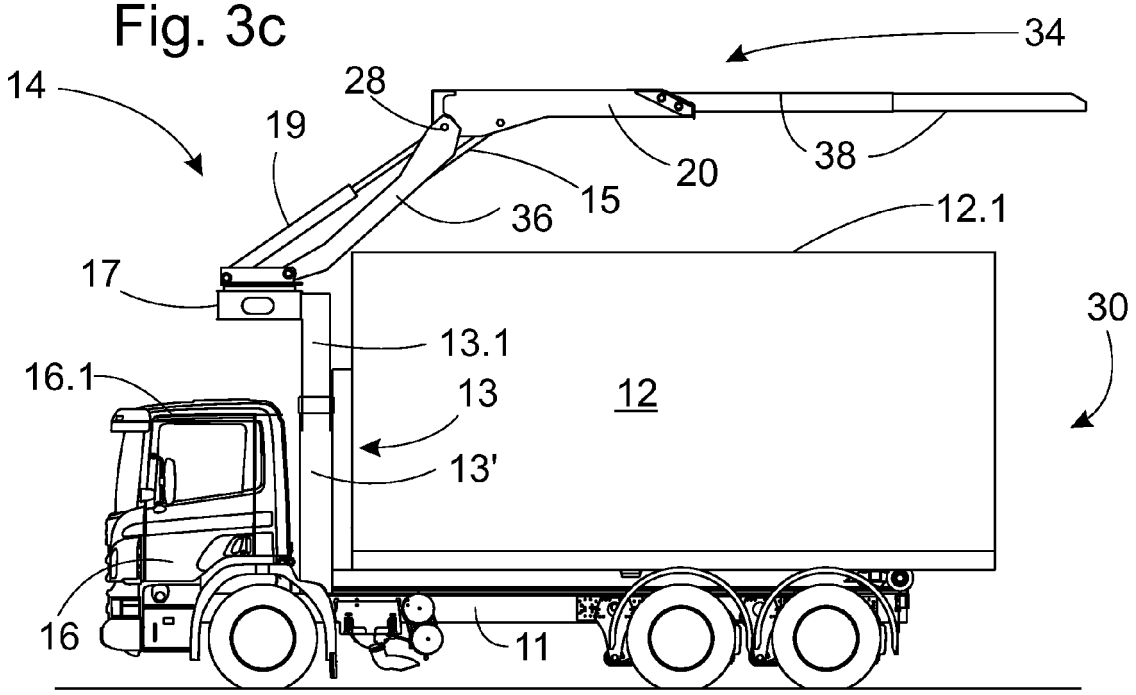
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Fig. 3d

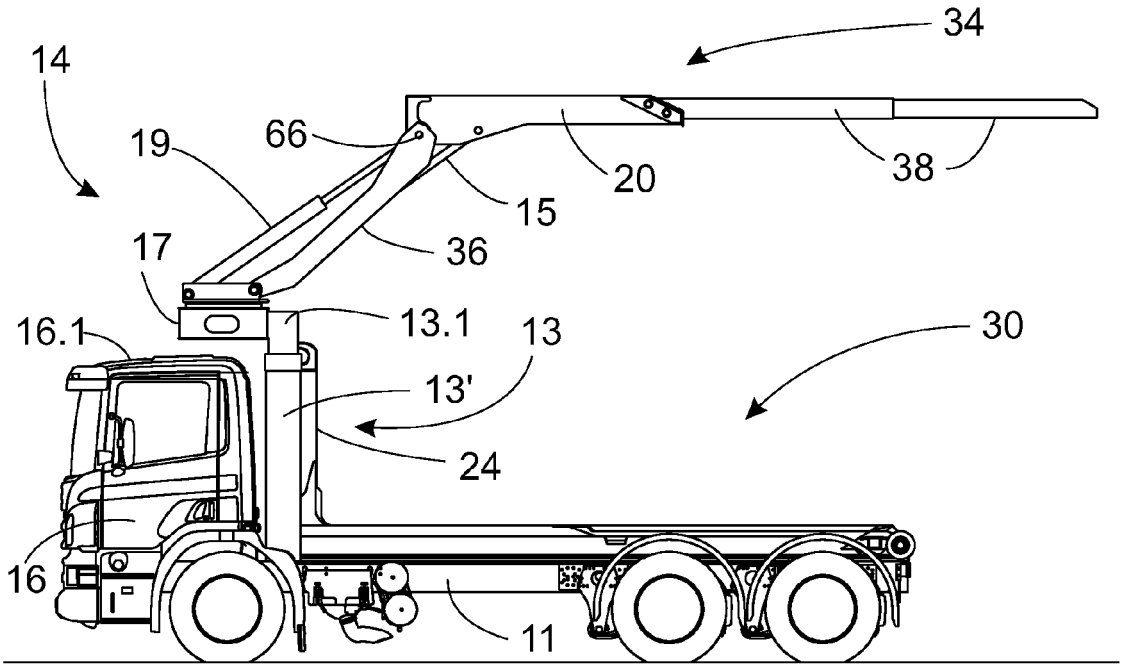
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Fig. 4

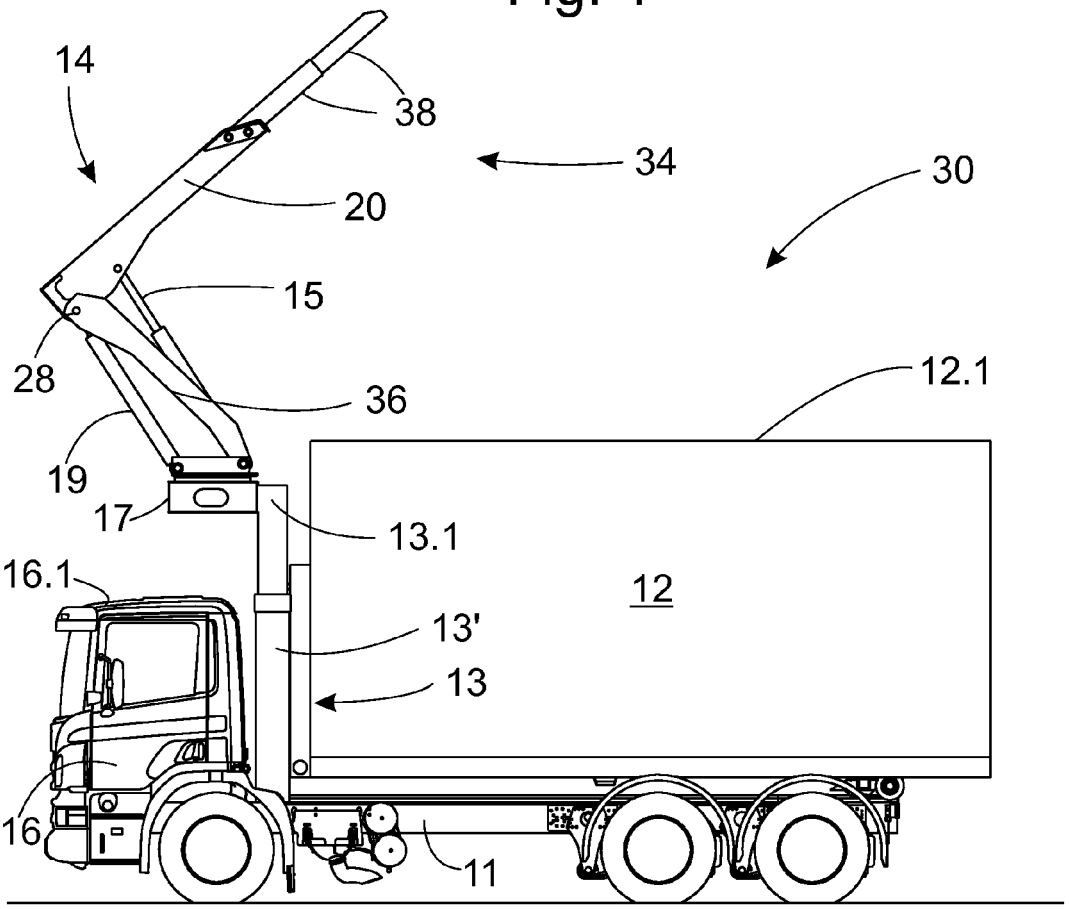
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Fig. 5

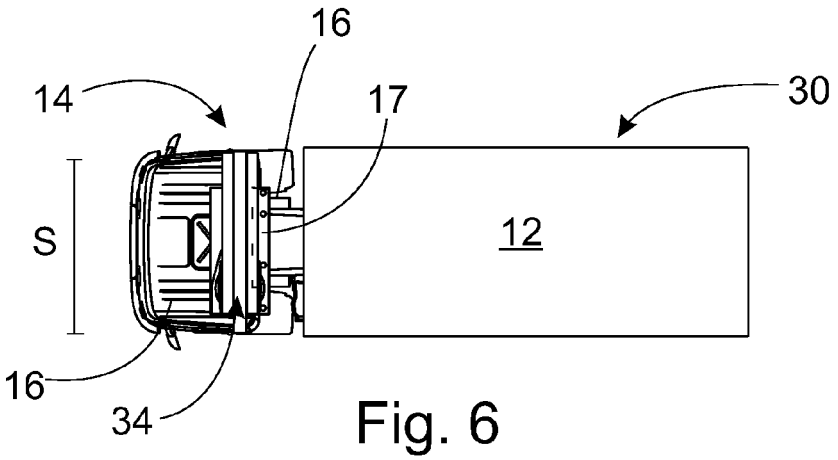

Fig. 6

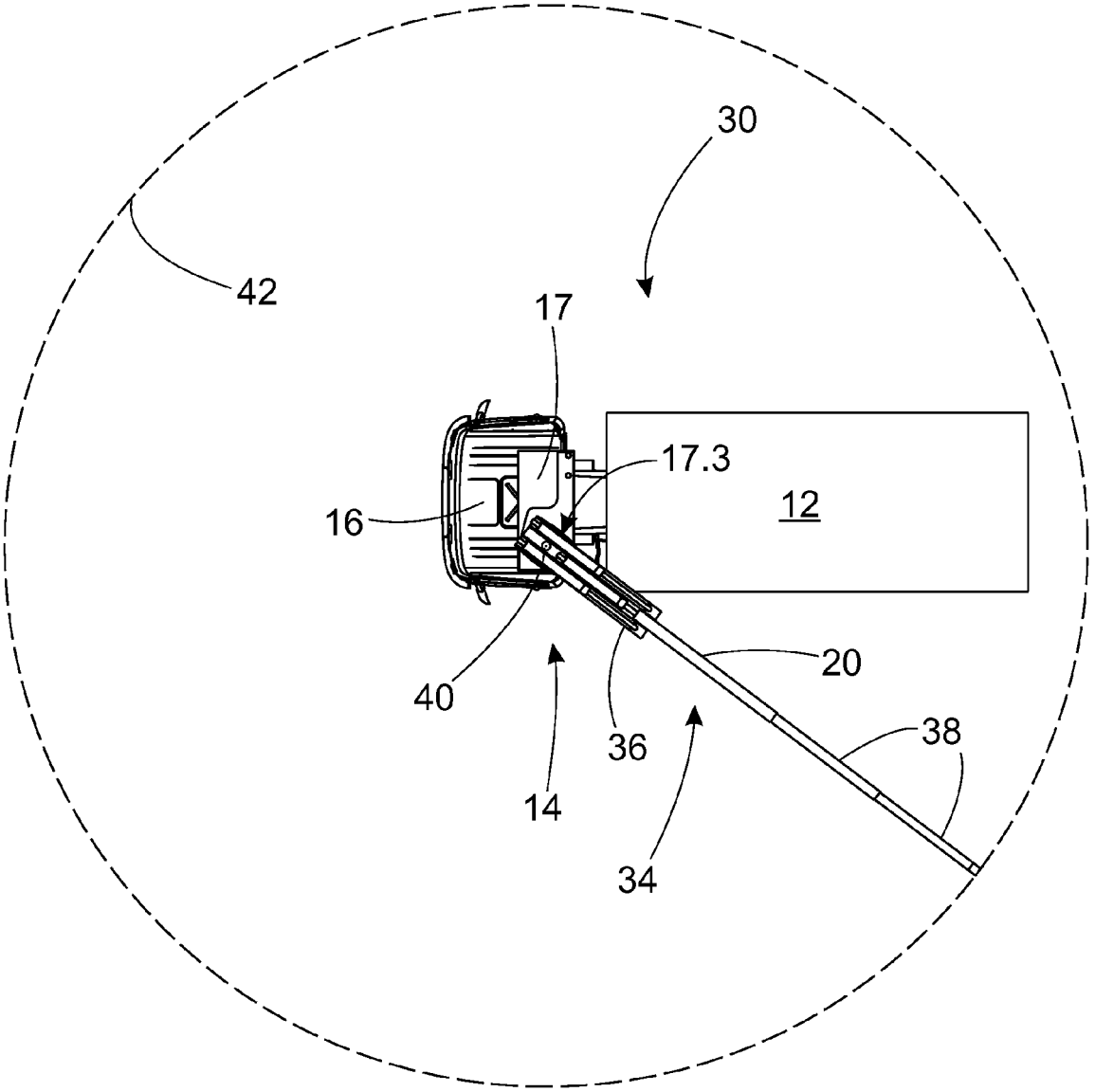

Fig. 7

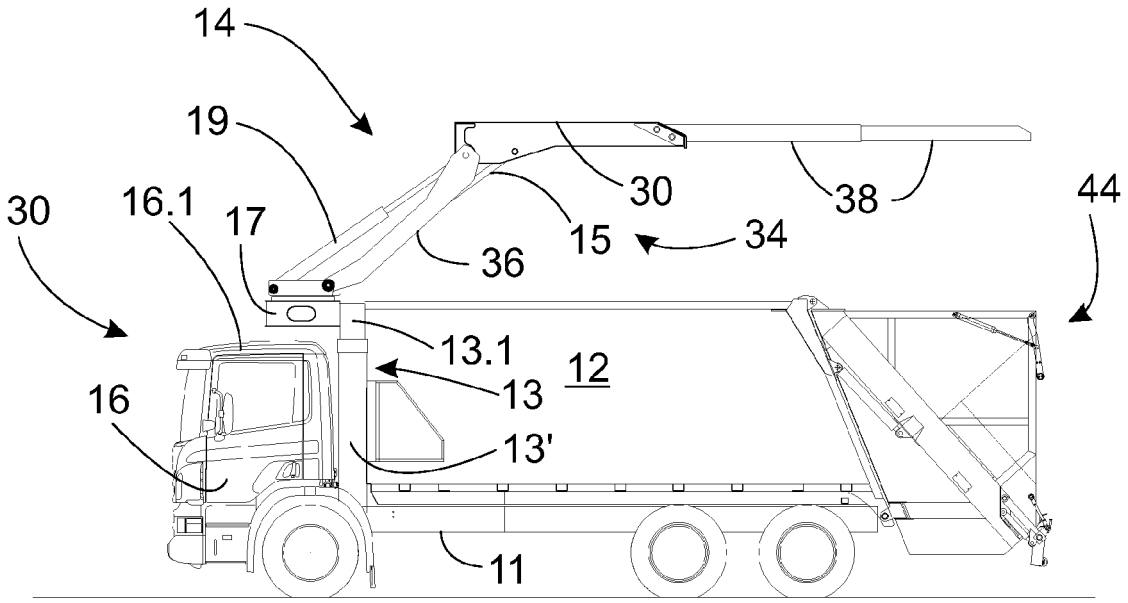
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Fig. 8

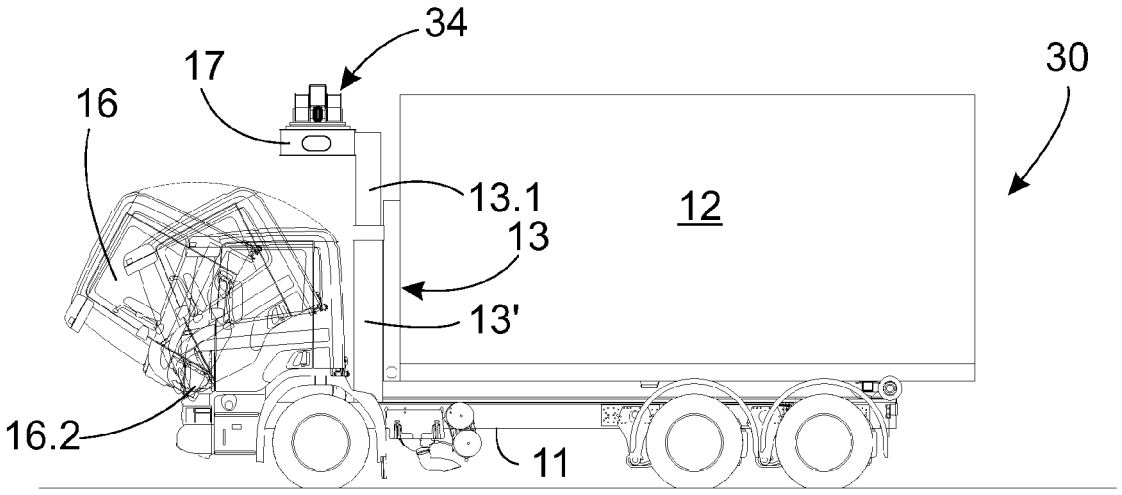
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Fig. 9

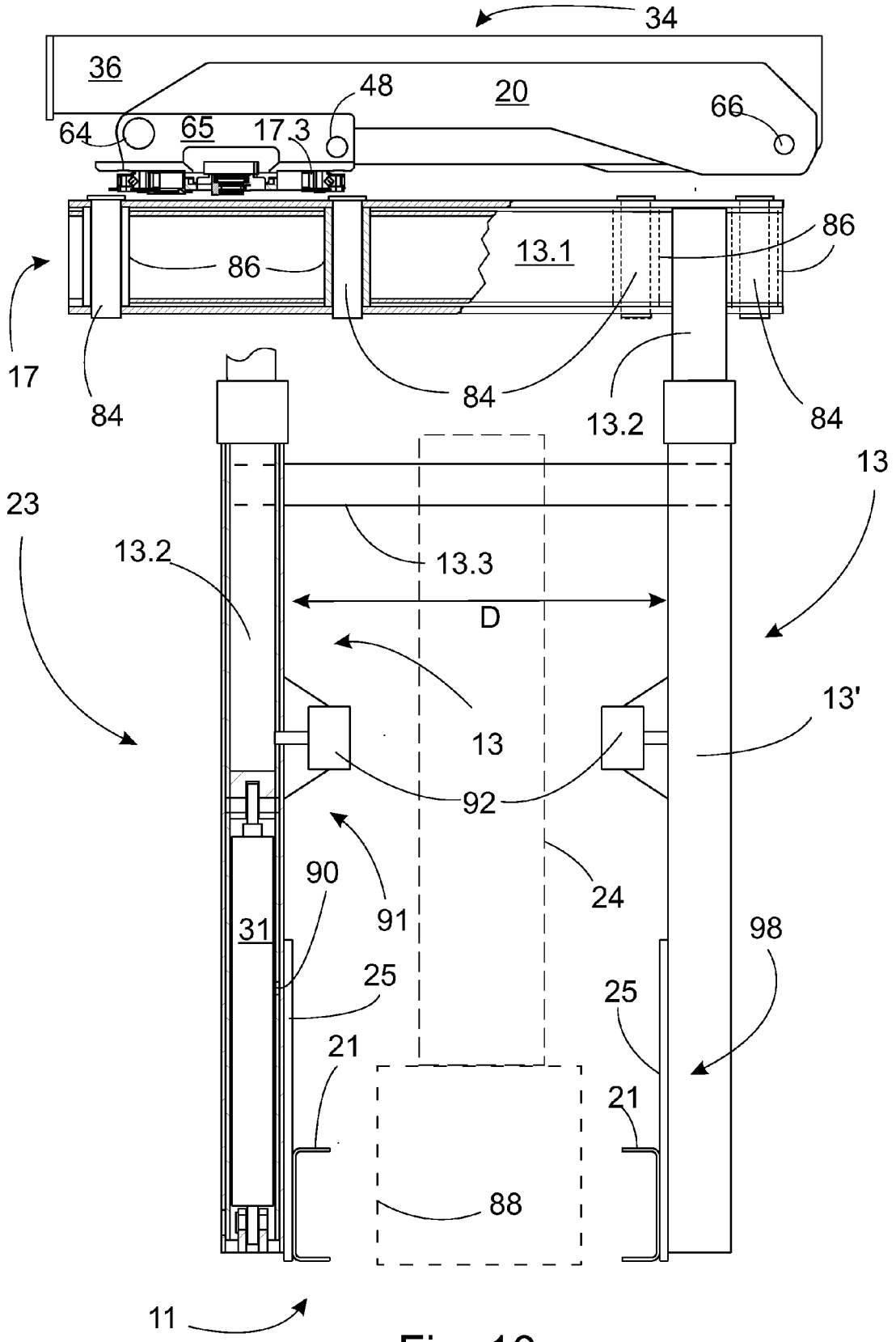
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Fig. 10

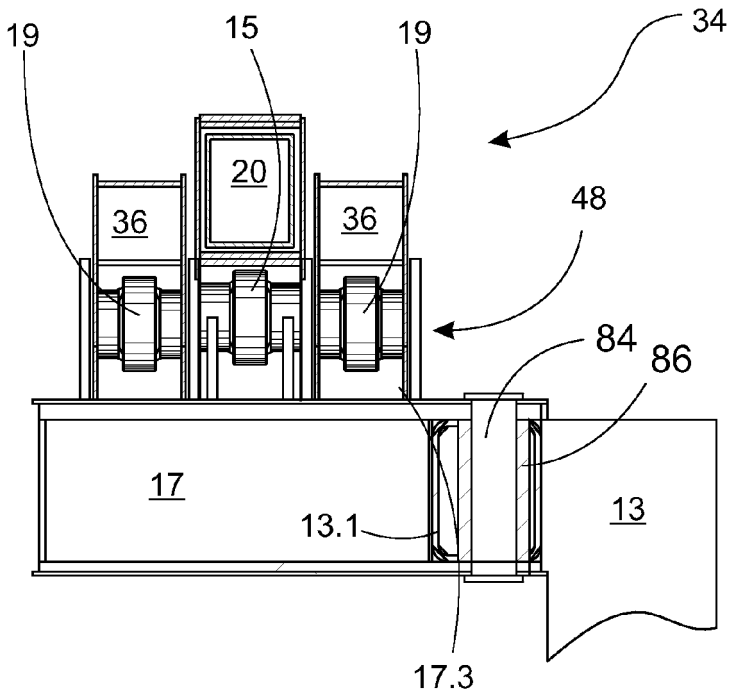
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Fig. 11

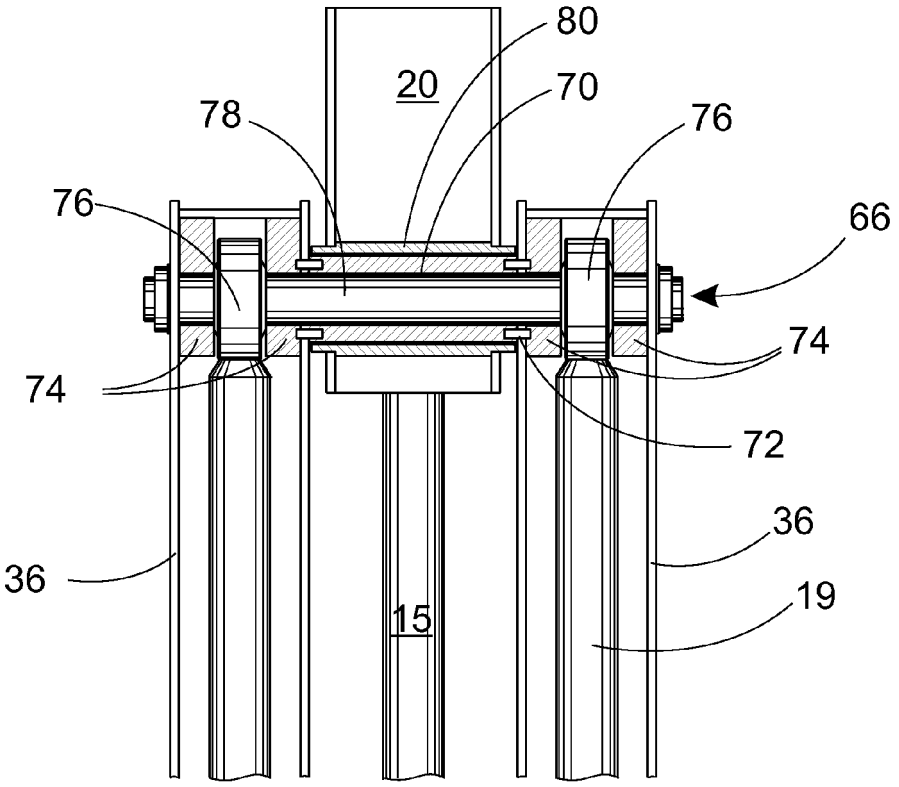
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Fig. 12

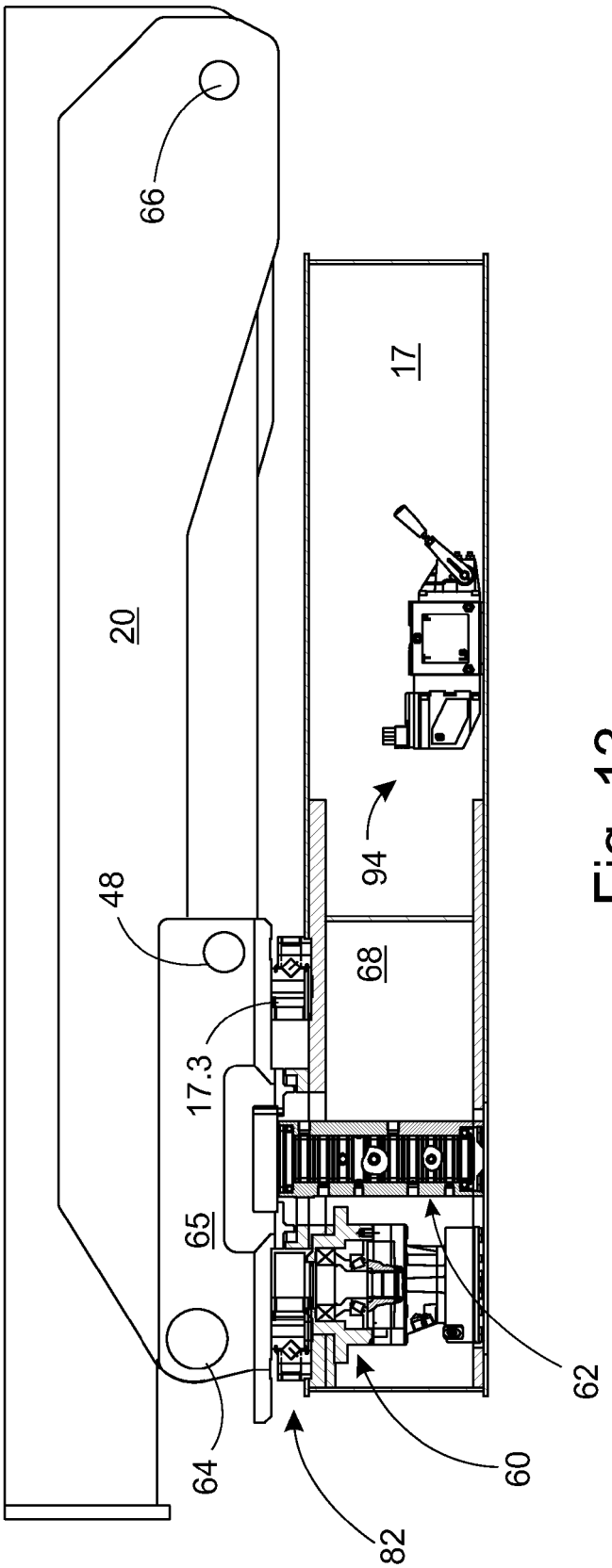

Fig. 13

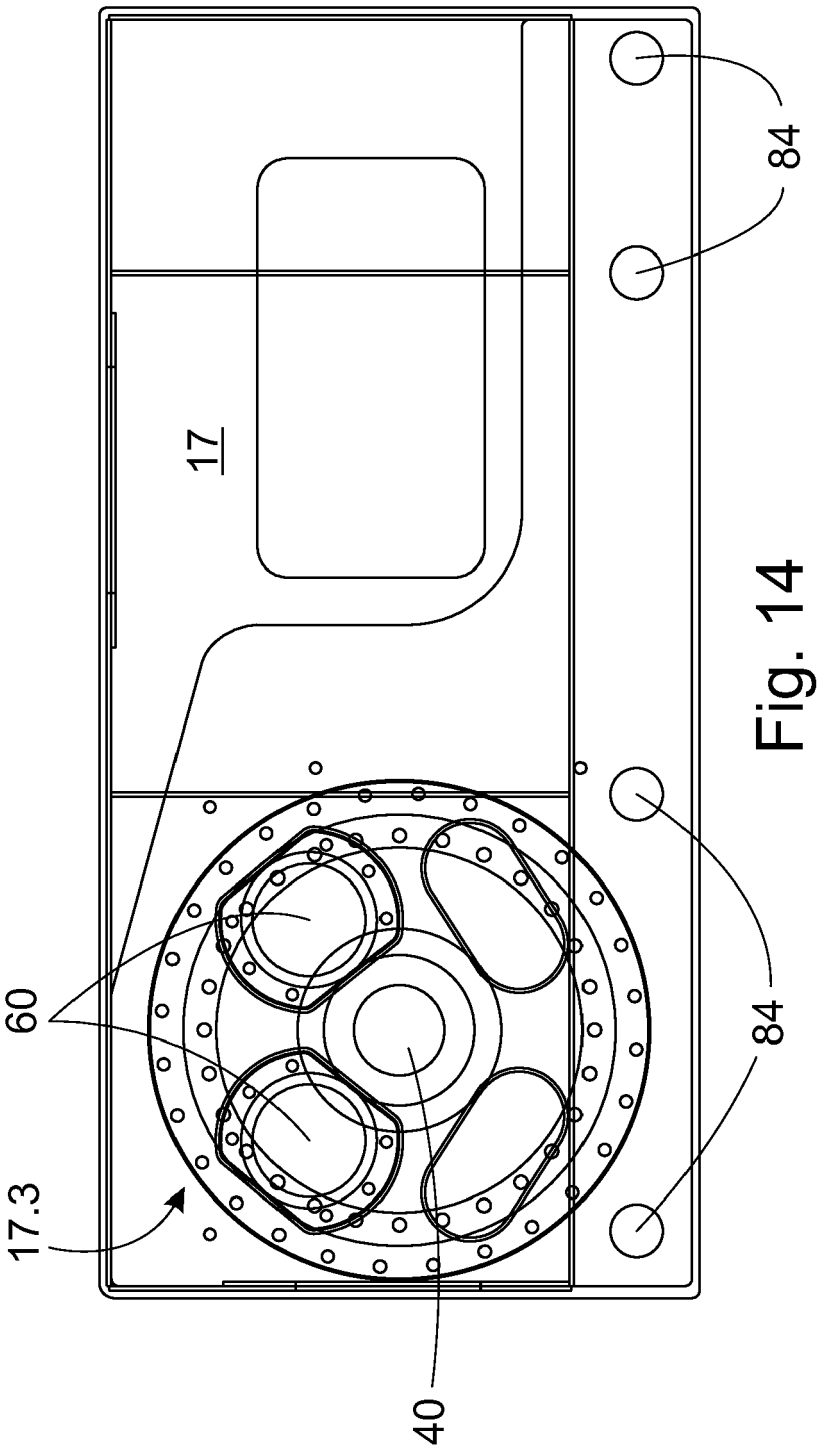

Fig. 14

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EUROPEAN SEARCH REPORT

Application Number
EP 10 17 3399

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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	6 December 2010	Szaip, András

CATEGORY OF CITED DOCUMENTS

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