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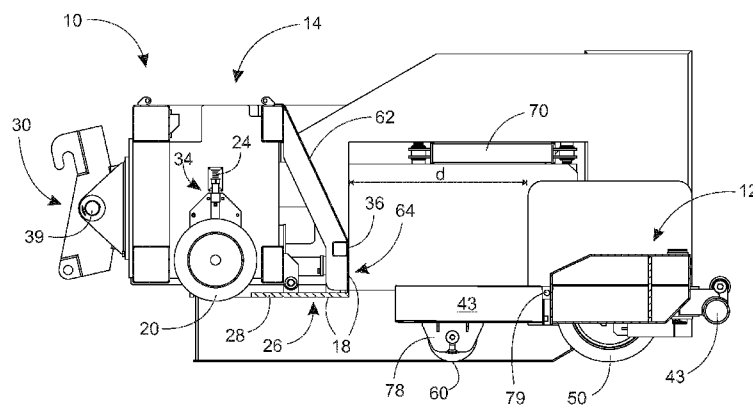


Fig. 9

(57) Abstract: The invention relates to a spreading device for a road-construction mass substance, which is arranged to be attached to a work machine (100), which spreading device (10) includes - a front frame (12) arranged to receive the road-construction mass substance (90), - a rear frame (14), attached at a distance (d) to the front frame (12), for spreading the road-construction mass substance (90), - a spreading blade (18) fitted to the rear frame (14), for delimiting the road-construction mass substance (90) to form a layer on the surface of the road (92), - a roller wheel (20) fitted to the rear frame (14), for compacting the spread road-construction mass substance (90), and - control devices (22) for adjusting the distance between the spreading blade (18) and the road (92) surface. The said spreading blade (18) includes a part (28) in the longitudinal direction of the spreading device (10), which is in length 5 - 20 % of the greatest width of the spreading device (10) and the spreading device (10) includes a loading operating device (24) for loading the said roller wheel (20).



SPREADING DEVICE FOR A ROAD-CONSTRUCTION MASS SUBSTANCE

The invention relates to a spreading device for a road-construction mass substance, which is arranged to be attached to a work machine, which spreading device includes

- a front frame arranged to receive the road-construction mass substance,
- a rear frame, attached at a distance to the front frame, for spreading the road-construction mass substance,
- 10 - a spreading blade fitted to the rear frame, for delimiting the road-construction mass substance to form a layer on the surface of the road,
- a roller wheel fitted to the rear frame, for compacting the spread road-construction mass substance, and
- 15 - control devices for adjusting the distance between the spreading blade and the road surface.

In road-building and renovation, an important stage in the work is spreading a loading-bearing layer. The load-bearing layer is usually formed of a suitable grade of gravel, crushed gravel, or other soil material. If the spreading of the load-bearing layer is unsuccessful, the road structure will not be sufficiently durable, and will not meet the requirements set for it.

25 The prior art is represented by the spreading device, disclosed in Finnish patent publication FI 92944, pushed by a work machine, which is attached to the work machine in place of its bucket. In this spreading device, the layer thickness of the road-construction mass substance being spread is controlled roughly with the aid of a horizontally mounted spreading blade. Due to unevenness in the base surface, the working depth of the spreading blade must be changed actively to result in a level surface. The horizontally mounted spreading blade has, however, a large surface area, of up to 3 m², to the road-construction mass

being spread, making it difficult to adjust the height of the spreading blade sufficiently quickly during running to conform to the form of the surface, in order to thin the layer being spread, due to the great resistance of the mass layer. The mass layer
5 resists a rapid downwards adjustment movement so strongly that the vertical cylinders used for adjustment can lift the front frame and its wheels into the air. In other words, the adjustment properties of the horizontal spreading blade are slow and imprecise. In the spreading device of the publication, control of
10 the working depth of the spreading blade is the only way to affect the layer thickness of the road-construction mass.

On the other hand, Finnish patent publication FI 122903 B is known from the prior art, which discloses a spreading device equipped
15 with a vertical spreading blade. The spreading device's spreading blade is attached with the aid of operating devices to the rear frame and can be moved very quickly in the vertical direction. The drawback in such a spreading device is, however, the expensive construction of the vertically moveably spreading blade, which
20 also wears rapidly. In addition, the construction disclosed in the publication is liable to pitch as the spreading device is supported on the road body mainly with the aid of its front wheels, so that the rear frame remains "floating" without support. The weight and pushing force of the work machine pushing the spreading device make
25 the spreading device very liable to pitch, causing a corrugated surface in the road being built.

The invention is intended to create a road-construction mass substance spreading device, which is more precise than spreading
30 devices according to the prior art and is more economical to operate. The characteristic features of the present invention are stated in the accompanying Claim 1.

This intention can be achieved by means of a road-construction mass substance spreading device, which is arranged to be attached to a work machine, which spreading device includes a front frame arranged for receiving the road-construction mass, a rear frame
5 attached at a distance from the front frame for spreading the road-construction mass, and a spreading blade fitted to the rear frame for delimiting the road-construction mass from the throat to form a layer on the surface of the road. The spreading blade includes a part in the longitudinal direction of the spreading
10 device, the length of which is 5 - 20 % of the greatest width of the spreading device. In addition, the spreading device includes a roller wheel fitted to the rear frame, for compacting the spread road-construction mass, control devices for regulating the distance between the spreading blade and the surface of the road,
15 and a loading operating device for loading the roller wheel.

Thanks to the spreading blade that is short in the horizontal direction, the force resisting vertical movement in the spreading blade is relatively small and the spreading blade can be adjusted
20 perpendicularly to the road surface sufficiently quickly to compensate for the shapes of the road surface. The use of a short horizontal spreading blade makes the spreading device liable to pitch, but this problem is eliminated by using the roller wheel. With the aid of the loadable roller wheel, the surface of the spread
25 road-construction mass substance can be compacted effectively when the roller wheel is supported on the layer of spread construction mass at the same time as it acts as a support point against the ground for the rear frame. Thus, the roller wheel stabilizes the spreading device longitudinally, thus preventing
30 pitching. Considerably greater precision is achieved by means of this kind of a road-construction mass spreading device, than by means of spreading devices of the prior art.

The transverse cross-section of the spreading blade has preferably an L-shaped profile, which includes the said longitudinal part of the spreading device and a vertical part. The term vertical part refers to the part that is transverse to the spreading device and perpendicular to the longitudinal part. The L-shaped spreading blade is sufficiently strongly constructed that it does not require separate reinforcements, so that the construction is cheaper in manufacturing cost than moveable spreading blades of the prior art. In addition, with the aid of the L-shaped profile, the surface of the spread road-construction mass is even.

The spreading device preferably further includes measuring means for measuring the surface before and after the spreading of the road construction mass and for creating measurement data, on the basis of which measurement data the roller wheel is arranged to be loaded, to compact the spread layer of construction mass. Thus, for example, thick mass layers can be compacted with a greater load than thin mass layers, thus achieving excellent quality.

The control devices are preferably arranged to use the data of the measuring means to level the spread layer of road-construction mass substance automatically, by moving the rear frame vertically. In other words, on the basis of the data of the measuring means, the control devices are operated to change the difference in height between the front frame and the rear frame, by moving the rear frame vertically in vertical guides attached to the front frame. The necessary changes in the distance of the rear frame from the road surface can be made rapidly using automatic control based on the measurement data, making the result even more precise. The narrow spreading blade also has less resistance to the movements of the rear frame, permitting rapid movements.

The measuring means can be ultrasound sensors. With the aid of ultrasound sensors, changes in the road surface can be detected rapidly, reliably, and with sufficient precision.

5 The length of the longitudinal part of the spreading blade can be 15 - 60 cm, preferably 30 - 50 cm. The spreading blade then has a sufficiently small surface area to be able to react rapidly when being adjusted against the surface of the road-construction mass.

10 According to one embodiment, the surface area of the longitudinal part of the spreading blade is 0.4 - 1.5 m², preferably 0.8 - 1.2 m². The small longitudinal surface area of the spreading blade facilitates the movement of the spreading blade in a direction perpendicular to the surface of the ground.

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The roller wheel is preferably arranged to carry the entire weight of the rear frame, in order to reduce the resistance caused by the spreading device. This permits the spreading device to be moved by the work machine during operation with a considerably smaller energy consumption than spreading devices without a roller wheel, according to the prior art. The energy consumption can be 50-% smaller than in spreading devices without a roller wheel, in which the weight of the spreading devices is directed to the road surface through the spreading blade and the work machine must work to overcome the sliding friction between the spreading device and the road surface. In the spreading device according to the invention, only the rolling friction of the roller wheel must be overcome with the aid of the work machine.

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30 The loading operating device is preferably a hydraulic operating device. With the aid of the hydraulic operating device, the roller wheel can be loaded, when required, with a sufficiently large load, when unevennesses remaining in the road-construction mass can be removed.

The loading operating device is preferably arranged to increase the loading of the roller wheel when the layer thickness of the road-construction mass being spread is increased and to reduce the loading when the layer thickness is reduced. The compactness of the spread mass layer will then remain the same in all layer thicknesses, so that the precision of the work remains good.

The loading of the roller wheel can also be adjusted differently for different road-construction mass substances according to their different compaction properties.

Alternatively, mechanical loading operating devices can also be used, when hydraulic lines will not be needed.

The spreading blade is preferably straight in the transverse direction of the spreading device. The spreading blade is then cheap to manufacture and does not narrow the throat.

According to one embodiment, the front wall of the rear frame, or, by another name, the end next to the front wall, is at least partly tilted away from the front frame, in order to increase the throat. The throat then receives space for a greater amount of road-construction mass substance and, at the same time, the tailboard of the truck bringing road construction mass to the spreading device has space to turn during tipping without touching the rear frame.

More specifically, the end is tilted away from the front frame above the spreading blade, to increase the throat. The L-shaped spreading blade can form a part of the front wall.

The front wall of the rear frame can be tilted at least 10°, preferably 15 - 35°. The throat's volume can then increase by up to 10 %.

5 According to one embodiment, the gap between the front frame and the rear frame can include at least one horizontally set throat operating device for regulating the throat by moving the front frame telescopically relative to the rear frame in the horizontal plane. With the aid of the throat operating device, the distance
10 between the front frame and the rear frame, and also the surface area of the throat and the volume of the feed silo can be adjusted telescopically.

According to one embodiment the spreading device further includes
15 a spreading plough equipped with wheels and pivoted inside the throat in the front frame to prevent arching of the road-construction mass substance. With the aid of the spreading plough, the spreading blade can be implemented without a separate plough shape, which would increase the weight of the spreading
20 device and slow the movements of the rear frame.

The spreading device preferably further includes side guides forming sides to the throat between the front frame and the rear frame for delimiting the road-construction mass substance from the
25 side and pivot arms for pivoting the side guides to the front frame and the rear frame, to permit adjustment of the width of the throat. With the aid of the use of pivot arms, the construction of the side guides is made lighter and cheaper to manufacture than when using telescopic arms.

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The side guides can be supported on the road surface with the aid of wheels belonging to the side guides. Thanks to the wheels, the side guides then move continuously slightly vertically, so that

the side guides will not jam in the guides belonging to the side guides.

5 According to one embodiment, each side guide includes a box structure and a plate-like wall structure fitted inside the box structure and arranged to move freely perpendicularly to the ground according to unevennesses in the ground. Such a construction permits the side guides to "float" relative to the ground surface.

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The plate-like wall structure can include two ends essentially perpendicular to the ground surface, an upper edge and lower edge between them and a centre line parallel to the upper edge and lower edge and between the upper edge and lower edge, of which at least one edge is curved in such a way that the length of the plate-like wall structure in the longitudinal length of the spreading device grows towards the centre line from the upper edge or lower edge. Thus, the curved plate-like wall structure can rotate inside the box structure, permitting the non-simultaneous movement of the two ends of the plate-like wall structure.

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The spreading blade is preferably fitted permanently to the rear frame. It is then simple to manufacture and reliable in operation.

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Using the spreading device according to the invention, the spreading of the road-construction mass substance can take place in a single spreading, or at least its use will require less back and forwards driving than spreading devices according to the prior art. With the aid of the spreading device, the road-construction mass can be spread immediately to the correct layer thickness, so that the work can be performed without adding or removing mass, the latter of which causes material waste. Further, the spreading device according to the invention is economical to use, because

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the energy consumed to move it is considerably less than that for spreading devices according to the prior art.

In the following, the invention is described in detail with
5 reference to the accompanying drawings showing some embodiments of the invention, in which

Figure 1a shows a partial cross-sectional side view of the spreading device according to the invention behind a
10 truck, when the height of the mass layer being spread is at its maximum,

Figure 1b shows a partial cross-sectional side view of the spreading device according to the invention behind a
15 truck, when the height of the mass layer being spread is at its minimum,

Figure 2a shows an axonometric view of the spreading device according to the invention, seen from in front and at an angle from above, when the side guides are at their
20 minimum width,

Figure 2b shows an axonometric view of the spreading device according to the invention, seen from in front and at an angle from above, when the side guides are spread,

Figure 3 shows an axonometric view of the spreading device according to the invention, seen from behind and at an angle from above, when the side guides are at their
25 minimum width,

Figure 4a shows a top view of the spreading device according to the invention, when the side guides are at their
30 minimum width,

Figure 4b shows a top view of the spreading device according to the invention, when the side guides are spread,

Figure 5 shows an axonometric view of the spreading device according to the invention, seen from behind and below,

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Figure 6 shows a rear view of the spreading device according to the invention,

Figure 7 shows a front view of the spreading device according to the invention,

5 Figure 8 shows a side view of the spreading device according to the invention, when the rear frame is raised to its maximum height,

Figure 9 shows an enlarged view of the spreading device of Figure 1a in partial cross-section,

10 Figure 10a shows a side view of a second embodiment of the spreading device according to the invention, shown shortened,

Figure 10b shows a side view of a second embodiment of the spreading device according to the invention, shown
15 extended,

Figure 11a shows a top view of a second embodiment of the spreading device according to the invention, shown shortened,

Figure 11b shows a top view of a second embodiment of the spreading device according to the invention, shown
20 extended,

Figure 12 shows a side view of a second embodiment of the spreading device according to the invention, with a side guide in cross-section.

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Figures 1a - 8 show one embodiment of the spreading device according to the invention. Figure 1a shows a side view of the spreading device 10 behind a truck 102, when the height of the mass layer being spread is at a maximum. In Figure 1b, the height of
30 the mass layer being spread is at a minimum. In both of Figures 1a and 1b the spreading device 10 is in partial cross-section, so that the roller wheel 20 is visible. Due to the cross-section, the side guides visible in Figures 2a - 3 cannot be seen in Figures 1a and 1b. The spreading device 10 includes a front frame 12 and

a rear frame 14, which connected together form a feed silo 15 for the road-construction mass substance 90 to be spread and a throat 16, from which the construction mass 90 is fed under the rear frame 14. From now on, the simplified name mass will be used for the road-construction mass substance. The throat 16, or by another name the throat opening, in the gap remaining between the front frame 12 and rear frame 14 is an open opening, through which the mass is poured from the feed silo out onto the base surface 80 of the road 92. The mass flowing from the feed silo 15 is levelled with the aid of the spreading blade 18 attached to the rear frame 14. The spreading blade 18 is fitted to the end 38 of the rear frame 14 next to the front frame 12, which is closest to the front frame 12 and the mass layer 90 being spread. Beneath the front frame 12 there are preferably pivoted support wheels 50, on which the front frame 12 travels along the base surface 80. In this connection, the words base surface 80 refers to the ground surface, on top of which the mass layer 90 is spread. The spreading device 10 is attached to the work machine 100 with the aid of an attachment counter-piece 30 preferably pivoted to the rear frame 14 of the spreading device 10. The attachment counter-piece 30 is preferably suitable for use with counter-pieces according to the standard for work machines.

When the spreading device 10 is being used, the spreading device 10 is initially attached to the work machine 100, for example a bucket loader, in place of its bucket. With the aid of the work machine 100, the spreading device 10 is pushed onto the rear wheel 104 of a truck 102 transporting mass. Spreading of the mass is started in such a way that the truck 102 and the work machine 100 with the spreading device 10 start moving and the bed 106 of the truck 102 is tilted, so that the mass falls into the feed silo 15 of the spreading device 10. The mass flows from the feed silo 15 through the throat 16 to form a mass layer 90 on top of the base surface 80, which the spreading blade 18 attached to the rear frame

14 scrapes to the selected thickness. The work machine 100 travels on top of the spread mass layer 90.

According to Figures 1a and 1b, the spreading device 10 can include
5 a buffer beam 42, which is pivoted in the middle in front of the front frame 12, so that it permits driving in a curve. The attachment counter-pieces 30, which are pivoted with the aid of pivots 39 to the rear frame 14, are also visible in Figure 1a. According to the figure, the rear frame 14 is attached to the front
10 frame 12 with the aid of beams 52 running in the longitudinal direction of the spreading device 10. In the ends of the beams 52 next to the front frame 12 vertical guides 54 according to Figure 8 are formed, on which the rear frame 14 can be moved vertically with the aid of the control operating devices 22 of the front frame
15 12. In other words, the rear frame 14 and the spreading blade 18 attached to it rise or fall relative to the base surface 80. The rear frame 14 pivots temporarily at pivot 39 relative to the work machine. Pivot 39 should be durable, as it is highly stressed during spreading work. During spreading work, the adjustments to
20 be made in the thickness of the mass layer being spread are preferably made only with the aid of the control operating devices 22 of the spreading machine 10. The front frame 12 always travels on the base surface 80 and the rear frame 14 in the same position as the work machine 100 on the surface of the spread road 92.

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In Figures 2a and 2b, the spreading device 10 is shown in an axonometric view. The spreading device 10 preferably includes a spreading plough 43 pivoted inside the throat 16 to the lower part of the feed silo 15 in the front frame 12, to prevent arching of
30 the mass. The spreading plough 43 can be triangular in shape, so that it spreads the mass effectively. The task of the spreading plough 43 pivoted to the front frame 12 by means of a pivot shaft 79 (Figure 6) is also to assist the mass to travel to the side from the centre of the throat 16, without causing resistance to the

movement of the mass. The spreading plough 43 can be moveably pivoted. The spreading plough 43 preferably includes a support wheel 60 to support the spreading plough 43 against the base surface 80. The support wheel 60 can be more clearly seen in Figure 5. When the support wheel 60 meets various unevennesses in the base surface 80, the spreading plough 43 rises and falls along with the unevennesses, causing a pumping motion in the spreading plough 43, which prevents the mass sticking, i.e. arching, in the feed silo 15. According to Figure 5, there are preferably attachments 78 in the spreading plough 43 for the support wheel 60, between which the support wheel 60 is supported. The spreading plough 43 can be pivoted to the front frame 12 with the aid of the pivot shaft 79 visible in Figure 9.

With the aid of the feed silo's 15 shaping and the spreading plough 43 it has been sought to reduce segregation of the crushed gravel appearing in the spreading device 10. As a result of segregation, the rougher material tends to flow along the surface and accumulate and block the throat opening. Segregation is also detrimental in terms of the quality of the work.

According to one embodiment, the gap between the front frame and the rear frame can include at least one horizontally installed throat operating device for regulating the throat by moving the front frame telescopically relative to the rear frame on the horizontal plane. There is preferably one throat operating device on each side of the spreading device. The throat operating device can be attached at one end to a guide attached to the rear frame and, at the other end, to the front frame. With the aid of the throat operating device, the distance between the front frame and the rear frame, and, at the same time, the volume of the feed silo can be adjusted telescopically. The adjustment margin in the horizontal direction can be a total of about 50 cm.

In the embodiment of Figures 1a - 8, the front frame 12 and the rear frame 14 are preferably permanently attached to each other, so that the spreading device 10 can be implemented without separate throat operating devices and guides between the front frame and the rear frame. Thus it is possible to save as much as hundreds of kilos in the weight of the spreading device.

Figures 2a - 3 also show the adjustable side guides 44 belonging to the spreading device 10, attached to the front frame 12 at the sides of the spreading blade 18 of the rear frame 14, to delimit the lateral spreading of the mass to the selected width. The side guides 44 are preferably pivoted to the front frame 12 and the rear frame 14 with the aid of pivot arms 46, which permit an accordion-like movement in the side guides 44 in the lateral direction of the spreading device 10. With the aid of the side guides 44, the working width of the spreading device 10 can be adjusted by as much as 2 m. The adjustment of the side guides 44 takes place with the aid of widening operating devices shown in Figures 2b and 4b. The side guides 44 can include, according to Figure 5, skirt plates 72, which run close to the base surface 80, keeping the edge of the mass under control. Wheels (not in the figures) are preferably mounted in bearing in the undersurfaces of the side guides, and run on the base surface, at the same time moving vertically according to unevennesses in the base surface. Thanks to this vertical movement, the side guides 44 move continuously slightly in their guides 77, thus preventing the side guides 44 jamming in their guides. Thus, the side guides remain always in operating condition and can follow the shapes of the base surface effectively. The adjustable side guides are also an advantage during transportation, when lifting the spreading device, and when starting moving. The side guides 44 are preferably about 100-cm wider than the front and rear frame 12 and 14 when spreading the mass, but in the transportation position are closed onto the front frame 12 and rear frame 14.

When spreading the mass, the amount of mass fed to the maximum working width of the spreading device should be greater, in order to achieve the desired layer thickness. With wide and thick mass layers, the tilted front wall 62 of the rear frame 14 shown in Figure 3 permits a greater volume of the throat, when the mass becomes thicker and suffices better at the sides of the spreading device. In spreading devices of the prior art, there has been the problem that at maximum width there is not sufficient mass, so that the layer thickness remains thinner. With the aid of the tilted front wall of the rear frame, the volume of the feed silo can be increased, when the problem is reduced or even eliminated. The tilt of the front wall can be at least 10° , preferably $15 - 35^\circ$, relative to the perpendicular to the road surface and the rear wall is preferably continuously tilted up to the level of the upper surface of the side guides. The tilted front wall of the rear frame also permits the truck's body to be tipped in such a way that the corner of the body does not touch on the spreading device's rear frame.

The spreading device's front frame 12 preferably includes control operating devices 22 for controlling the height of the rear frame 14 relative to the front frame 12, according to Figure 8. Hydraulic cylinders 65, which can be more clearly seen in Figure 8, preferably act as the control operating devices 22. The thickness of the mass layer 90 spread by the spreading device 10 is regulated by adjusting the height of the spreading blade 18, by altering the vertical positioning of the front frame 12 and the rear frame 14. According to Figures 1a and 1b, the support wheels 50 of the front frame 12 and the support wheel 60 of the spreading plough 43 travel on the base surface 80.

The spreading blade 18 can be adjusted in its entirety about 40 cm vertically by altering the height of the rear frame relative to the front frame. Figure 1a shows the situation in which the rear

frame 14 is at its maximum height and Figure 1b at its minimum height. By means of a spreading device according to this embodiment, the thickness of the mass layer can be 1 cm at a minimum and 40 cm at a maximum. 50 cm is, in practice, the limit of the layer thickness, which can, within acceptable limits, be spread at one time in connection with normal road construction. Greater layer thicknesses and, by them, also greater adjustment margins, can be possible in some embodiments intended for the exceptional use of the spreading device. In other words, the minimum and maximum values can vary according to different embodiments of the spreading device. The spreading blade 18 is preferably permanently attached to the rear frame 14.

The mass layer, spread to from a suitable layer with the aid of the spreading blade 18, can be compacted with the aid of the loadable roller wheel 20 visible in Figures 1a - 2b, 5, 6, 8, and 9. The roller wheel 20 is fitted to the rear frame 14 after the spreading blade 18, in the direction of travel of the spreading device 10, where the roller wheel compacts the spread mass. The roller wheel 20 is preferably the width of the throat 16 of the spreading device 10, and can consist of one, or according to Figure 5 of several short cylindrical parts. The roller wheel 20 is preferably attached to vertical guides 64 in the rear frame 14, according to Figure 9, so that the roller wheel 20 can be moved in the guides in a direction perpendicular to the spread mass. The roller wheel 20 can be loaded by loading the axle, with the aid of which the roller wheel 20 is slidably attached to the guides 64.

By using the hydraulic cylinders 34, visible in Figure 6, as the loading operating devices 24, the loading of the roller wheel 20 can be adjusted automatically or manually as required. The term loading refers to the fact that the roller wheel is pressed in the guides towards the surface of the mass layer using an external

force. Each of the loading operating devices 24 can be attached at one end, for example, to the transverse beams 68 or vertical beams 66 of the rear frame 14 and at the other end to the axle of the roller wheel 20. Other operating devices suitable for the purpose can also be used to load the roller wheel, for example, threaded rods or similar mechanical loading means. With the aid of loading, the spread mass layer coming from the spreading blade can be pressed into a more compact agglomeration, which can thin the final thickness of the mass layer.

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In the control of the loading of the roller wheel, control valves, for example, can be used, which pass a flow of hydraulic oil to the hydraulic cylinders. The control of the valves can be manually or electrically implemented. Control takes place preferably with the aid of the control computer of the spreading device, which in turn utilizes the measurement means' data for controlling the loading.

The spreading device according to the invention includes, in addition, measuring means located in front of the front frame and the gap of the roller wheel, with the aid of which the shapes of the base surface are measured continuous to create measurement data. The roller wheel is preferably arranged to be loaded on the basis of the measurement data of the measuring means, in such a way that the result achieved is the even desired layer thickness. The spreading device is preferably controlled by software, in which case the spreading device includes a control computer and its user interface, from which the target thickness of the mass is set. The measuring means measure the shape and height of the base surface and the thickness of the spread mass layer. The measuring means transmit the data to the control computer, which by means of software adjusts the height of the rear frame, in such a way that the result obtained is a spread mass layer according to the target.

Ultrasound sensors, which measure precisely the shape, i.e. the height variations of the base surface, are preferably used in the measuring means. The ultrasound sensors send ultrasound waves
5 towards the base surface of the road and measure the distance to the base surface on the basis of the waves reflected back. The ultrasound sensors are preferably located in front of the front frame on both sides of the device, from where they can measure the base surface on which the spreading device is arriving. In
10 addition, at least one ultrasound sensor is preferably fitted between the roller wheels, from where it measures the distance of the spread mass layer from the ultrasound sensor. Thus, on the basis of the difference between the heights of the base surface and the spread mass layer information is obtained on the thickness
15 of the spread mass layer.

The adjustment operations of the spreading device can be controlled, in addition to ultrasound sensors, by means of generally known technologies, such as, for example, GPS, lasers,
20 or tachometers, so that the control of the height of the spreading blade according to the designed shapes takes place automatically. The adjustments can also be performed manually. The measuring means can also include a pulse sensor fitted to the outer surface of the axle of the roller wheel, which measures the number of
25 rotations of the roller wheel and in this way the distance travelled by the spreading device. Thus, on the basis of a trip program programmed into the control computer, the control computer can adjust the layer thickness of the spread mass automatically according to a selected distance. Instead of ultrasound sensors,
30 for example a rod potentiometer, or laser device, or some similar device can be set to control the layer thickness, in which case control of the layer thickness or surface height takes place automatically through the work machine's own hydraulics. The location of the spreading device is preferably monitored

continuously with the aid of GPS and its own profile for the work to be performed is set in the control computer for the distance spread, from which on the basis of the position data the control computer controls the control operating devices with the aid of
5 the ultrasound sensors' data.

In Figures 2a - 4b and 7, a slot 76 can be seen in the middle of the front frame 12, which permits a truck to back onto the spreading device without the coupling 108 of the truck 102 touching on the
10 front frame 12 of the spreading device 12 (in Figures 1a and 1b). The dimensions of the spreading device can vary according to the application. The width of the front and rear frames of one embodiment is 3.2 m, the height about 1.2 m, the total length of the spreading device with the throat in the minimum position 3.7
15 m, and the length of the throat a minimum of 0.95 m. The length of the vertical part of the spreading blade can be, for example, 0.30 m and the length of the horizontal part 0.40 m. The height of the spreading device can be 1.1 m.

20 Figure 9 shows the spreading blade 18 in greater detail. The spreading blade is preferably formed from an L-shaped profile 26, which includes preferably a vertical part 36 and a part 28 in the longitudinal direction of the spreading device 10, which are attached to each other. The term vertical part refers to the part,
25 which is perpendicular relative to the road surface in the operating position of the spreading device. The longitudinal part is essentially horizontal in the operating position of the spreading device. The profile 26 is attached to the rear frame 14 to the lower edge in front of the rear frame 14. The length of the
30 horizontal part is at most 5 - 20 % of the greatest width of the spreading device, so that the horizontal part of the spreading blade does not form too great a surface area that would resist the vertical adjustment movements of the rear frame. For example, in a 3.2-m wide rear frame, the length of the spreading blade in the

longitudinal direction of the spreading device can be in the order of 40 cm. The length of the vertical part is preferably essentially the same as the length of the horizontal part. When using the profile, the spreading blade can be implemented without separate spreading-blade reinforcements. The L-shaped profile can be straight and thus extremely stiff and durable. The tilted rear wall 62 of the throat 16 is attached to the vertical part 36 from above.

The thickness of the spreading blade can be about 1 - 3 cm and it forms partly the wall of the throat delimiting to the rear frame. According to Figure 9, the longitudinal part 28 of the spreading blade can be thicker than the vertical part 36, as the longitudinal part 28 is subject to greater wear from contact with the road surface. The resistance opposing the adjustment of the spreading blade of the spreading device according to the invention is considerably smaller than that of spreading devices according to the prior art equipped with a large horizontal spreading blade, so that adjustment of the height of the spreading blade can be performed quickly and precisely. According to Figure 9, the front frame 12 and the rear frame 14 are fitted together with a gap d , in order to form the throat 16. The magnitude of the gap d depends on the capacity required in the spreading device.

Figures 10a - 12 show a second embodiment of the spreading device according to the invention. In this embodiment, the front frame 12 and the rear frame 14 are fitted together with the aid of telescopic guides. In addition to the guides, the spreading device can include a throat operating device, with the aid of which the distance between the front frame 12 and the rear frame 14 can be adjusted from a short position according to Figures 10a and 11a to an extended position according to Figures 10b and 11b. With the aid of adjustment, the size of the throat 16 can be adjusted as required, so that segregation of the road-construction material can be avoided. The throat operating device is not shown in the

figures, but the throat operating device or throat operating devices can be situated inside the beams 52.

In addition to the telescopic guides, the second embodiment of the spreading device according to the invention of Figures 10a - 12 also differs in the construction of the side guides 44 from the embodiment of Figures 1a - 9. According to Figure 12, the side guides 44 form a box structure 44.2, which is open on its lower edge, and a wall structure 44.1, the upper part of which enters the box structure 44.2, according to Figures 10a and 10b. The side guides in the embodiment of Figures 1a - 9 are also similar in this respect. According to Figure 12, the vertical ends 44.6 of the plate-like wall structure 44.1 are curved, so that, when one edge rises along with an unevenness in the ground, the wall structure 44.1 can rotate around its centre point. The curved edge permits tilting and a smaller friction surface between the box structure 44.2 and the wall structure 44.1. Thus the wall structure's 44.1 jamming in place in the box structure 44.2 is considerably less likely due to, for example, dirt. Thus, the side guides follow the road base more reliably and mass cannot spread from under the side guides, which minimizes material waste.

In this connection, the term curved refers to the fact that the plate-like wall structure 44.1 includes ends 44.6 and an upper edge 44.3 and lower edge 44.4 between them, which are essentially parallel to the longitudinal direction of the spreading device 10. If a centre line 44.5 is imagined between the upper edge 44.3 and lower edge 44.4, it is preferable that at least one end 44.6 is curved in such a way that the length of the plate-like wall structure 44.1 in the longitudinal direction of the spreading device shortens from the centre line 44.5 towards the upper edge 44.3 or lower edge 44.4. In other words, the rotation axis of the curvature of the said ends 44.6 is perpendicular to the plane of

the plate-like wall structure at the centre point of the plate-like wall structure 44.1.

5 In the case of its front and rear frames, the spreading device according to the invention is preferably made of sufficiently strong steel. For its part, the roller wheel can be rubber. In connection with the roller wheel there can also be vibration means, which boost the roller wheel's compacting effect on the mass layer.

10 Because the spreading device is attached in front of the work machine and is preferably pushed, the work machine can be any work machine whatever suitable for the task, in which there are lifting devices. Being pushed also brings the advantage that the truck need not drive on top of the mass layer being spread. With the aid of
15 alterations, the spreading device can also be made to be towed.

The particle size of the mass being spread by the spreading device according to the invention can be 0 - 150 mm, preferably 0 - 31 mm or 0 - 56 mm for crushed gravel, which means that the size
20 distribution of the mass to be spread varies within this range. Gravel, which has a particle size of 11 - 45 mm and 25 - 55 mm, can also be spread using the device according to the invention. The usual layer thickness being spread can be 10 - 20 cm. The spreading device's width can be 3.5 - 4.9 m, and length 3.3 - 4.9
25 m, but it should be understood that the device's dimensions can vary according to the application.

Catchers, by which the spreading device is connected to the preceding truck, can also be used in the spreading device.

30

The spreading device can be used primarily for spreading a road-construction mass such as gravel or crushed gravel, but it can also be used in other, corresponding applications.

CLAIMS

1. Spreading device for a road-construction mass substance, which is arranged to be attached to a work machine (100), which spreading device (10) includes
- a front frame (12) arranged to receive the road-construction mass substance (90),
 - a rear frame (14), attached at a distance (d) to the front frame (12), for spreading the road-construction mass substance (90),
 - a spreading blade (18) fitted to the rear frame (14), for delimiting the road-construction mass substance (90) to form a layer on the surface of the road (92),
 - a roller wheel (20) fitted to the rear frame (14), for compacting the spread road-construction mass substance (90), and
 - control devices (22) for adjusting the distance between the spreading blade (18) and the road (92) surface.
- characterized in that the said spreading blade (18) includes a part (28) in the longitudinal direction of the spreading device (10), which is in length 5 - 20 % of the greatest width of the spreading device (10) and the spreading device (10) includes a loading operating device (24) for loading the said roller wheel (20).
2. Spreading device according to Claim 1, characterized in that the spreading device (10) further includes measuring means for measuring the surface before and after the spreading of the road-construction mass substance (90) and creating measurement data, on the basis of which measurement data the roller wheel (20) is arranged to be loaded, to compact the spread layer of road-construction mass substance (90).
3. Spreading device according to Claim 1 or 2, characterized in that the said control operating devices (22) are arranged to

use the data of the measuring means for evening the layer of road-construction mass substance (90) automatically by moving the rear frame (14) vertically.

5 4. Spreading device according to any of Claims 1 - 3, characterized in that the said roller wheel (20) is arranged to carry essentially the entire weight of the rear frame (14), to reduce the resistance caused to the spreading device (10).

10 5. Spreading device according to any of Claims 1 - 4, characterized in that the said rear frame (14) includes an end (38) next to the front frame (12), which is at least partly tilted away from the front frame (12), to increase the throat (16).

15 6. Spreading device according to Claim 5, characterized in that the end (38) is tilted by at least 10°, preferably by 15 - 35° to increase the capacity of the spreading device.

20 7. Spreading device according to any of Claims 1 - 6, characterized in that the profile (26) also includes a vertical part (36) arranged to form part of the end (38) of the rear frame (14) next to the front frame (12).

25 8. Spreading device according to any of Claims 1 - 7, characterized in that the said longitudinal part (28) is attached to the surface of the vertical part (36) and rear frame (14) coming against the road-construction mass substance (90), the length of which longitudinal part (28) is at most 10 % of the height of the rear frame (14).

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9. Spreading device according to any of Claims 1 - 8, characterized in that the said spreading device (10) further includes a spreading plough (43), equipped with wheels, pivoted

to the front frame (12) inside the said throat (16), to prevent the arching of the road-construction mass substance (90).

10. Spreading device according to any of Claims 1 - 9,
5 characterized in that the said spreading device (10) further includes side guides (44) forming sides of the throat (16) in the gap between the front frame (12) and the rear frame (14), to delimit the road-construction mass substance (90) from the sides.

10 11. Spreading device according to Claim 10, characterized in that the said spreading device (10) includes pivot arms (46) for pivoting the side guides (44) to the front frame (12) and rear frame (14), to permit adjustment of the width of the throat (16).

15 12. Spreading device according to Claim 10 or 11, characterized in that the aid side guides (44) are supported on the road (92) surface with the aid of wheels belong to the side guides (44).

13. Spreading device according to any of Claims 10 - 12,
20 characterized in that each said side guide (44) includes a box structure (44.2) and a plate-like wall structure (44.1) fitted inside the box structure (44.2) and arranged to move freely perpendicularly to the ground according to the ground's unevennesses.

25

14. Spreading device according to Claim 13, characterized in that the said plate-like wall structure (44.1) includes two ends (44.6) essentially perpendicular to the ground surface, an upper edge (44.3) and a lower edge (44.4) between them, and a centre line
30 (44.5) between the upper edge (44.3) and the lower edge (44.4) and parallel to the upper edge (44.3) and the lower edge (44.4), of which at least one end (44.6) is curved in such a way that the length of the plate-like wall structure (44.1) parallel to the longitudinal direction of the spreading device (10) increases from

the lower edge (44.4) or the upper edge (44.3) towards the centre line (44.5).

15. Spreading device according to any of Claims 1 - 14,
5 characterized in that the said spreading blade (18) is fitted permanently to the rear frame (14).

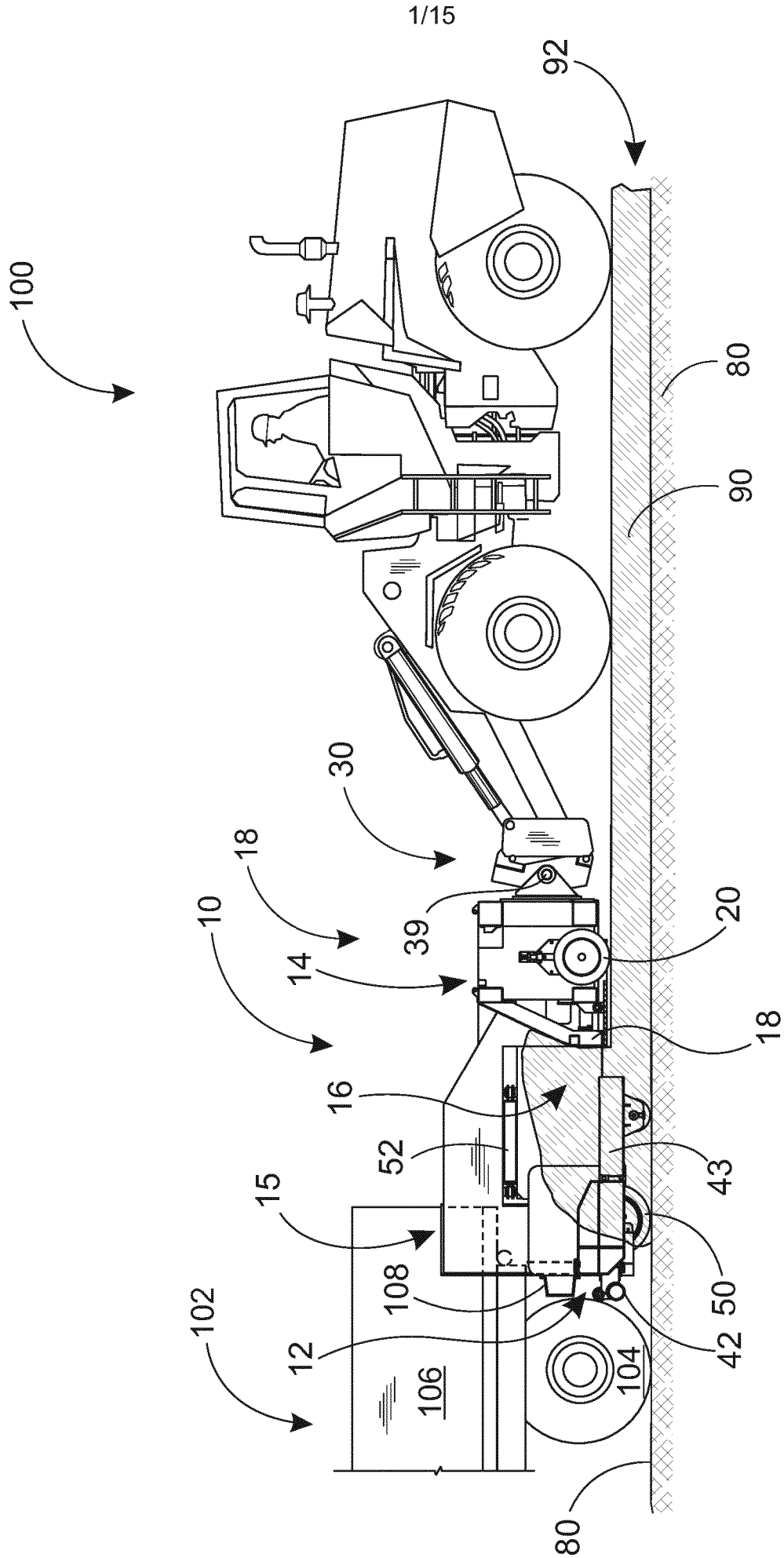


Fig. 1a

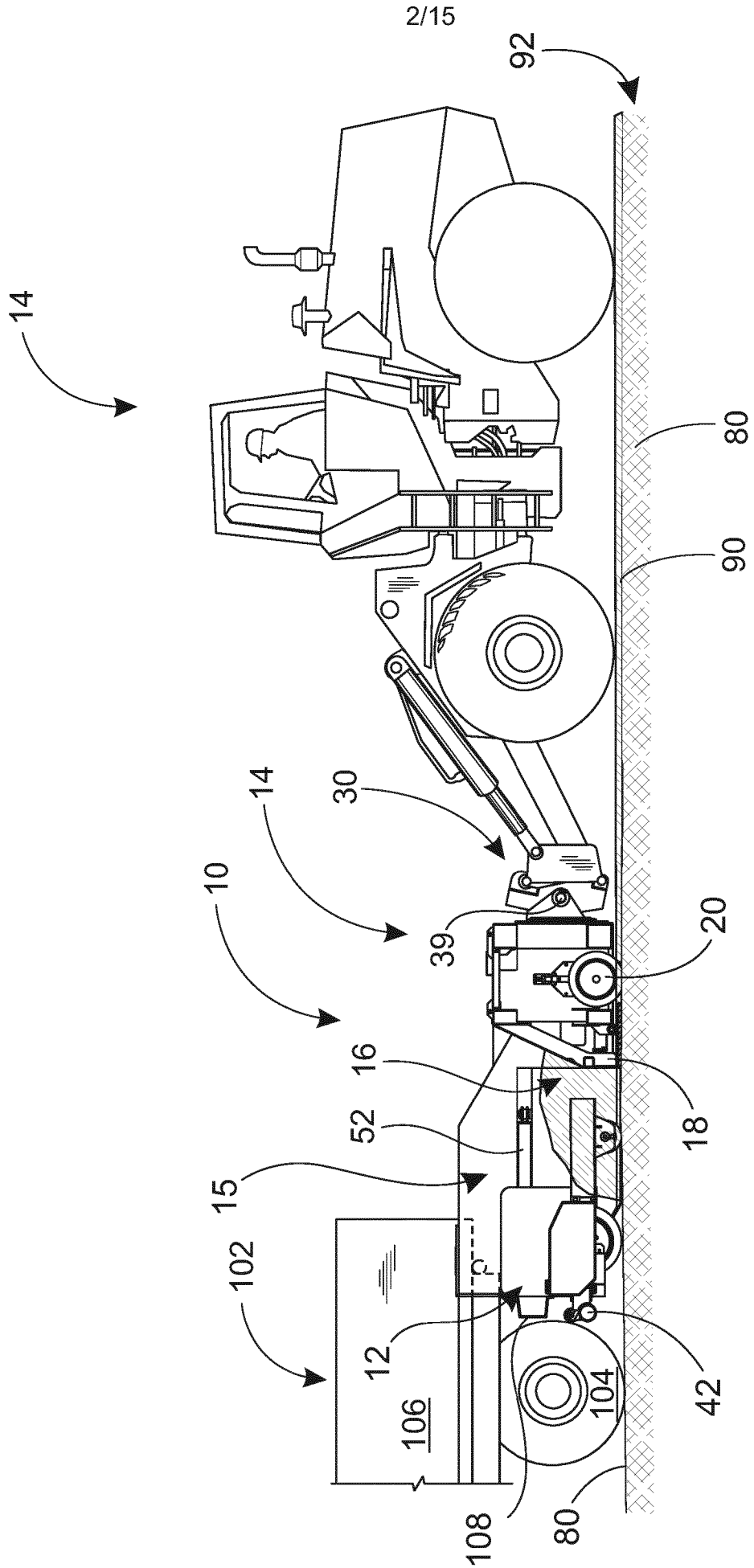


Fig. 1b

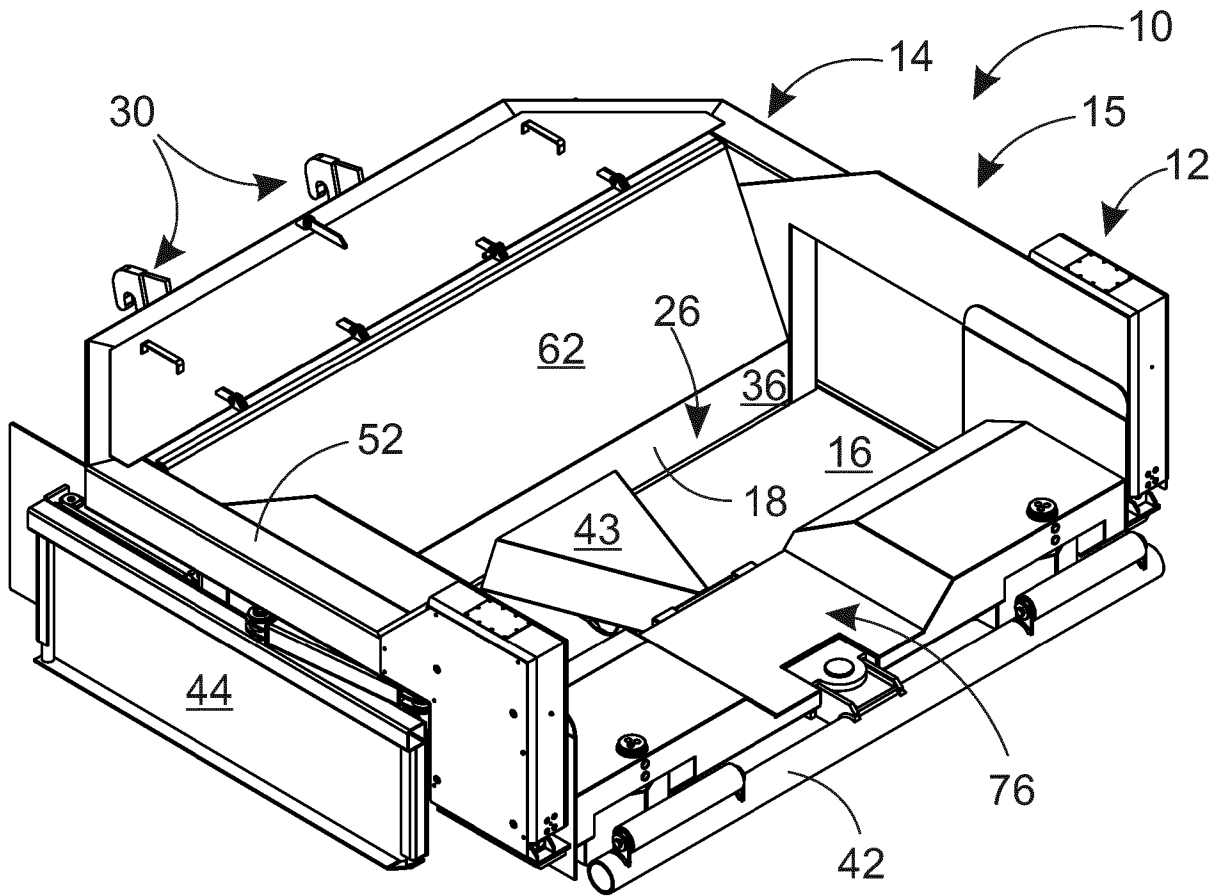


Fig. 3

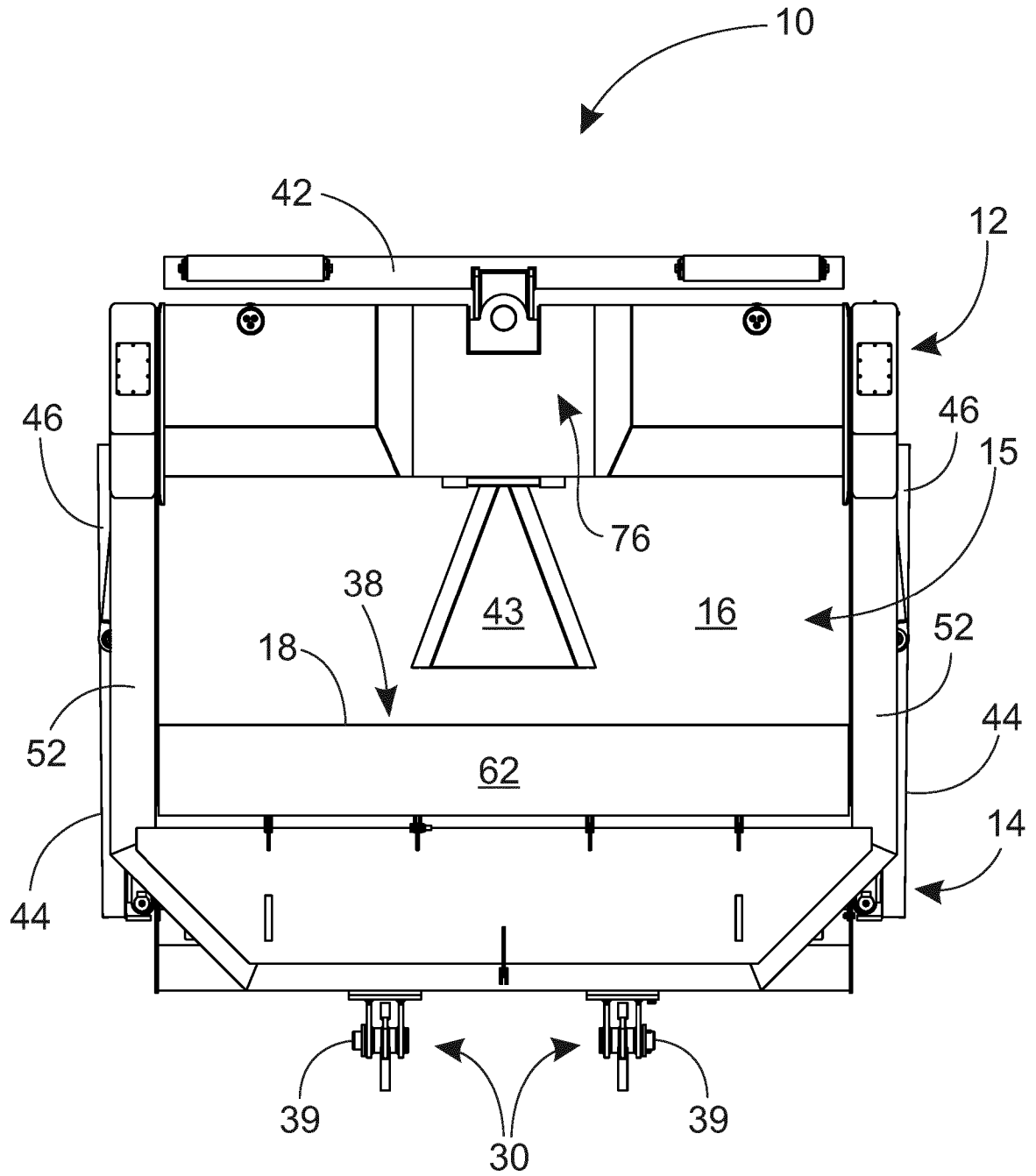


Fig. 4a

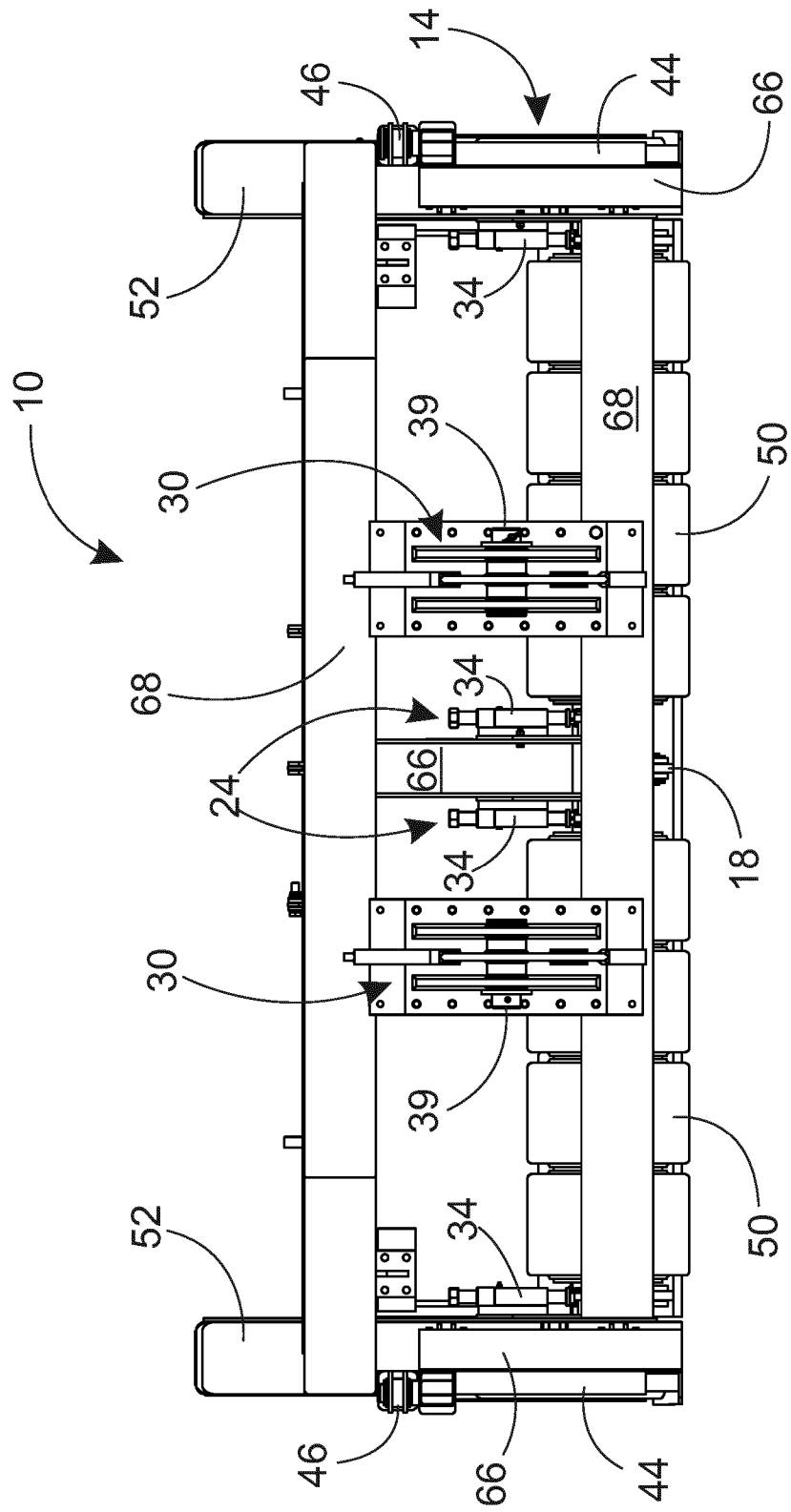


Fig. 6

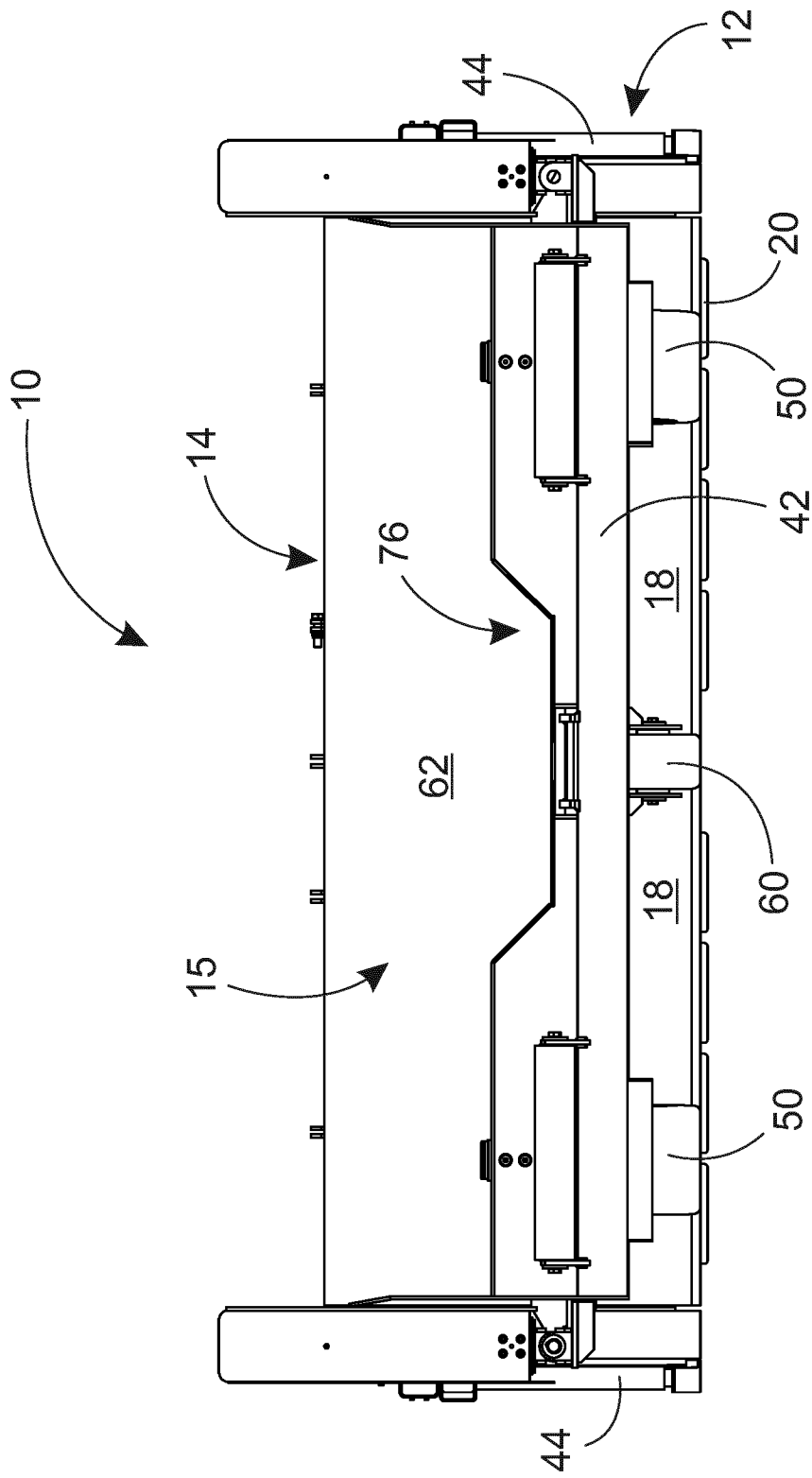


Fig. 7

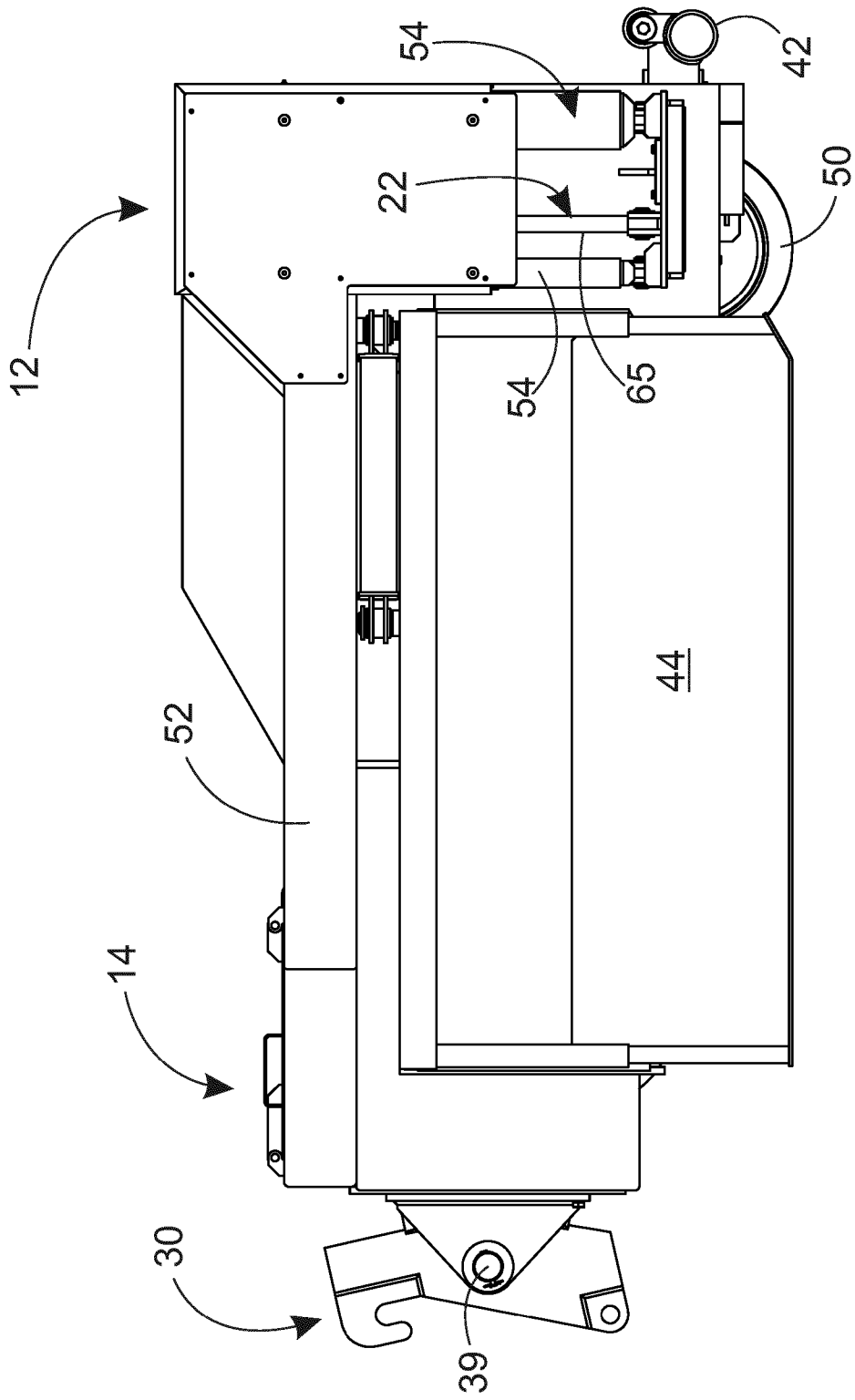


Fig. 8

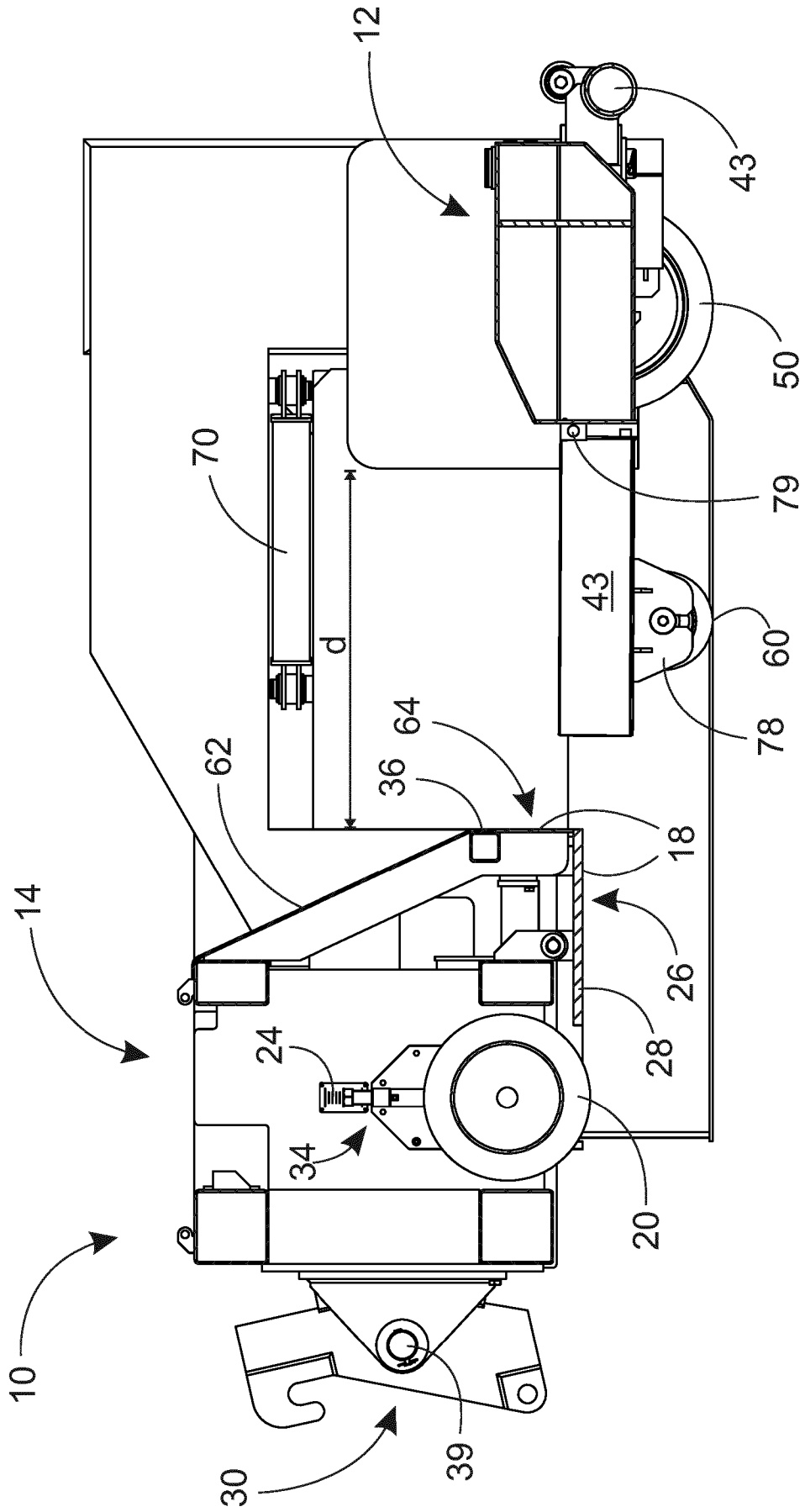


Fig. 9

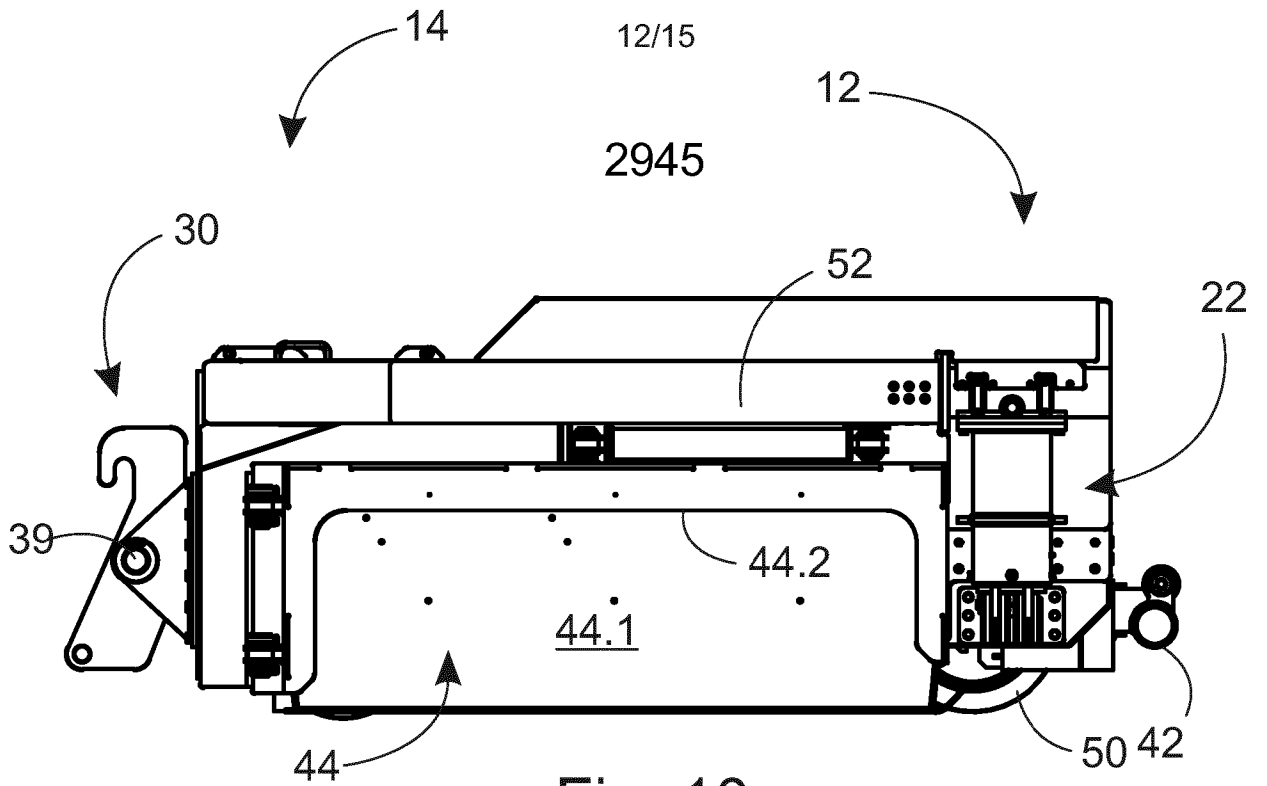


Fig. 10a

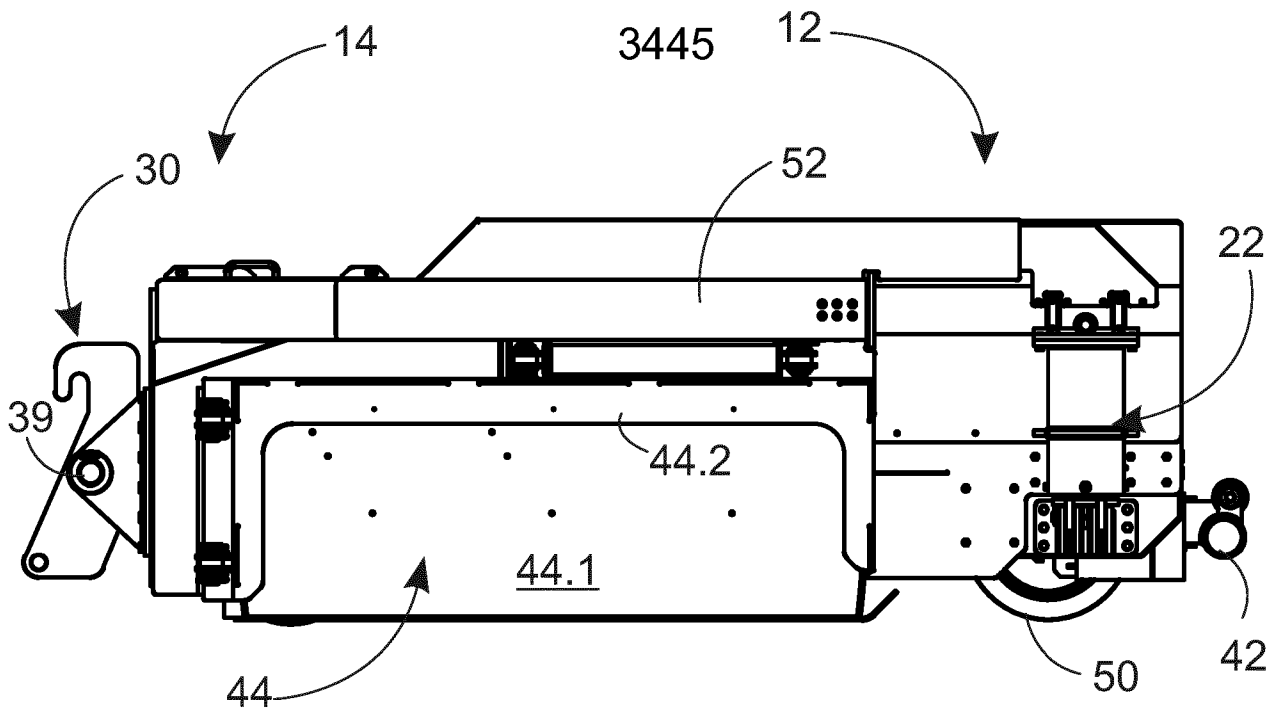


Fig. 10b

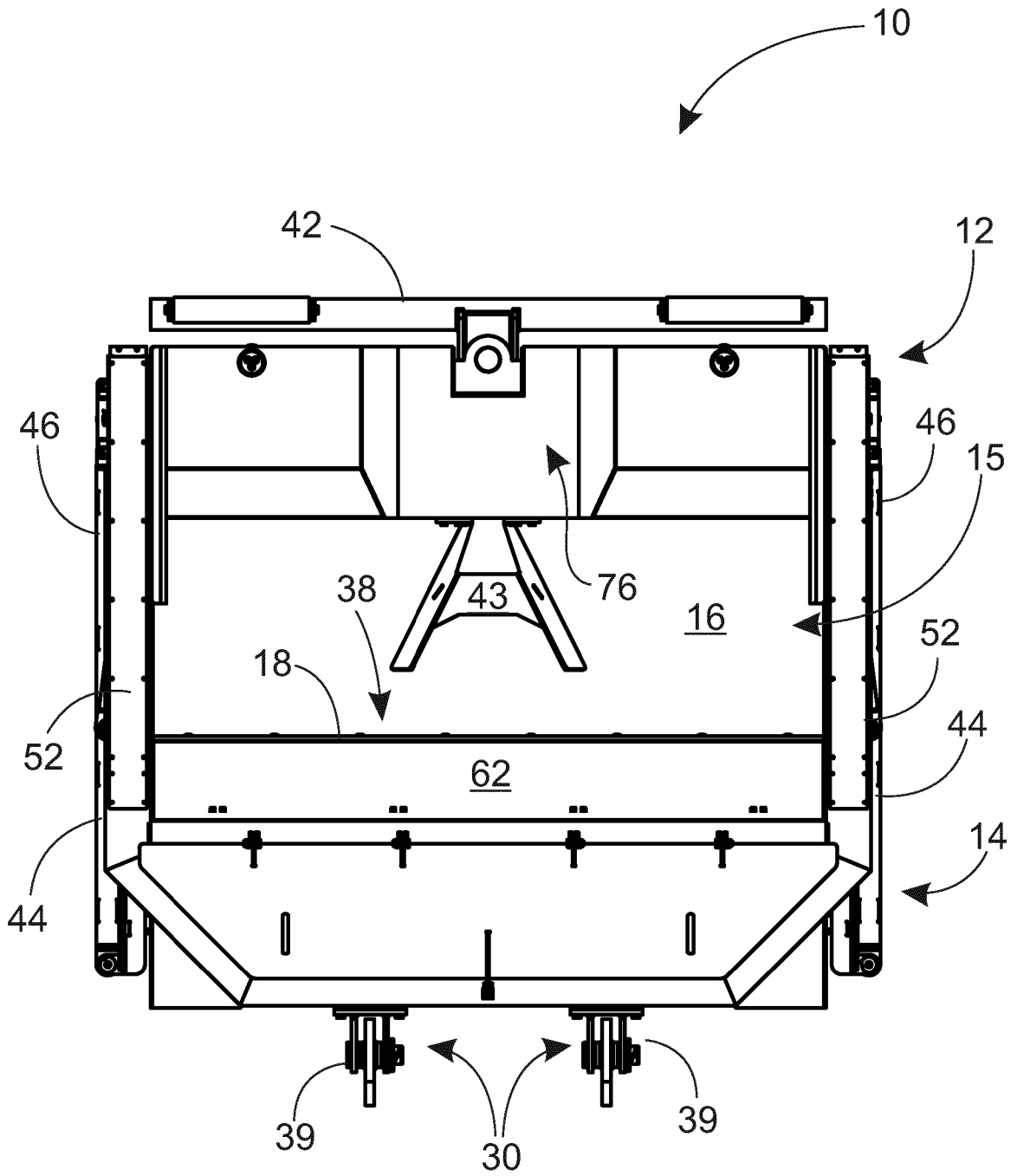


Fig. 11a

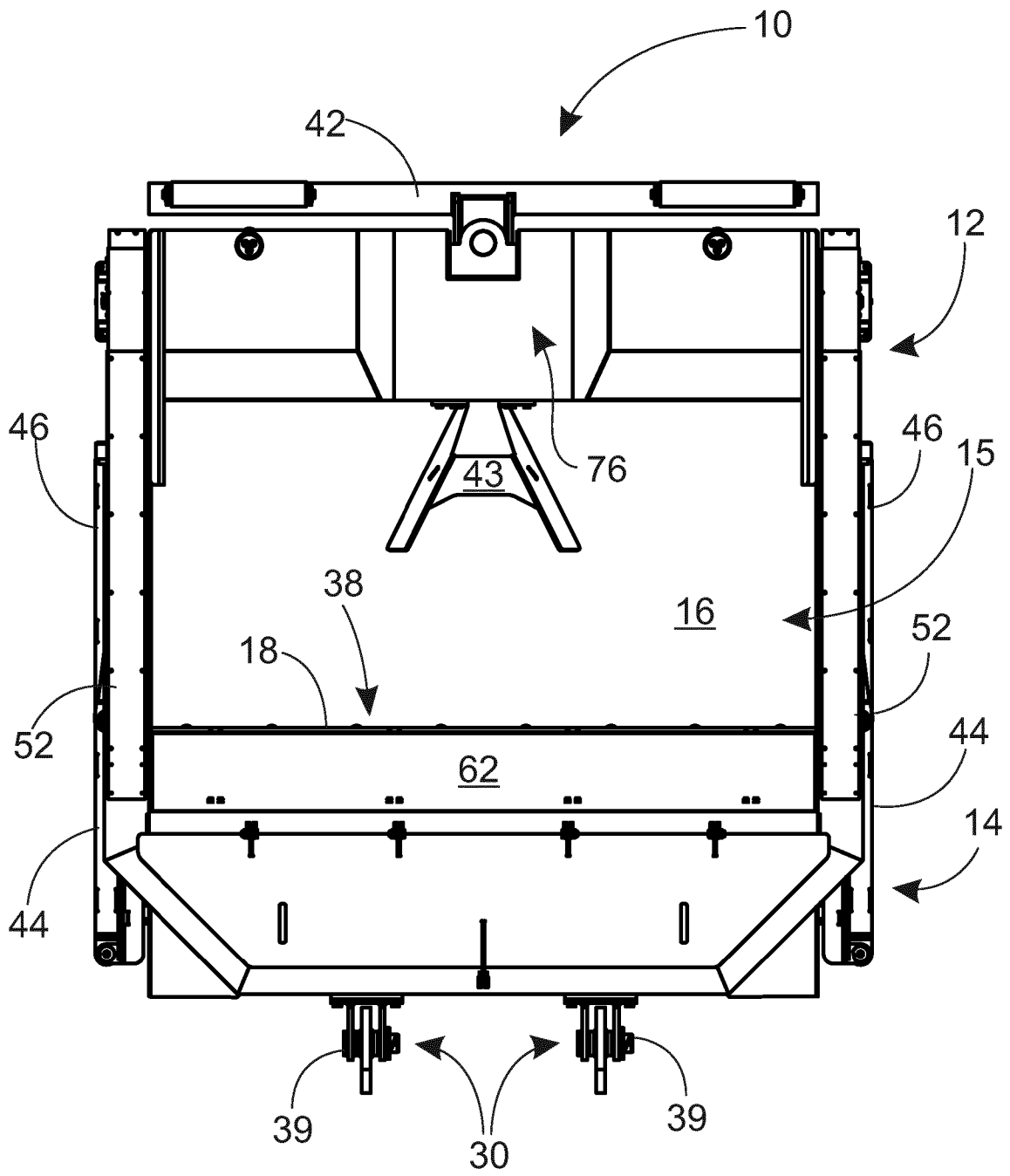


Fig. 11b

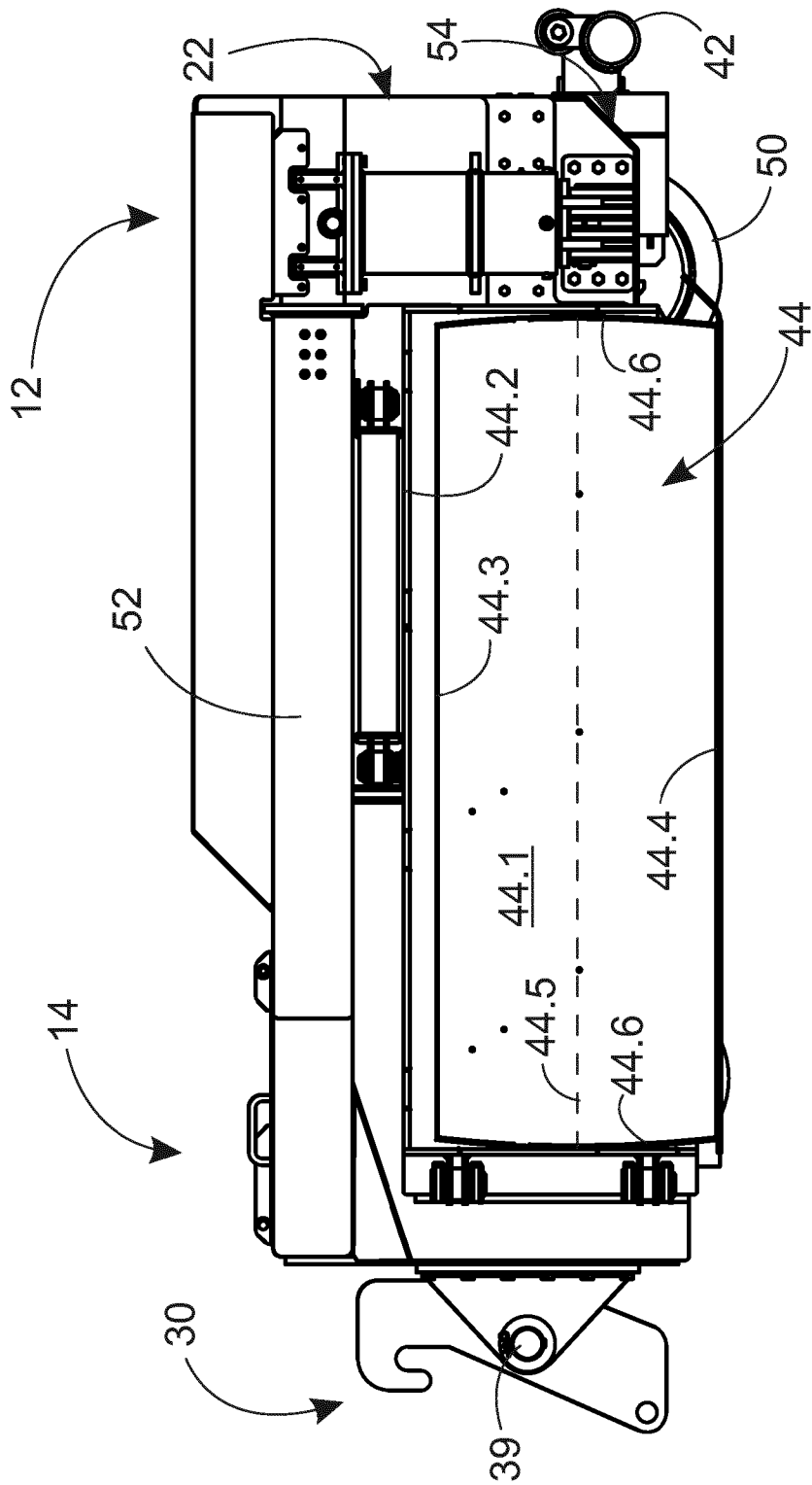


Fig. 12

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2016/050354

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: E01C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base, and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	FI 122903 B (EPT KONE JA LAITE OY [FI]) 31 August 2012 (31.08.2012) figures 1c and 4; page 7, lines 8-32	1-15
A	JP H1136220 A (GAIAATO KUMAGAI KK) 09 February 1999 (09.02.1999) figure 1; machine translation into English by ThomsonReuters, chapter [0049]	1-15
A	CN 1269442 A (GOU HONGXIA [CN]) 11 October 2000 (11.10.2000) figure 3; English translation in database TXPCNEA/EPO, detailed description of figure 3	1-15

 Further documents are listed in the continuation of Box C.
 See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

26 August 2016 (26.08.2016)

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT
Information on Patent Family Members

International application No.
PCT/FI2016/050354

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CLASSIFICATION OF SUBJECT MATTER

IPC
E01C 19/20 (2006.01)
E01C 19/48 (2006.01)
E01C 19/15 (2006.01)
E01C 3/00 (2006.01)