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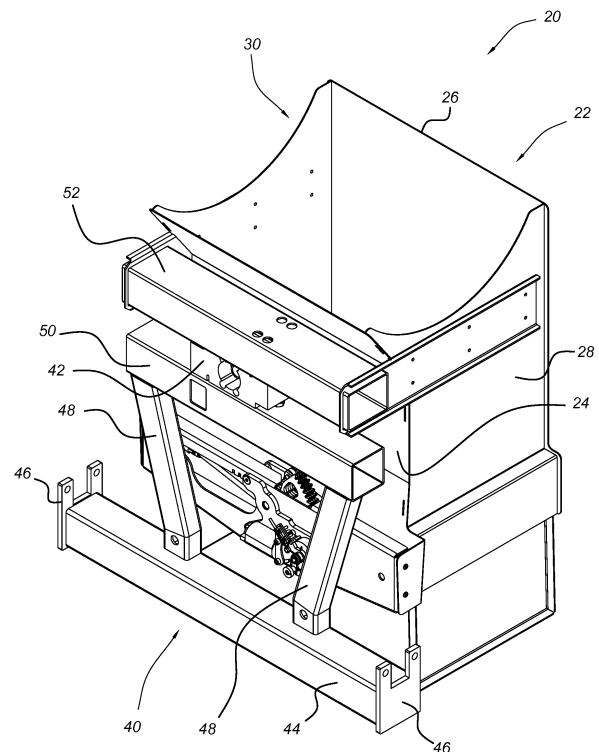
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(54) **MODULAR WEIGHING UNIT FOR WASTE COLLECTION SYSTEM**

(57) A waste collection system (10) comprises a base (14), a collection unit (16) beneath the base (14) for storing waste, a waste receiving unit (12) supported on top of the base (14) and comprising a cylindrical rotary drum (18) for receiving the waste; and a weighing unit (20). The weighing unit (20) comprises a housing (22) defining a collection chute for receiving waste from the rotary drum (18); one or more movable flaps (34) connected to the housing (22), moveable to a closed position for weighing waste and an open position to allow waste through the housing (22) to the collection unit (16); a frame (40) for connecting the weighing unit (20) to the waste collection system base (14); and a load cell (42) connecting the housing (22) to the frame (40). The housing (22) is configured to fit within the waste receiving unit (12) and comprises a top portion (30) complementary in shape to the rotary drum (18) such that the top portion (30) aligns close to but not connecting to the rotary drum (18).

Fig. 2A



Description

Field of the invention

[0001] The present invention relates to a weighing unit for a waste collection system that includes a cylindrical rotary drum.

Background art

[0002] Waste collection system with a cylindrical rotary drum typically include a waste receiving unit above ground sitting on a base, and a large collection unit beneath the base. The waste receiving unit receives waste through a double-barrelled cylindrical rotary drum, which ensures that the collection unit is closed off when the rotary drum is open to receive waste, and that the rotary drum is closed when the waste is free to move to the collection unit beneath the base. Such a collection system can work well to store a large amount of waste between emptying while ensuring the waste already collected is not subject to environmental forces or access by, for example, birds or other animals which may get into the waste and spread it elsewhere.

[0003] Such a waste collection system is typically emptied by a large truck or crane which secures to a feature on the top of the waste receiving unit and moves the receiving unit, base and collection unit vertically such that all are above the ground. The movement then takes the entire system above a truck or other container, and opens doors at the base of the collection unit to release the collected waste. Then then doors are closed, and the collection unit is returned to the underground position, with the base and waste receiving unit sitting above ground.

Summary

[0004] According to a first aspect of the invention, a weighing unit for a waste collection system is provided. The waste collection system comprises a base, a collection unit beneath the base for storing waste, and a waste receiving unit supported on top of the base and comprising a cylindrical rotary drum for receiving the waste. The weighing unit comprises a housing defining a collection chute for receiving waste from the cylindrical rotary drum; one or more movable flaps connected to and movably disposed within the housing, moveable to a closed position for weighing waste and an open position to allow waste through the housing to the collection unit; a frame for connecting the weighing unit to the waste collection system base; and a load cell connecting the housing to the frame. The housing is configured to fit within the waste receiving unit and comprises a top portion complementary in shape to the rotary drum such that the top portion aligns close to but not connecting to the rotary drum.

[0005] Such a weighing unit allows for accurate weighing of waste in a rotary drum waste collection system by

forming a weighing unit which can fit free-standing inside the waste collection unit only connecting to the base, and aligns with the rotary drum at a top portion of the housing. The alignment and complementary shape of the top portion of the housing allow the weighing unit to work with the rotary drum waste collection system, and the ability to only connect to the base allows the weighing unit to perform very accurate weight measurements.

[0006] According to an embodiment, the frame comprises a base beam with one or more connection devices for connecting the base bar to the waste receiving unit base; a connecting beam for connecting the frame to the load cell; and one or more legs connecting the base beam to the connecting beam. Such a frame can form a stable connection between the weighing device and waste collection system base, allowing for stable freestanding within the waste collection unit and therefore very accurate weight measurements.

[0007] According to an embodiment, the one or more connection devices comprises a connection plate on each end of the base beam for connecting to the waste receiving unit base. The connection plates can connect to the base, for example an underside of the base and/or a base girder by any suitable connection means. This could include bolts, welding, etc.

[0008] According to an embodiment, the housing comprises a generally rectangular back wall; a front wall which connects to the frame; and side walls connecting the back wall and the front wall, the top portions of each side wall with a curvature to follow the curvature of the rotary drum. Optionally, the front wall extends outward at the top portion and/or at the bottom portion. By forming the walls of housing in such forms, housing can accurately align with rotary drum to ensure all waste from rotary drum is guided into the weighing unit.

[0009] According to an embodiment, the one or more movable flaps comprises first and second flaps connected to a motor drive unit for moving from the open position to the closed position and vice versa. Such a system can ensure waste is held stably in the weighing unit for weighing and then released into the collection unit when the weight measurement has been taken. The one or more flaps could also take other forms for closing the housing and selectively preventing waste from travelling through the housing to the collection unit. The motor drive unit for displacing the closure means with respect to one another is also preferably supported solely by the weighing unit.

[0010] According to an embodiment, the weighing unit further comprises a lock mechanism to releasably lock the one or more flaps in the closed position and/or releasably lock the load cell. This can ensure that the weighing unit is protected during operations where it is jostled around and may be subject to damage, for example, operations where the waste collection system is being emptied and/or connecting the weighing unit to the waste collection system.

[0011] According to a further aspect of the invention,

the weighing unit is part of a waste collection system with a waste collection unit with a rotary drum. Such a waste collection system can reliably and accurately weigh waste inserted.

[0012] According to an embodiment, the weighing unit connects to the base of the waste receiving unit and fits within the waste receiving unit such that the housing top portion follows the outline of the rotary drum at a distance of about [distance cm]. This ensure that the weighing unit is freestanding from the base beam and only connects to the other components of the waste collection system through the waste collection system base to provide more accurate weight measurements that are not influenced by other parts of the waste collection system and/or movements of the rotary drum.

[0013] According to a further aspect of the invention, a method of assembling a waste collection system with a waste collection unit comprising a cylindrical rotary drum for receiving the waste, a weighing unit for weighing waste, a base and a collection unit beneath the base for storing the waste is provided. The method comprises inserting a weighing unit housing into the waste receiving unit such that a housing top portion aligns close to but not connecting to the rotary drum; and connecting a frame of the weighing unit to the base of the waste collection unit, the weighing unit frame connected to the housing through the load cell. Such a method can allow for weight measurements on waste collection system with rotary drums. This method can be applicable to entirely new systems or can retrofit old rotary drum waste collection systems with the new ability to weigh waste entering the system.

[0014] According to an embodiment, the step of connecting a frame of the weighing unit to the base of the waste collection unit comprises connecting a base beam of the frame to an underside of the waste collection unit base. By connecting the frame only to the base of the waste collection unit, the weighing unit is able to be free-standing within the waste collection unit and thereby provide more accurate measurements.

[0015] According to an embodiment, the method further comprises calibrating the weighing unit. This can be done by, for example, putting a known weight into the weighing unit and making a weight measurement. Then the load cell can be adjusted to accurately reflect the known weight.

[0016] Some embodiments could include more than one load cell for accurate weight measurements.

[0017] According to an embodiment, recording means for recording the amount of waste on the basis of the weighing data supplied by the weighing unit can be provided. Said recording means may comprise a reading device for reading individualized user data. In addition, the recording means may be connected to a cost module for individually assigning costs or credit to users on the basis of the weighed amount of waste.

[0018] One or more sensors may also be provided for recording the closed position of the rotary drum of the

waste receiving unit. In this connection, it is also possible to provide regulating means connected to the sensor in order to permit the rotary drum of the housing to open only if the weighing unit is empty and/or the collection unit is not full.

[0019] According to an embodiment, the weighing unit can be solar and/or battery powered. Such a weighing unit allows for use in areas where electrical power is not otherwise available. Further, solar and/or battery power can provide for an economical waste collection system.

Short description of drawings

[0020] The present invention will be discussed in more detail below, with reference to the attached drawings, in which

Fig. 1A shows perspective view of a waste collection system.

Fig. 1B shows a perspective view of the waste collection system of Fig. 1A with a part of the waste receiving unit removed for viewing purposes.

Fig. 1C shows a close up view of part of Fig. 1B.

Fig. 2A shows a perspective view of a weighing unit for a waste collection system.

Fig. 2B shows a side view of the weighing unit of Fig. 2A.

Fig. 2C shows a front view of the weighing unit of Fig. 2A.

Description

[0021] Fig. 1A shows perspective view of a waste collection system 10, Fig. 1B shows a perspective view of waste collection system 10 with a part of the waste receiving unit 12 removed for viewing purposes, and Fig. 1C shows a close up view of part of Fig. 1B.

[0022] Waste collection system 10 includes waste receiving unit 12, base 14, collection unit 16 and weighing unit 20. Waste receiving unit 12 includes rotary drum 18 and pick-up point 19. Rotary drum 18 is a cylindrical double-barrelled rotary drum rotates from an open position in which waste can be inserted into drum 18 to a closed position (as shown in Fig. 1A), which waste can move from the drum toward the collection unit 16 beneath base 14. Waste collection system 10 is generally emptied by a large truck or crane connecting to pick-up point 19, and moving the entire waste collection system 10 vertically for emptying from a bottom of collection unit 16.

[0023] Weighing unit 20 includes housing 22 (with front wall 24, back wall 26, side walls 28, top portion 30 and bottom portion 32), moveable flaps 34 with journals 36, motor drive unit 38, frame 40 and load cell 42. Frame 40 includes base beam 44 with connection plates 46 on each end, legs 48 and connecting beam 50. An additional housing support frame 52 can be connected for connecting housing 22 to load cell 42.

[0024] Weighing unit 20 sits within waste collection unit

12, as shown in Fig. 1B, and connects to waste collection system 10 only through base 14. Specifically, connection plates 46 connect between base beam 44 of weighing unit 20 and an underside of base 14, through any suitable connection means, for example, welding or bolts. Weighing unit 20 is then freestanding from base beam 44, not connecting to any other component of waste collection system 10. Once inserted and connected to base 14, weighing unit 10 could be calibrated, for example, by placing known weights into weighing unit 20.

[0025] When frame 40 is connected to base 14, housing 22 sits inside waste receiving unit 12. Top portion 30 of housing 22 is complementary in shape to rotary drum and aligns close to but not connecting to rotary drum 18, as shown in Fig. 1B. The distance between then top of housing 22 and rotary drum 18 can be, for example 5-25 mm, or around 12 mm. Front wall 24 of housing extends outward at top portion 30 to form this complementary shape and ensure that all waste travels directly from rotary drum 18 into weighing unit 20, and none gets stuck or falls into another part of waste collection system 10. One or more walls 24, 26, 28 can extend outward at bottom portion 32 to ensure waste does not become trapped in housing 22 after weighing and when being released to collection unit 16.

[0026] Fig. 2A shows a perspective view of a weighing unit 20 for waste collection system 10, Fig. 2B shows a side view of weighing unit 10, and Fig. 2C shows a front view of weighing unit 10. The motor drive unit 7 is fastened to the lock means 5. The journals 14 of the two flaps 15, 16 are rotatably suspended from the front wall 9 and the rear wall 10, which journals are connected to the motor drive unit 7.

[0027] Frame 40 connects to housing 22 through load cell 42, which in the embodiment shown connects to housing 22 through beam 52. Motor drive unit 38 connects to and rotates journals 36 to extend or retract flaps 34. Weighing unit 10 can also include a locking system to lock flaps 34 in place for a waste collection system 10 emptying operation (as discussed in relation to Fig. 1A) and/or to releasably lock down and protect load cell 42 during an emptying operation. As discussed in relation to Figs. 1B-1C, the only connection between weighing unit 20 and other components of waste collection system 10 is the connection between frame 40 of weighing unit 20 and base 14.

[0028] As can be clearly seen in this picture, side walls 28 of housing 22 at least partially follow the arc of a circle to ensure they are complementary in shape to rotary drum 18. Front wall 24 extends outward, and back wall 26 is rectangular and extends generally planar but higher than the other walls. While this embodiment is shown to be shaped in this form, housing 22 top portion 30 could take other forms as long as it is shaped to align complementary to rotary drum 18 without touching rotary drum 18. Similarly, frame 40 could take many different forms in connecting between load cell 42 and base 14.

[0029] Weighing unit 20 works by accurately weighing

waste inserted into waste collection system 10. Specifically, waste inserted into rotary drum 18 is delivered to weighing unit housing 22 upon the closing of rotary drum 18. Flaps 34 are held in a closed position by motor drive unit 38. Once waste is stably in chamber, which can be detected by, for example, a sensor, load cell 42 can accurately weigh the waste. The weight amount could be reported to a recording means and/or another system to record and/or report out the weight of the waste. Once an accurate weight measurement has been taken, the motor drive unit 38 can retract flaps 34 to allow waste to move into collection unit 16 below base 14.

[0030] By forming weighing unit 20, and particularly housing 22 complementary to rotary drum 18, and such that it will align close to but not actually touching when installed and only connecting weighing unit 20 to base 14, weighing unit 20 can provide accurate weight measurements for waste inserted into a rotary drum waste collection system. While past waste collection systems have included weighing units, none have been suitable or able to be used with a rotary drum waste collection system. Weighing unit 20 overcomes this issue by designing all components such that they can both fit within a standard rotary drum waste collection system 10 while being freestanding (only connecting to base 14) to provide an accurate weight reading for the waste inserted. Further, the locking system can help to protect weighing unit 10 and particularly load cell 50 during an emptying operation, which can jostle the entire waste collection system 10.

[0031] The compact size of weighing unit 10 and shaping of housing 22 make it able to be used inside a waste receiving unit 12 with rotary drum 18. The connection only to base 14 ensures that no other parts of waste collection system 10 come into contact with weighing unit 20, making it better able to provide accurate readings. The close alignment of top portion 30 of housing 20 with rotary drum ensures that waste is properly guided into weighing unit 10 and does not fall outside of weighing unit 20 or get caught on other components.

[0032] The present invention has been described above with reference to a number of exemplary embodiments as shown in the drawings. Modifications and alternative implementations of some parts or elements are possible, and are included in the scope of protection as defined in the appended claims.

Claims

1. A weighing unit for a waste collection system comprising a base, a collection unit beneath the base for storing waste, and a waste receiving unit supported on top of the base and comprising a cylindrical rotary drum for receiving the waste; the weighing unit comprising:

a housing defining a collection chute for receiv-

- ing the waste from the cylindrical rotary drum, the housing configured to fit within the waste receiving unit and comprising a top portion complementary in shape to the rotary drum such that the top portion aligns close to but not connecting to the rotary drum;
 one or more movable flaps connected to and movably disposed within the housing, moveable to a closed position for weighing waste and an open position to allow waste through the housing to the collection unit;
 a frame for connecting the weighing unit to the waste collection system base; and
 a load cell connecting the housing to the frame.
2. The weighing unit of claim 1, wherein the frame comprises:
- a base beam with one or more connection devices for connecting the base bar to the waste receiving unit base;
 a connecting beam for connecting the frame to the load cell; and
 one or more legs connecting the base beam to the connecting beam.
3. The weighing unit of claim 2, wherein the one or more connection devices comprises:
 a connection plate on each end of the base beam for connecting to the waste receiving unit base.
4. The weighing unit of any of the preceding claims, wherein the housing comprises:
- a generally rectangular back wall;
 a front wall which connects to the frame; and
 side walls connecting the back wall and the front wall, the top portions of each side wall with a curvature to follow the curvature of the rotary drum.
5. The weighing unit of claim 4, wherein the front wall extends outward at the top portion and/or at the bottom portion.
6. The weighing unit of any of the preceding claims, wherein the one or more movable flaps comprises:
 first and second flaps connected to a motor drive unit for moving from the open position to the closed position and vice versa.
7. The weighing unit of any of the preceding claims, and further comprising a lock mechanism to releasably lock the one or more flaps in the closed position and/or releasably lock the load cell.
8. The weighing unit of any of the preceding claims, wherein the weighing unit is solar and/or battery powered.
9. A waste collection system comprising the weighing unit of any of the preceding claims.
10. The waste collection system of claim 9, wherein the weighing unit connects to the base of the waste receiving unit and fits within the waste receiving unit such that the housing top portion follows the outline of the rotary drum at a distance of about 5-25 mm.
11. The waste collection system of any of claims 9-10, wherein the weighing unit is freestanding from the base beam and only connects to the other components of the waste collection system through the waste collection system base.
12. A method of assembling a waste collection system with a waste collection unit comprising a cylindrical rotary drum for receiving the waste, a weighing unit for weighing waste, a base and a collection unit beneath the base for storing the waste, the method comprising:
- inserting a weighing unit housing into the waste receiving unit such that a housing top portion aligns close to but not connecting to the rotary drum; and
 connecting a frame of the weighing unit to the base of the waste collection unit, the weighing unit frame connected to the housing through the load cell.
13. The method of claim 12, wherein the step of connecting a frame of the weighing unit to the base of the waste collection unit comprises connecting a base beam of the frame to an underside of the waste collection unit base.
14. The method of any of claims 12-13, and further comprising the step of:
 calibrating the weighing unit.

Fig. 1A

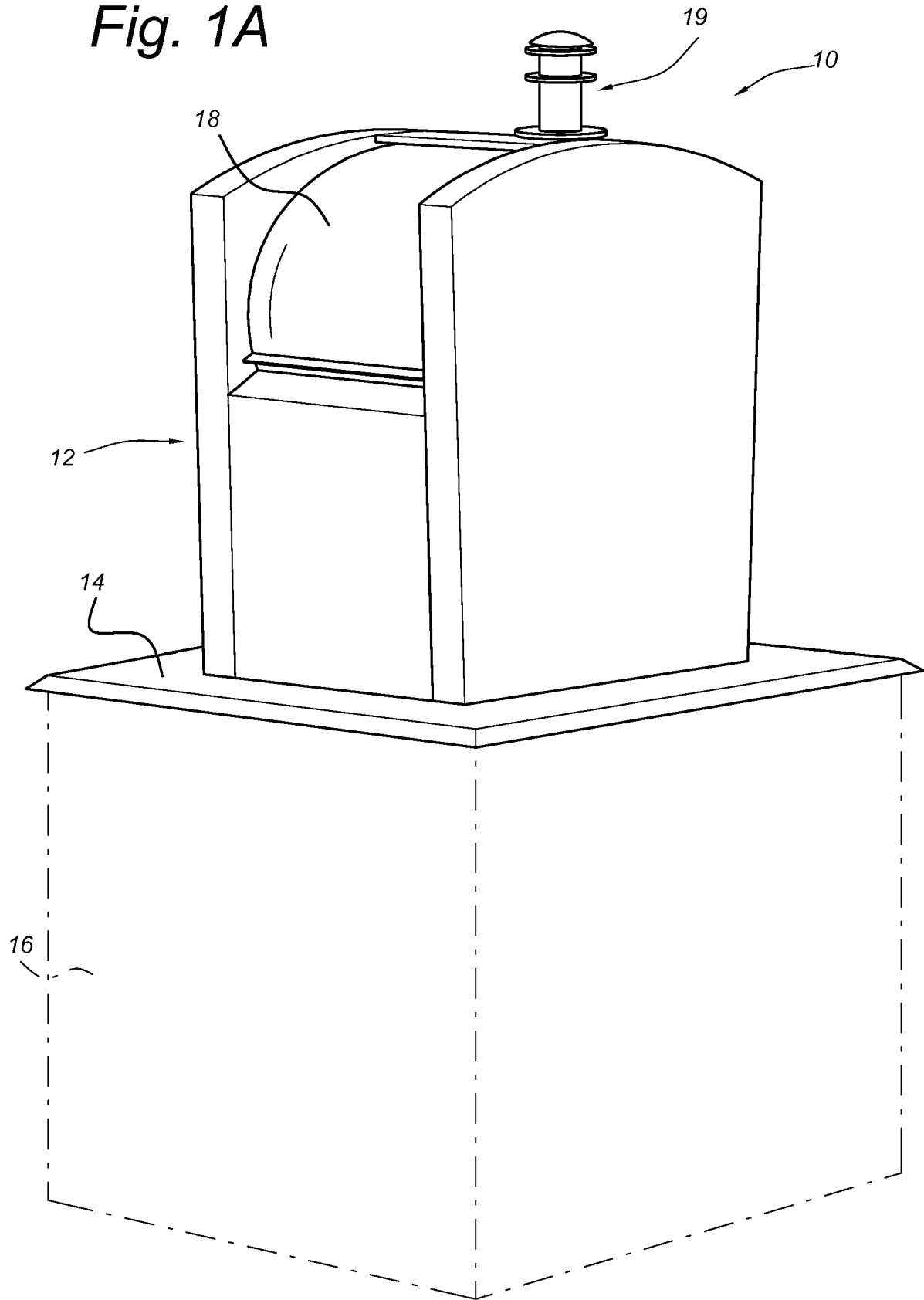


Fig. 1B

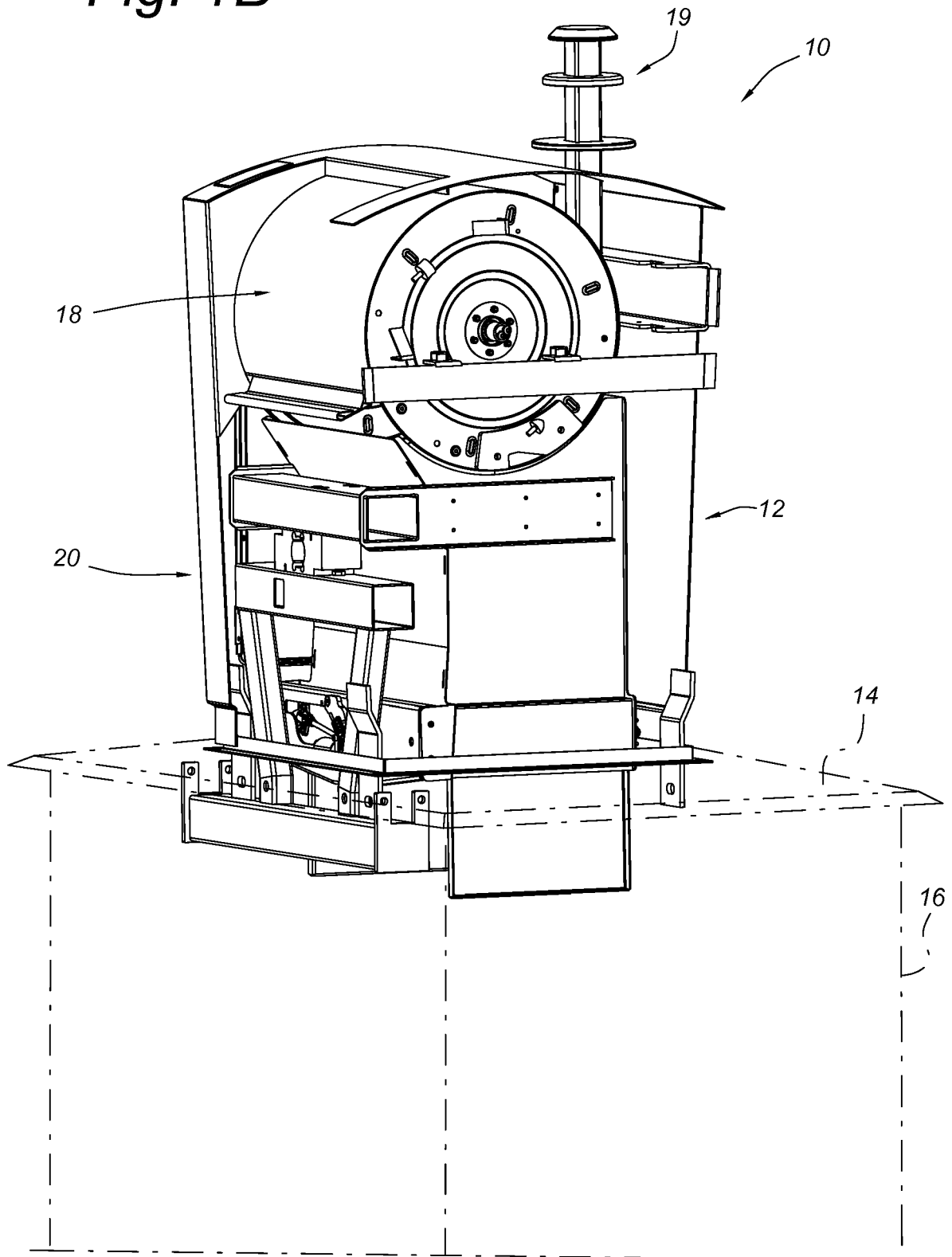


Fig. 1C

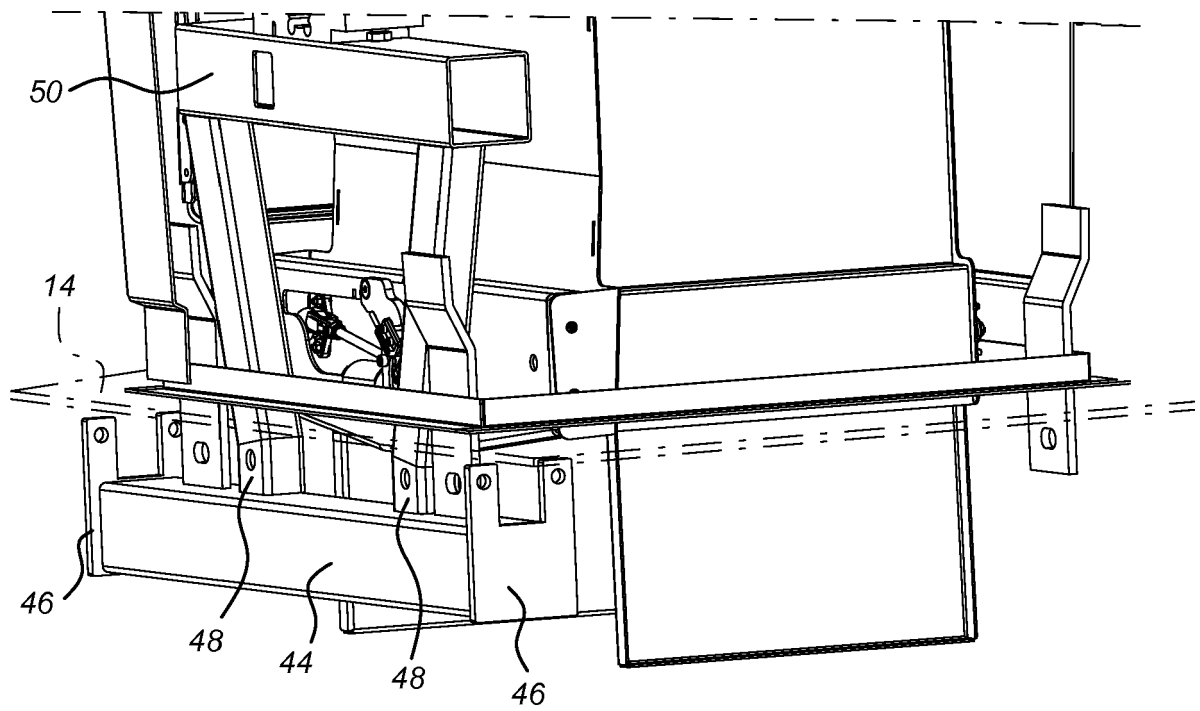


Fig. 2A

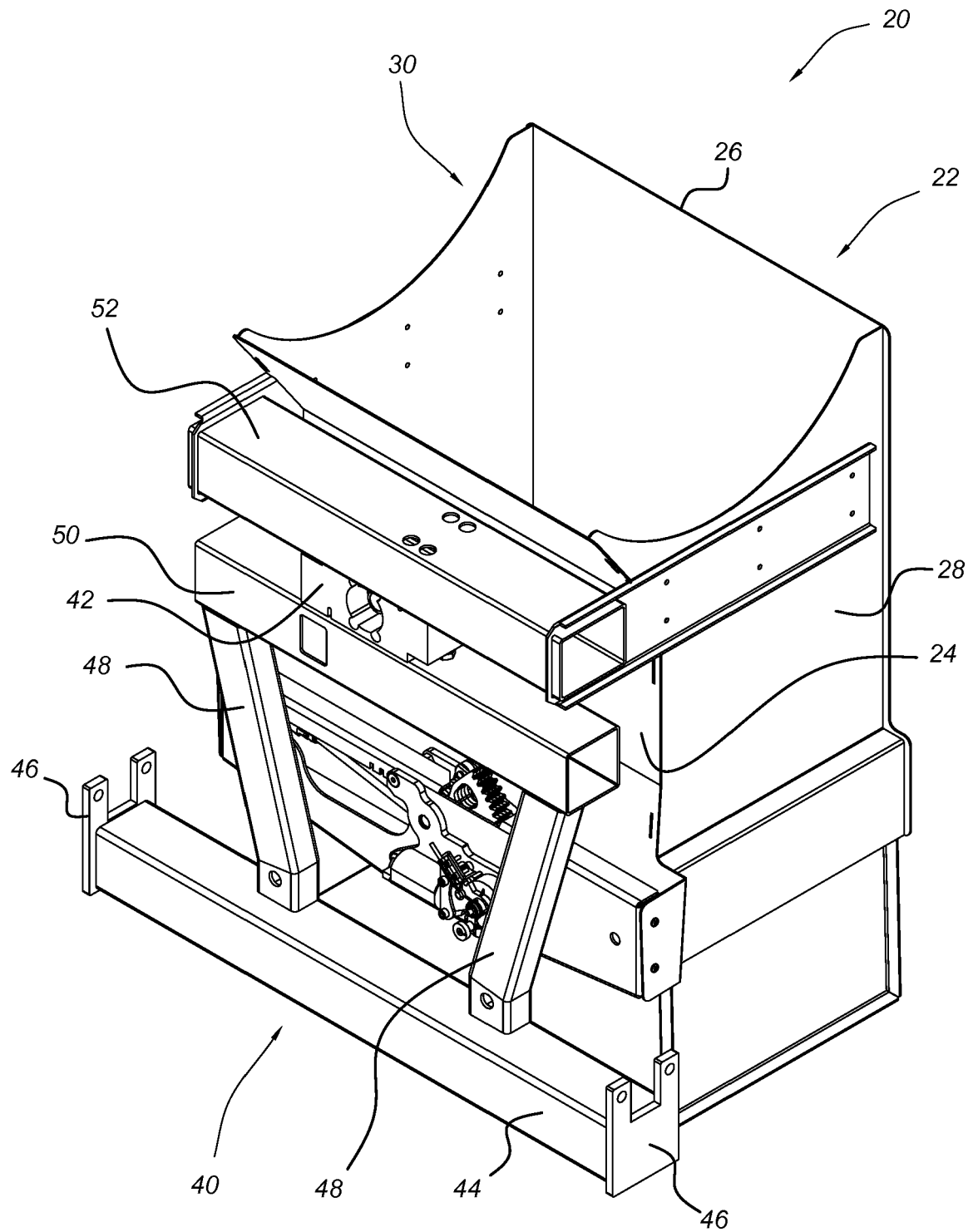


Fig. 2B

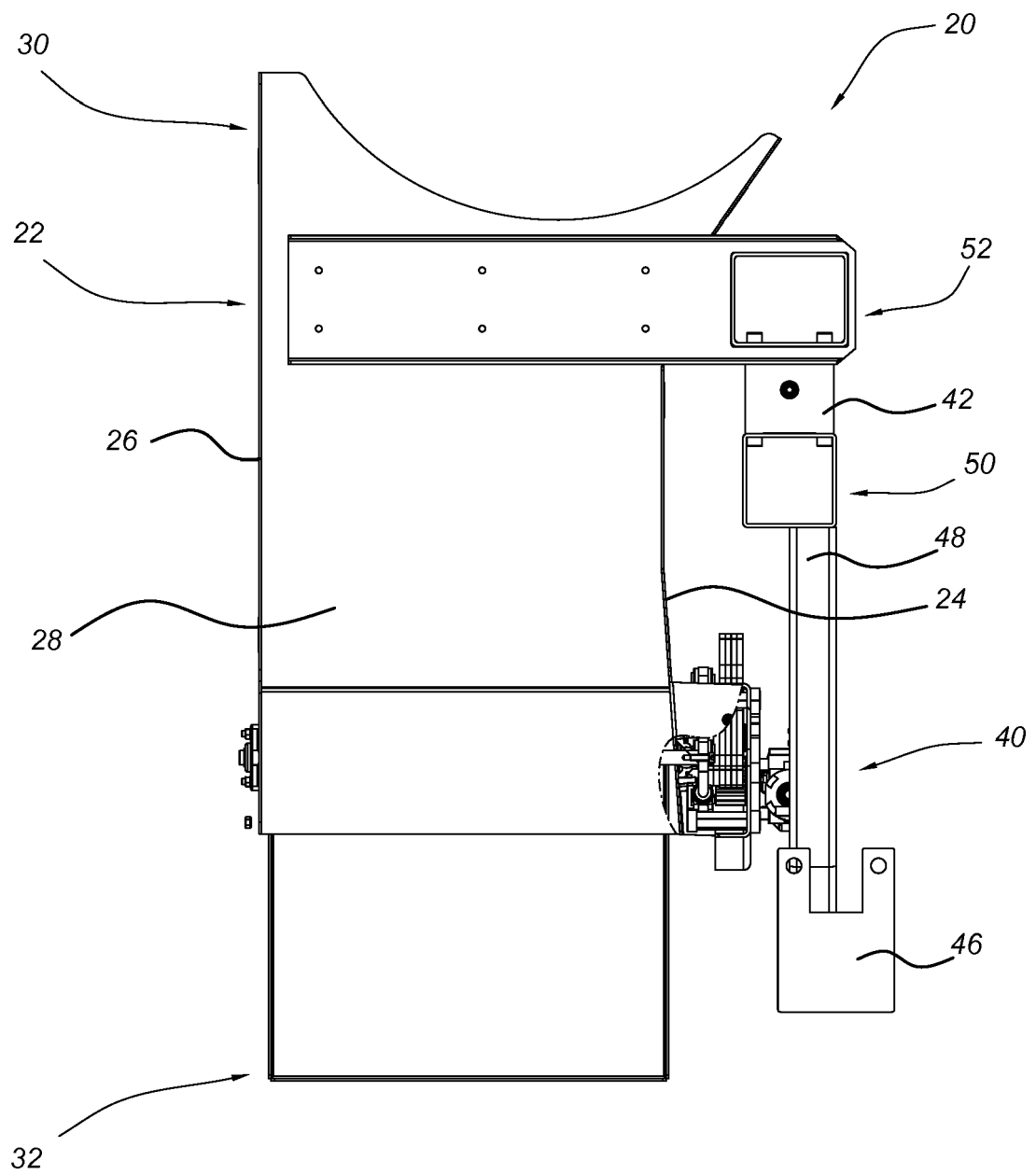


Fig. 2C

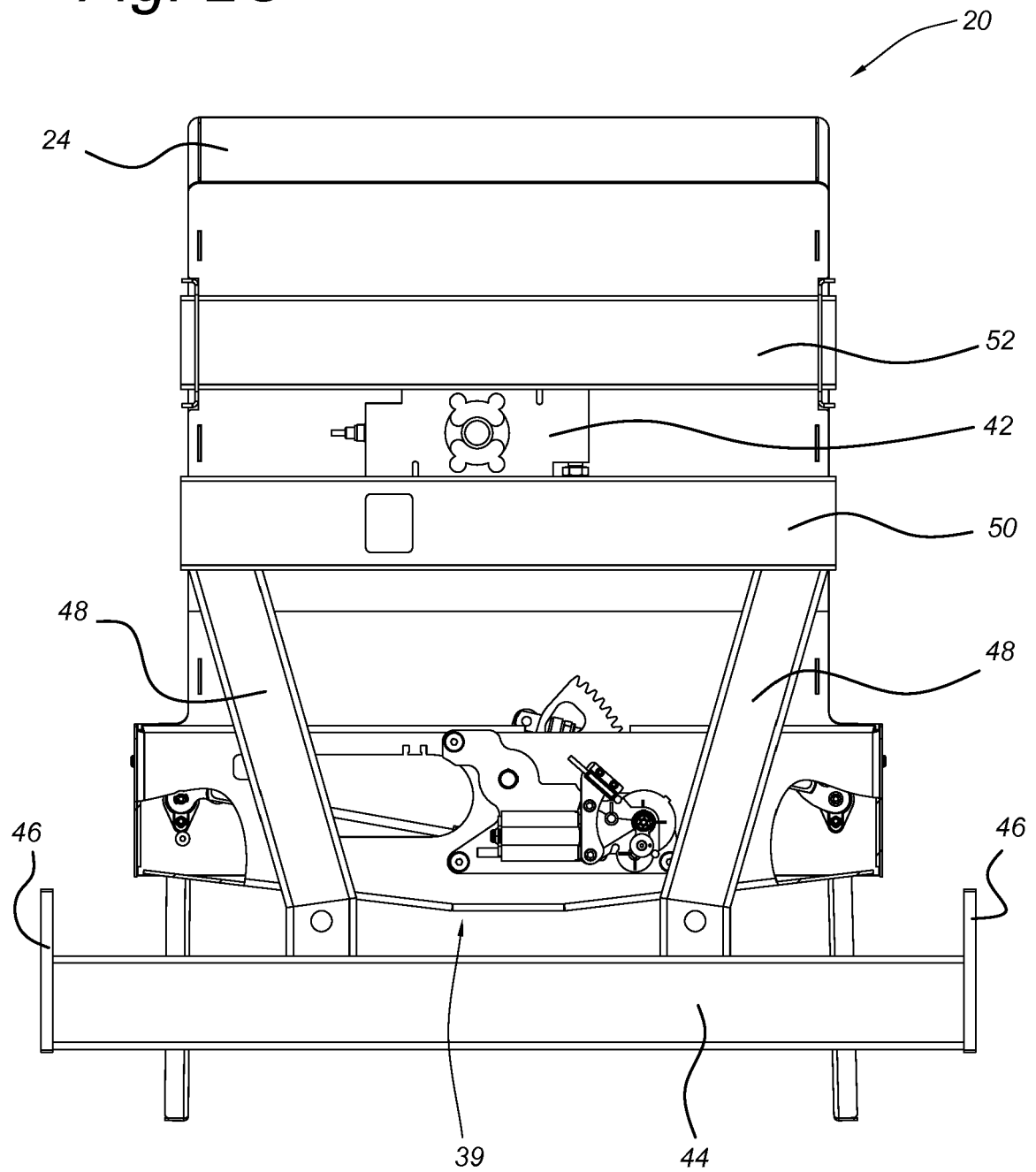
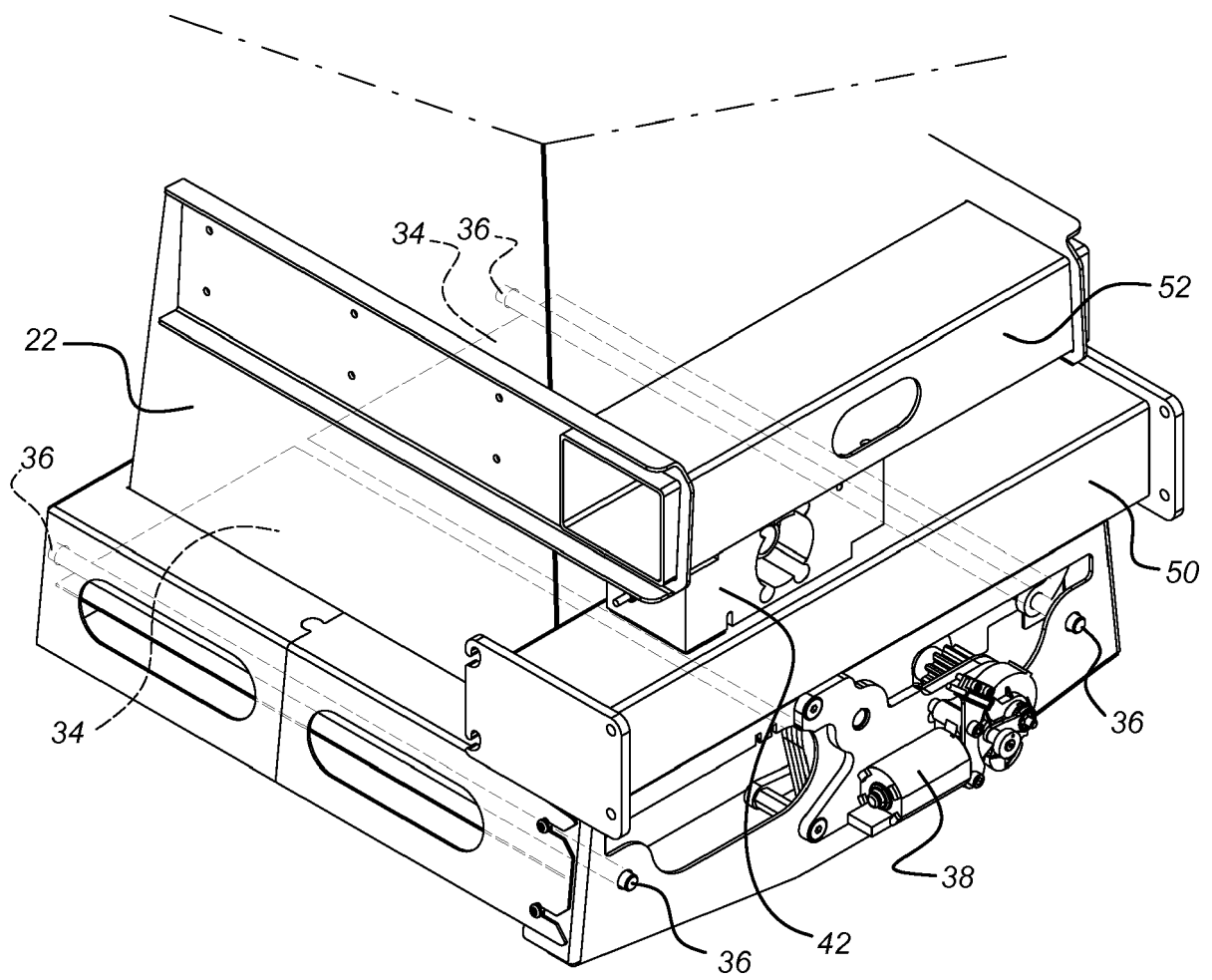


Fig. 2D





EUROPEAN SEARCH REPORT

Application Number
EP 18 18 4932

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 660 168 A1 (WASTEC B.V.) 6 November 2013 (2013-11-06) * paragraph [0016] - paragraph [0020] * * figures 1,2 * -----	1-14	INV. B65F1/10 ADD. B65F1/14
			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 20 August 2018	Examiner Smolders, Rob
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 18 4932

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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