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## (54) Waste Compactor

(57) A waste compactor 10 has a housing defining a waste compaction region 17 in which waste is compacted, and a compacted waste receiving space 18 below compaction region 17. Two opposed substantially parallel power-driven press plates 24,25 are disposed within the compaction region 17 for movement towards and away from each other along a common axis. A trapdoor 30 separates the compaction region 17 from the receiving space 18, the trapdoor being moveable between a closed position for waste compaction and an open position for depositing compacted waste in the receiving space 30. A trapdoor operating mechanism allows the trapdoor 30 to pivot to the open position when the press plates 24,25 have been moved closer than a pre-determined spacing and also moves the trapdoor to the closed position when the press plates 24,25 have been moved apart after compacting waste.

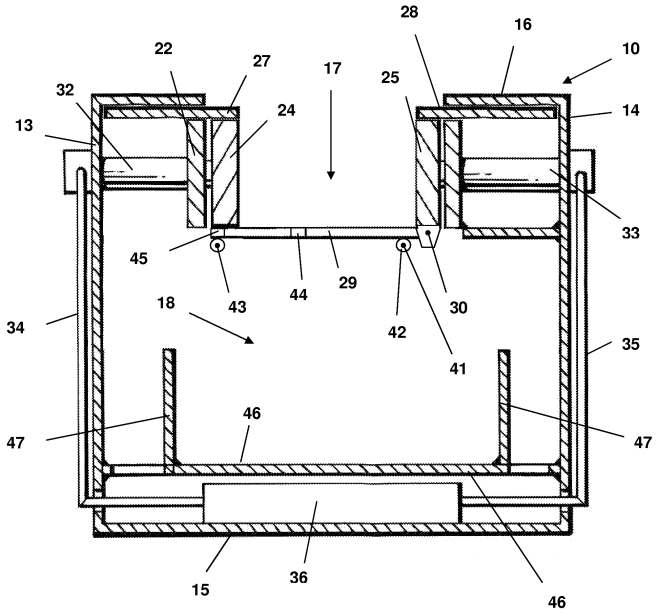


Figure 1

EP 2 070 691 A2

## Description

**[0001]** This invention relates to a waste compactor and in particular, but not exclusively, to a waste compactor suitable for use in compacting waste domestic containers, cartons, cans, packaging and the like, hereinafter referred to as "domestic waste".

**[0002]** Domestic waste compactors are used to break up and compact various emptied containers and packaging materials, including containers of paper, plastics, glass and metal to facilitate the storage and transport of the used containers for recycling or disposal, without wasting space. Though compactors for use with domestic waste are known, mostly these are relatively large and unsuitable for use with small volumes of containers, such as may be found in a domestic environment or in the catering trade, hotels and the like.

**[0003]** There have been proposals for small-scale domestic waste compactors. For example, EP1745921 shows a domestic waste compactor which has a press plate operated by ram acting through a lazy-tong mechanism, positioned above a container for storing crushed waste. The ram is arranged to force the press plate down into the container to crush domestic waste placed therein. This arrangement has the drawback that only a limited force can be exerted on the waste without damaging the container but in any event the mechanical advantage of the lazy-tong mechanism is somewhat limited and so the crushing power may not be able to deal with glass bottles.

**[0004]** US5778773 describes a can crusher having a vice with a fixed anvil and a sliding element driven by a rack and pinion, the pinion being turned by a manual lever affixed thereto. A trapdoor is arranged below the vice and is spring loaded to the closed position but is opened on operation of the lever. The vice is able to crush only a single can in one cycle and in the event of incomplete crushing of a can or the can becoming distorted, closing of the trapdoor under the spring force may be blocked so preventing further operation of the crusher.

**[0005]** This invention aims at providing a domestic waste compactor that is capable of producing a high compressive force within a limited volume. According to the present invention there is provided a domestic waste compactor comprising:

- a housing defining a waste compaction region in which waste is compacted and a compacted waste receiving space disposed below the compaction region;
- two relatively moveable substantially parallel opposed press plates disposed within the compaction region;
- power drive means to move the press plates towards and away from each other along a common axis;
- a trapdoor separating the compaction region from the receiving space, the trapdoor being moveable between a closed position for waste compaction and an open position for depositing compacted waste in the receiving space; and
- a trapdoor operating mechanism arranged to cause movement of the trapdoor, said operating mechanism being linked to the movement of the press plates, whereby on movement of the press plates to have less than a pre-determined spacing the operating mechanism causes the trapdoor to move to the open position and on separating movement of the press plates after waste compaction the mechanism raises the trapdoor to the closed position.

**[0006]** In the compactor of this invention, waste to be compacted is inserted into the waste compaction region and then the press plates are driven closer together. As the compaction stroke completes, the trapdoor opens to allow the compacted waste to be released on subsequent separation of the press plates, so allowing the waste to fall into the receiving space for subsequent removal. The power drive means should be sufficiently powerful to ensure the press plates move closer than a pre-determined spacing (typically about 30mm for the compaction of domestic waste) so that the trapdoor operating mechanism may effect opening of the trapdoor. Subsequently the press plates are returned to their initial, furthest-apart position and in the course of this, the operating mechanism closes the trapdoor.

**[0007]** Preferably, the power drive means comprises hydraulic rams together with an electric motor-driven hydraulic pump and control gear for the rams and motor. Conveniently, each plate has a single hydraulic ram associated therewith, disposed to act substantially centrally on the plate. The two press plates are forced towards the centre of the compaction region by the hydraulic rams to compact any waste therebetween. If required, and particularly on larger domestic waste compactors, each plate may have two or more rams associated therewith.

**[0008]** Pressure sensors may be provided for the hydraulic pressure applied to the rams. In this case, the press plates are driven closer together by the rams until a pre-set pressure threshold is reached, whereat the operation of the rams is reversed so as to return the press plates to their initial furthest-apart position. Further pressure sensors may detect that the press plates have reached their furthest-apart position and the waste compactor ceases operation, though this function could be performed by limit switches associated with the movement of the press plates. Advantageously, the pre-set pressure threshold is adjustable to suit the intended use of the compactor.

**[0009]** The invention incorporates an operating mechanism to open and close the trapdoor with the action of the press plates. In a preferred embodiment a single trapdoor is provided which is hinged beneath the compaction region to allow waste to fall into the receiving space, when open and the waste is no longer gripped by the press plates. In this embodiment, the trapdoor is hinged to the lower edge of one of the press plates. The trapdoor may open by pivoting under gravity about the hinge so as to

allow the contents of the compaction region fall into the receiving space.

**[0010]** The trapdoor operating mechanism is arranged to allow the trapdoor to hinge under gravity to its open position once the press plates have moved towards each other so that there is a pre-determined spacing between the press plates, and then on returning the press plates to their furthest-apart setting, the trapdoor is raised back to its closed position. Preferably, the mechanism includes a trapdoor support positioned lower than the trapdoor hinge and arranged so that when the press plates move towards their furthest spacing the trapdoor is raised by the support to its closed position. Conveniently, the support comprises a bar arranged parallel with the lower edge of the press plate carrying the trapdoor, that bar being furnished with a pair of rollers so that the edge margins of the trapdoor will run on the rollers for the initial part of a cycle of operation until the hinge passes over the rollers, and also the last part of a cycle of operation.

**[0011]** In the preferred embodiment, the housing carries a pair of further rollers also arranged to support the edge margins of the trapdoor until the press plates reach said pre-determined spacing as discussed above. Those edge margins are provided with respective notches sufficiently large for the further rollers to pass therethrough so that on reaching the pre-determined spacing, the trapdoor no longer is supported by the further rollers and so may swing under gravity to its open position. The operating mechanism may employ alternative means to effect the opening and closing of the trapdoor, such as a catch and release mechanism.

**[0012]** The compaction region is preferably substantially cuboidal, comprising two fixed side walls between which the press plates slide. A lid may be provided for the compaction region, and the trapdoor, when in its closed position, forms a base for said compaction region.

**[0013]** The press plates are preferably maintained substantially parallel during a compaction cycle, for example by means of one, but preferably two, guide rods associated with each press plate. Further, each press plate is provided with at least one guide pin slidably connected to the housing to restrain turning movement of the press plate. Each press plate may be provided with two pairs of vertically spaced guide pins, mounted towards the top and bottom of each side of the press plate, the guide pins extending into parallel grooves or slots in the side walls of the compaction region.

**[0014]** It is found that when compacting waste domestic containers and particularly plastic bottles, there is a tendency for those containers to return to their previous shape once crushed. To eliminate this, it is preferred that crushing blades are attached to the compacting surface of each press plate, which serve to break up or at least puncture plastic bottles and prevent this problem. The crushing blades may also assist in the compaction of other waste and also the breakage of glass bottles.

**[0015]** During use the crushing blades may become worn or broken, so it is preferred that the blades are replaceable. The crushing surface may be provided with grooves in which the blades locate, although alternative means for replacing the crushing blades may be provided.

**[0016]** In one embodiment of compactor the receiving space is a separate chamber within the housing with a hinged door to access the interior thereof. The door may have a safety switch so that the waste compactor will not operate if that door is open. Preferably, a removable container is located in the receiving space to collect the compacted waste and a key-lock is mounted in the door to prevent unauthorised opening.

**[0017]** The compaction region is preferably accessed from above, through an opening having a lid. That lid conveniently is slidable between open and closed positions and may be associated with a switch, so that the waste compactor operates automatically once the lid has been closed, but will not operate if the lid is not fully closed.

**[0018]** So that the invention may be better understood, one specific embodiment of domestic waste compactor will now be described in detail, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a cross sectional side view of the embodiment of waste compactor in an open position;
Figure 2 is a cross sectional side view of the compactor in a closed position;
Figure 3 is a plan view on the compaction region of the compactor;
Figure 4 is a view from below of the compaction region;
Figure 5 is a front view of the waste compactor;
Figure 6 is a plan view of the press plates and crushing blades;
Figure 7 is a side view on the trapdoor on an enlarged and exaggerated scale, for clarity; and
Figure 8 diagrammatically illustrates a control system for the embodiment of compactor.

**[0019]** Referring to the drawings, the embodiment of waste compactor generally indicated at 10 has a housing which comprises a front wall 11, a rear wall 12, side walls 13,14, a base 15 and a top panel 16. Internally, the waste compactor 10 is divided into a waste compaction region 17, in which waste domestic containers such as cans and bottles are compacted, and a waste receiving space 18 below the compaction region 17 and into which the compacted waste is deposited.

**[0020]** The compaction region 17 is defined by an internal front wall 20, an internal rear wall 21 and opposed internal side walls 22,23. A pair of opposed press plates 24,25 are slidably mounted on the internal side walls 22,23 by means of pins 26 projecting laterally from the press plates and received in elongate slots (not shown) formed in the internal front and rear walls 20,21, there being two vertically spaced pins 26 on each side edge of each press plate. A cover for the compaction region

comprises two doors 27,28 slidably mounted to the underside of the top panel 16, though a single sliding door could instead be provided, and may be transparent to allow observation of the operation. The compaction region 17 and the receiving space 18 are separated by a resiliently flexible trapdoor 29 (for example, of stainless steel), which is pivotally attached to the lower edge of press plate 24 by a hinge 30. When the press plates 24,25 are separated as shown in Figure 1 and the sliding doors 27,28 are open, waste containers and the like may be deposited into the waste compaction region 17, the waste being retained in that region 17 by the trapdoor 29.

**[0021]** The press plates 24,25 are provided with respective hydraulic rams 32,33 mounted on the housing side walls 12,13 and internal side walls 22,23, each ram acting essentially centrally on the associated press plates 24,25. Hydraulic fluid under pressure to drive the rams 32,33 is supplied through pipes 34,35 respectively from an electric motor driven pump 36 mounted on the base 15. Motion of each press plate 24,25 is controlled by a pair of guide rods 37 connected to the press plates adjacent their side edges and slidably mounted in sleeves 38 supported by the side walls 13,14 and internal side walls 22,23 respectively. The guide rods 37 together with the pins 26 received in the slots in the front and rear walls 20,21 serve to restrict turning movement of the press plates 24,25 relative to the housing and assist the linear sliding movement of the plates under the action of the rams 32,33 when waste is being compacted.

**[0022]** As shown in Figure 5, each press plate 24,25 carries a plurality of removable crushing blades 39, and in this embodiment there are five such blades on each press plate. These crushing blades 39 assist the breaking or puncturing of waste containers such as plastic bottles and may be replaced when worn or if broken. Each blade is of triangular cross-sectional shape and is received in a correspondingly-shaped slot in the press plates 24,25, closed at its lower end to prevent a received blade falling out of the slot but permitting removal of the blade by upward sliding movement.

**[0023]** A mechanism is provided to control movement of the trapdoor 29 during operation of the waste compactor, so that the trapdoor remains closed as the press plates 24,25 are moved towards each other until there is a pre-determined spacing therebetween, the mechanism subsequently closing the trapdoor on separating the press plates once more. The mechanism includes a bar 41 mounted in and extending between the internal front and rear walls 20,21, transversely to the line of movement of the press plates. The bar 41 carries a pair of rollers 42 adjacent the front and rear walls, the side edges of the trapdoor running on those rollers for an initial and final stage of a cycle of operation, as will be described below.

**[0024]** The internal front and rear walls 20,21 also carry a pair of further rollers 43, spaced from bar 41 and disposed below press plate 25 when in its fully retracted position, as shown in Figure 1. The side edges of the trapdoor 29 run on these further rollers 43 for part of the cycle of operation of the compactor. The opposed side edges of the trapdoor are provided with central notches 44 and end notches 45, the notches 44 and 45 being slightly larger than the diameter of the further rollers 43 so that those rollers may pass through the notches.

**[0025]** In operation, the rams 32,33 are supplied with hydraulic fluid under pressure so as to move the press plates 24,25 closer together from the initial position shown in Figure 1. The trapdoor 29 is for the initial stage of movement supported horizontally by the hinge 30 and rollers 42 on bar 41, until the end notches 45 have passed over the further rollers 43. The trapdoor is then supported by those further rollers 43 as well as the rollers 42 until press plate 24 passes over rollers 42 on bar 41; thereafter, the trapdoor is supported solely by hinge 30 and further rollers 43. Continued movement of the press plates closer together eventually brings the central notches 44 into alignment with the rollers 43 such that the trapdoor may swing downwardly under gravity to the position shown in Figure 2, the further rollers 43 passing through the central notches 44. The arrangement should be such that this occurs with a spacing of approximately 30mm between the press plates 24,25.

**[0026]** Once the trapdoor has swung downwardly as shown in Figure 2, contracting movement of the rams 32,33 will separate the press plates 24,25 until the position is reached where the trapdoor 29 engages rollers 42. Continued contracting movement will cause the trapdoor to swing upwardly until the upper face thereof engages the further rollers 43. Further contraction of the rams to increase the separation of the press plates will resiliently bend the trapdoor as shown in Figure 7 until the further rollers 43 come into alignment with the end notches 45, whereafter the trapdoor may spring upwardly to the position shown in Figure 1, ready to receive another charge of waste. It will be appreciated that Figure 7 is not to scale and shows the trapdoor much shorter than it should be relative to the other components. As such the bending of the trapdoor is exaggerated in Figure 7 in order to show the principle of operation.

**[0027]** Though not shown in the drawings, the relative disposition of the rollers 42 on bar 41 and hinge 30 on press plate 24 may be such that in the position of Figure 1 where the press plates have their maximum separation, the trapdoor is given a slight convex shape (from above) by virtue of the engagement of the further end of the trapdoor with the lower edge of the press plate 25. This will ensure that in the event relatively heavy waste is placed on the trapdoor, it will not be flexed downwardly and so the side edges will still run on to the upper surfaces of the further rollers 43 during the initial closing movement of the press plates 24,25.

**[0028]** The receiving space 18 beneath the compaction region 17 is defined by the housing front wall 11, rear wall 12, side walls 13,14 and an internal base 46. Upstanding from the internal base 46 are runners 47 for a removable container (not shown) for compacted waste. The receiving space 18 is accessed through a hinged

door 48, as shown in Figure 6, provided with a key-lock to prevent unauthorised opening.

**[0029]** The waste compactor is provided with safety controls, to ensure operation cannot occur during loading of waste or removal of compacted waste. A low-voltage electric motor 50 (Figure 8) drives pump 36, the motor, pump and reservoir for hydraulic fluid being located in the space between base 15 and internal base 46. The motor 50 is supplied with power by a control circuit 51 which receives inputs from various switches and sensors. These include an input 52 from a main on/off switch, an input 53 from magnetic switches provided in association with the sliding doors 27,28, an input 54 from a switch provided in association with receiving space door 48 and an input 55 from a sensor for hydraulic fluid pressure supplied to the rams. The control circuit operates a valve 56 which controls the supply of hydraulic fluid under pressure from the pump 36 to the rams 32,33 so as thereby to cause compacting movement of the press plates or withdrawing movement thereof following compaction of waste.

**[0030]** The magnetic switches associated with the sliding doors 27,28 and also the switch associated with the hinged door 48 serve to inhibit operation of the motor 50 other than when the doors are fully closed, so closing off the compaction region 17 and the waste receiving space 18. The pressure sensors provided in association with the hydraulic rams 32,33 serve to prevent continued driving of the rams once the pressure rises to a pre-set threshold.

**[0031]** The initial setting of the waste compactor 10 is shown in Figure 1. Here, the press plates 24,25 are fully retracted, the trapdoor 29 is in its raised (closed) position and the doors 27,28 are slid apart to give access to the waste compaction region 17. Waste is placed into the compaction region 17 and then the doors 27,28 are slid closed. The magnetic switch associated with those doors is automatically operated, so allowing operation of the motor 50 so long as the other inputs to the control circuit are in the appropriate settings. The pump 36 supplies hydraulic fluid under pressure to the rams and the compacting process begins. The press plates are moved closer together under the action of the hydraulic rams 32,33 until pressure of the hydraulic fluid supplied to the rams reaches the threshold value, typically of 100Bar.

**[0032]** On the press plates 24,25 reaching the pre-determined spacing (in this embodiment, about 30mm) the further rollers 43 become aligned with the central notches 44 in the edge margins of the trapdoor 29 so allowing the trapdoor to swing down and open the compaction region 17, as shown in Figure 2. Compaction continues until the pressure threshold is reached whereafter the action of the rams is reversed, so moving the press plates back to their initial position shown in Figure 1. This deposits the crushed compacted waste in the receiving space 18. Should too much waste have been placed in the compaction region so preventing the predetermined spacing being reached by the time the hydraulic pressure has risen to the threshold value, the operation of the rams will be reversed before the trapdoor opens. Some partly-compacted waste may then be removed from the compaction region 17 and the cycle commenced again.

**[0033]** Once the trapdoor 29 has swung downwardly as shown in Figure 2, contraction of the rams brings the trapdoor into engagement with the rollers 42 and continued contraction will then raise the trapdoor to the position shown exaggerated in Figure 7, as described above. In the last stage of contraction of the rams, the trapdoor end notches 45 come into alignment with the further rollers 43 so allowing the trapdoor once more to take up its fully closed position shown in Figure 1. The compaction region 17 is then ready for receiving another charge of waste.

## Claims

**1.** A domestic waste compactor (10) comprising:

- a housing defining a waste compaction region (17) in which waste is compacted and a compacted waste receiving space (18) disposed below the compaction region;
- two relatively moveable substantially parallel opposed press plates (24,25) disposed within the compaction region (17);
- power drive means (32,33,36,50) to move the press plates (24,25) towards and away from each other along a common axis;
- a trapdoor (29) separating the compaction region (17) from the receiving space (18), the trapdoor being moveable between a closed position for waste compaction and an open position for depositing compacted waste in the receiving space; and
- a trapdoor operating mechanism (41-44) arranged to cause movement of the trapdoor (29), said operating mechanism being linked to the movement of the press plates (24,25), whereby on movement of the press plates to have less than a pre-determined spacing the operating mechanism causes the trapdoor to move to the open position and on separating movement of the press plates after waste compaction the mechanism raises the trapdoor to the closed position.

**2.** A domestic waste compactor as claimed in claim 1, wherein the power drive means comprises hydraulic rams (32,33) together with an electric motor-driven pump (36,50) and control gear therefor.

**3.** A domestic waste compactor as claimed in claim 2, wherein each press plate (24,25) is provided with an hydraulic ram (32,33) disposed to act substantially centrally on the respective press plate.

4. A domestic waste compactor as claimed in claim 3, wherein each press plate (24,25) is provided with at least one guide rod (37) acting in a direction parallel to the line of action of the associated ram (32,33) to maintain the press plates parallel to one another.

5. A domestic waste compactor as claimed in claim 3 or claim 4, wherein each press plate (24,25) is provided with at least one guide pin (26) slidably connected to the housing to restrain turning movement of the press plate.

6. A domestic waste compactor as claimed in any of claims 2 to 5, wherein there is provided a pressure sensor for the hydraulic fluid supplied to the rams (32,33) and a control system (51) is arranged to reverse operation of the rams to separate the press plates (24,25) when a pre-set pressure threshold is reached.

7. A domestic waste compactor as claimed in any of the preceding claims, wherein the trapdoor (29) is pivotally connected by a hinge (30) to the lower edge of one of the press plates (24).

8. A domestic waste compactor as claimed in claim 7, wherein the trapdoor (29) is held shut by a support (42) positioned beneath the trapdoor hinge (30) and arranged so that when the press plates (27, 28) move towards their furthest spacing, the trapdoor is raised by the support to its closed position.

9. A domestic waste compactor as claimed in claim 8, wherein the support comprises a bar (41) arranged parallel with the lower edge of the press plate (24).

10. A domestic waste compactor as claimed in claim 9, wherein the bar is furnished with a pair of rollers (42), the edge margins of the trapdoor (29) running on the rollers for a part of the cycle of operation.

11. A domestic waste compactor as claimed in any of claims 7 to 11, wherein the housing carries a pair of further rollers (43) arranged to support the edge margins of the trapdoor (29) until the press plates (24,25) reach a predetermined spacing, the trapdoor edge margins being provided with respective notches (44) through which the rollers (43) pass to allow the trapdoor to move to its open position upon the press plates reaching said predetermined spacing.

12. A domestic waste compactor as claimed in claim 11, wherein the trapdoor edge margins remote from the hinge (30) are provided with end notches (45) through which the further rollers (43) pass to allow the trapdoor to be raised its closed position as the press plates (24,25) become fully separated.

13. A domestic waste compactor as claimed in any of the preceding claims, wherein crushing blades (39) are attached to the confronting surfaces of the two press plates (24,25).

14. A domestic waste compactor as claimed in claim 13, wherein the crushing blades (39) are slidably located in grooves in the confronting surfaces of the press plates (24,25).

15. A domestic waste compactor as claimed in any of the preceding claims, wherein the compaction region (17) is provided with a closable inlet door (27,28), a switch is associated with that door, and a control system which serves to inhibit operation of the compactor until the inlet door (27,28) is closed.

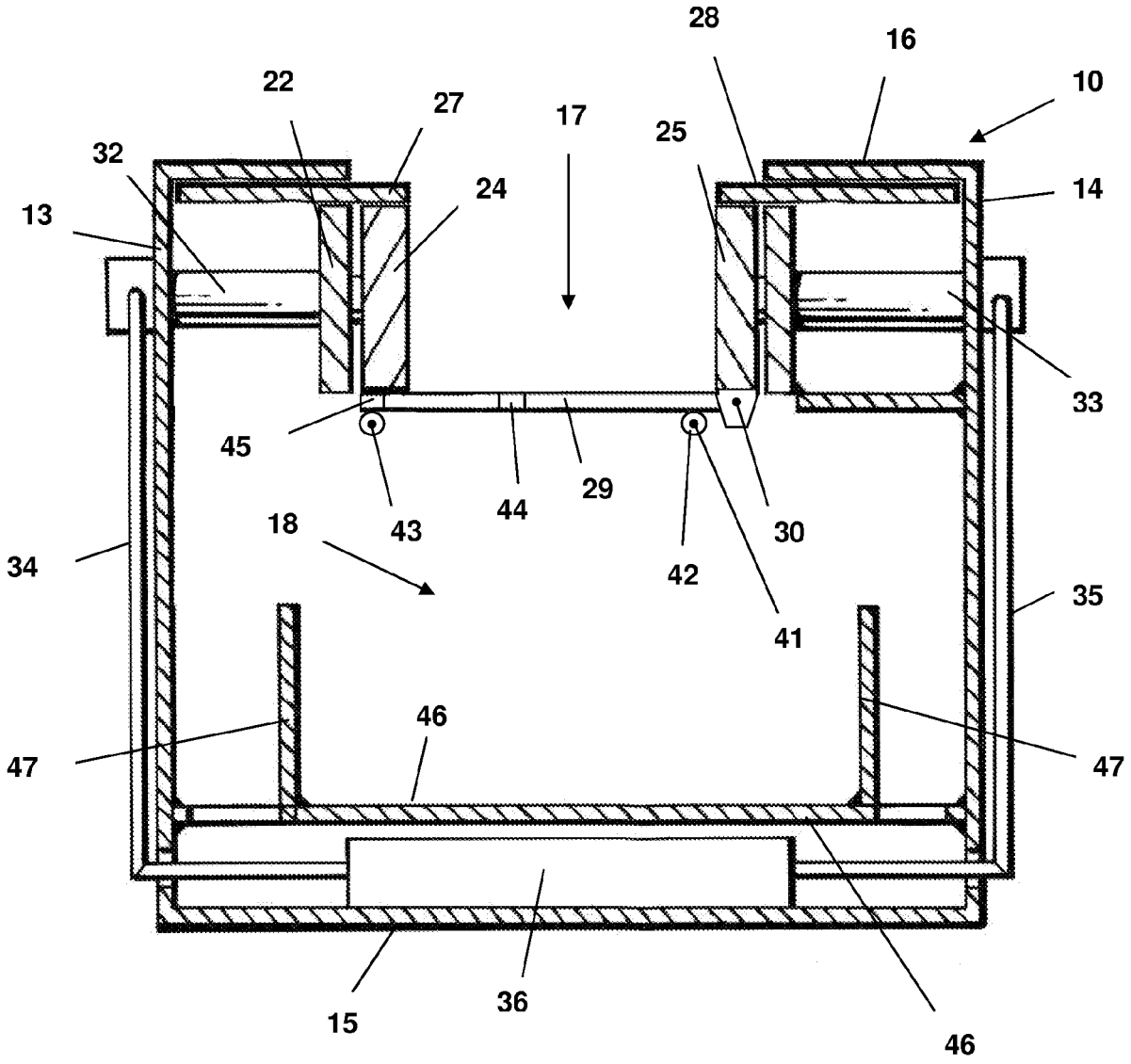
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Figure 1

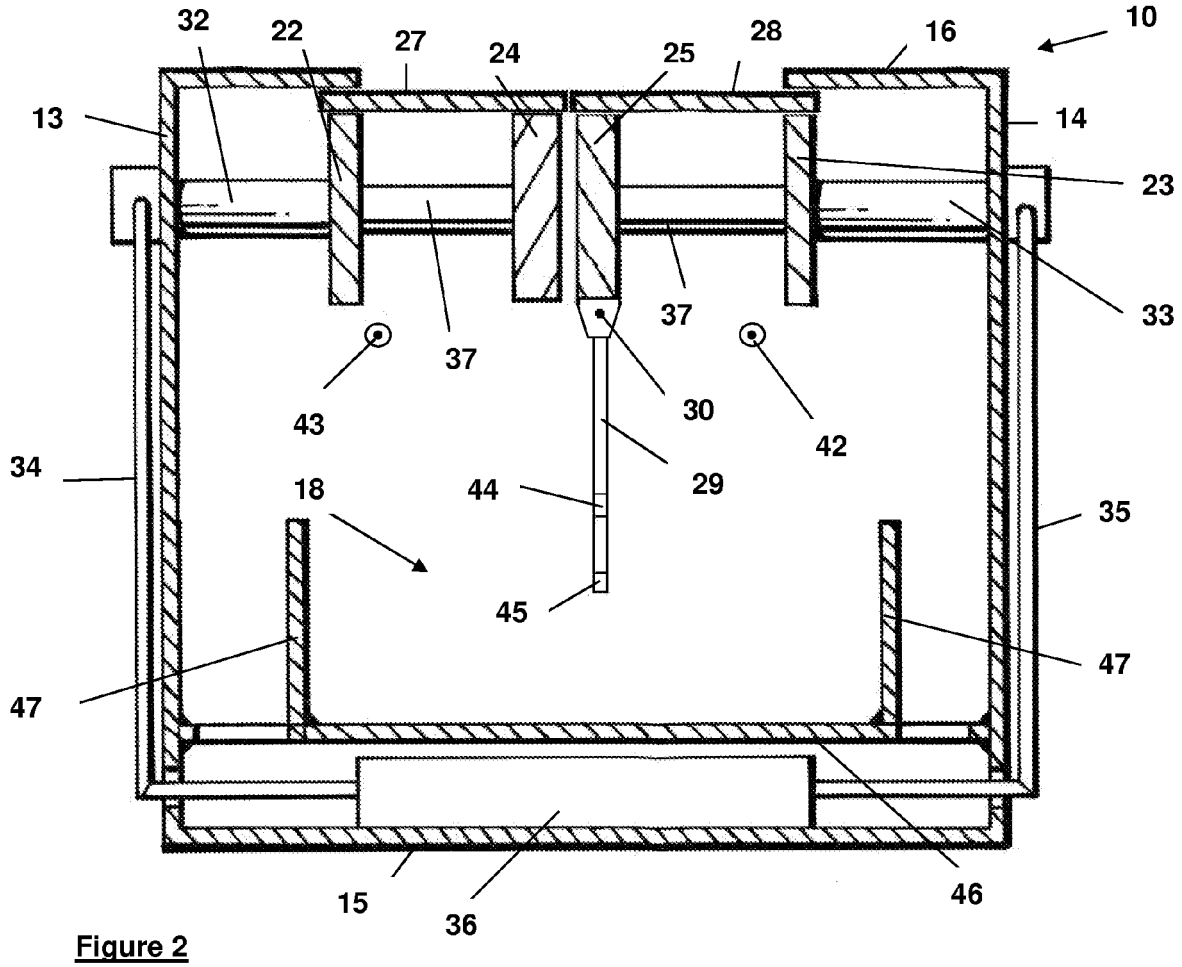


Figure 2

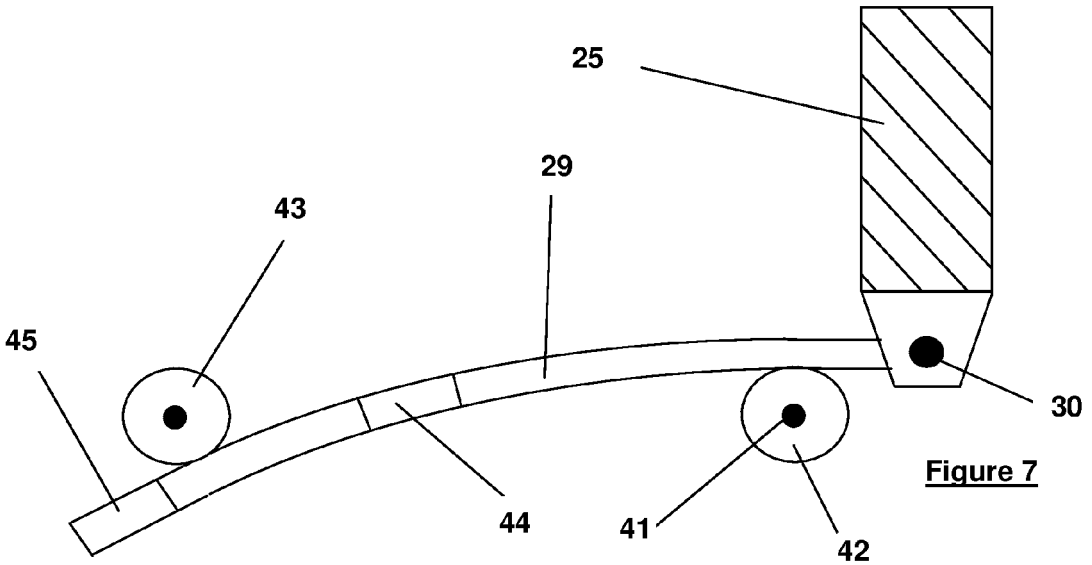


Figure 7

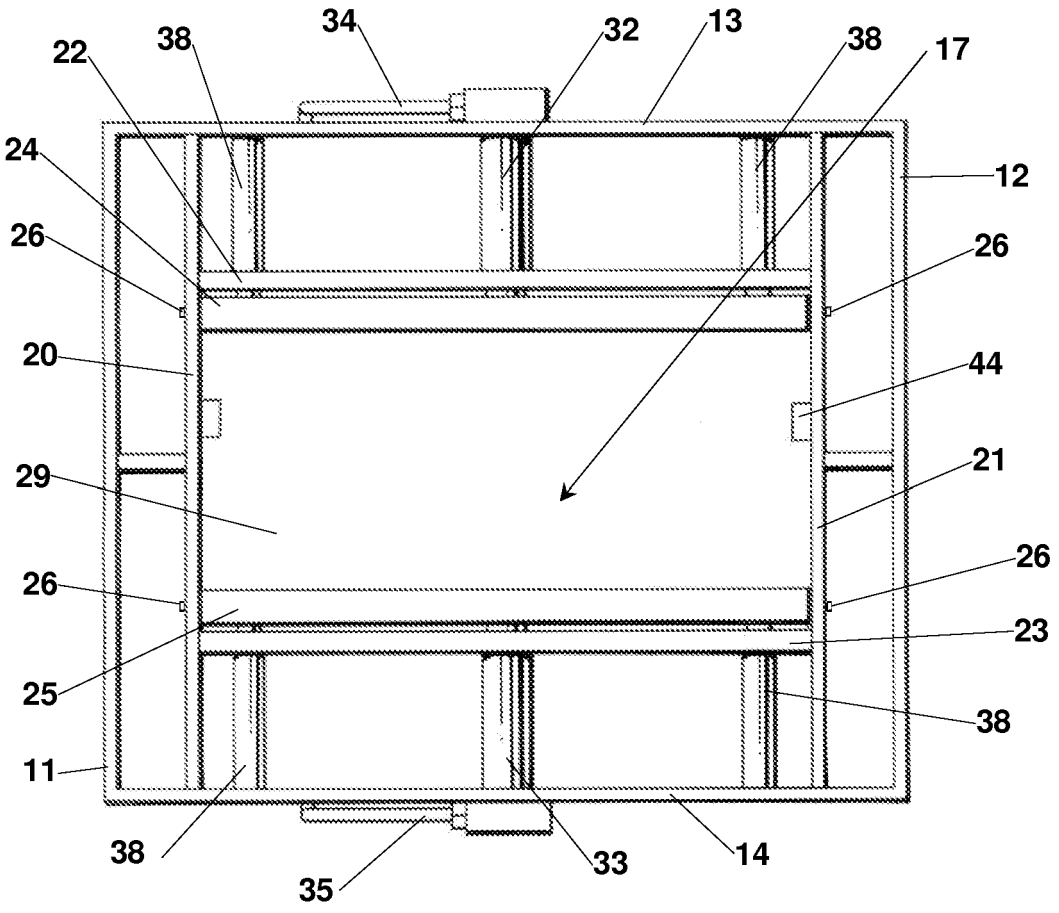
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Figure 3

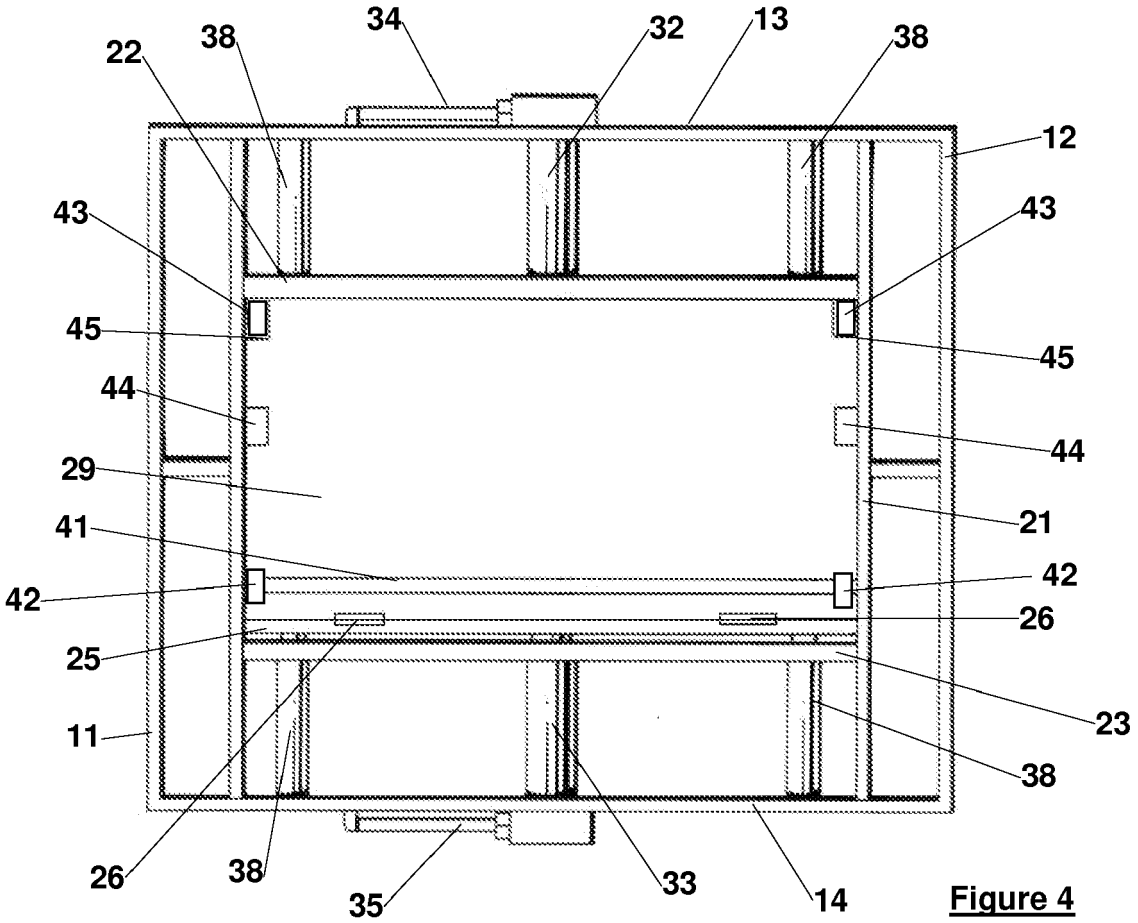
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Figure 4

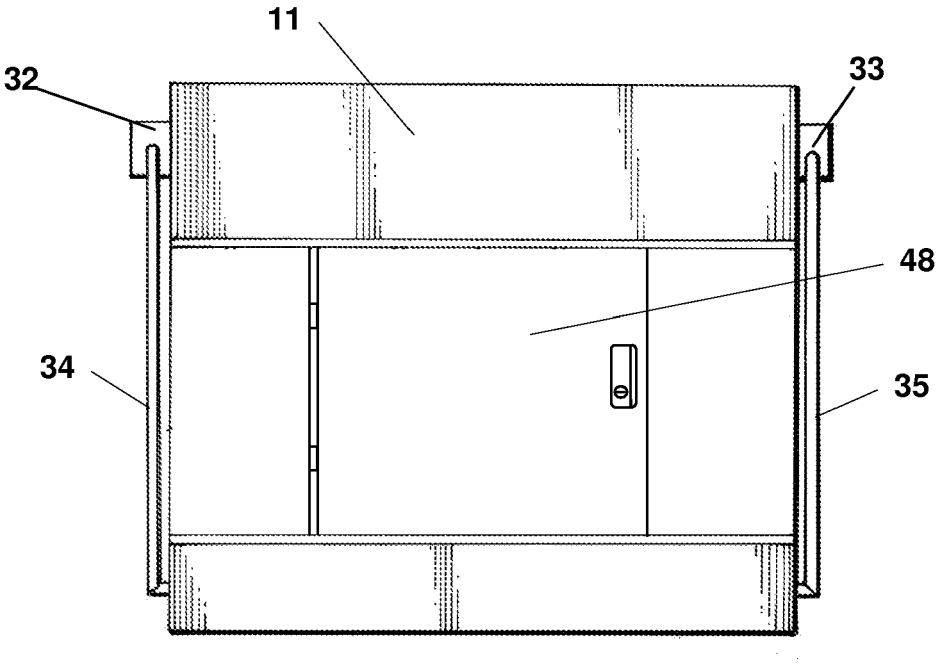



Figure 5

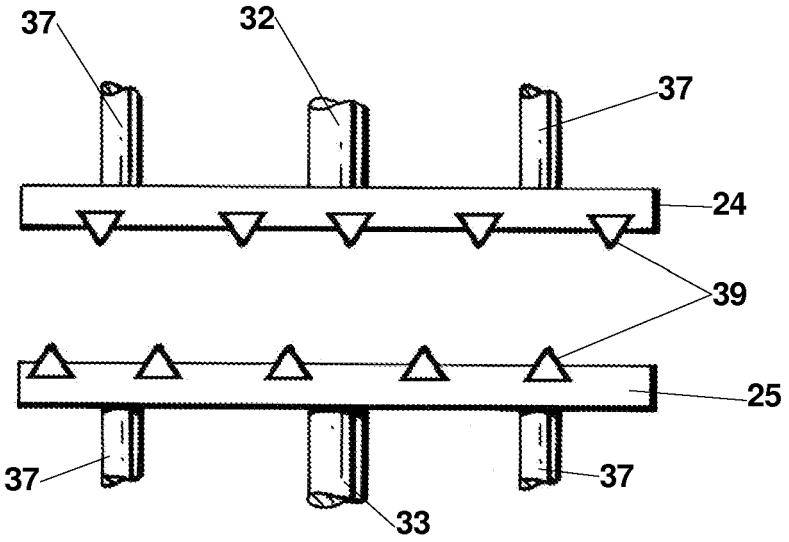
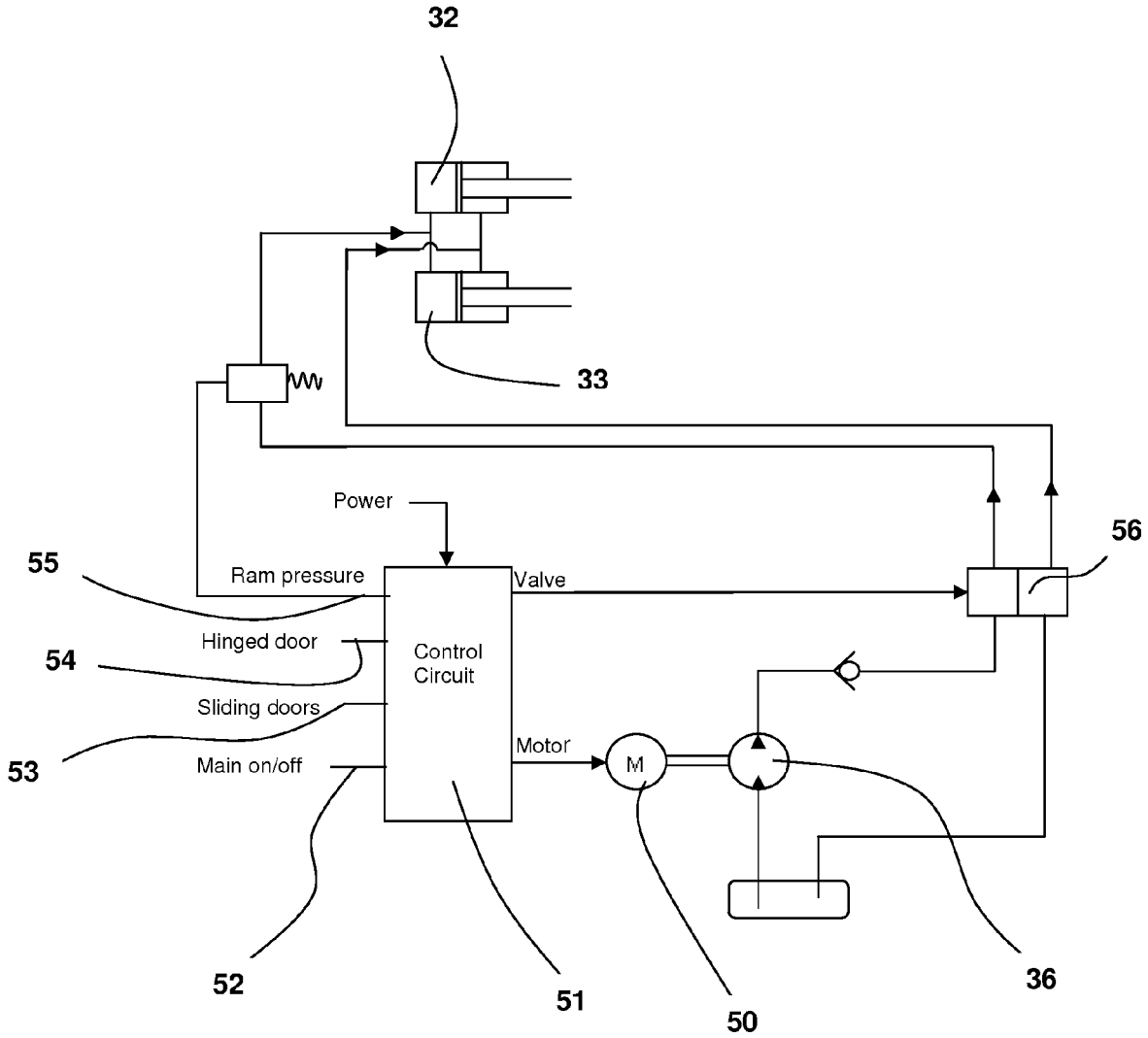



Figure 6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Power
56
55
Ram pressure
Valve
Hinged door
54
Control
Circuit
Sliding doors
53
Motor
Main on/off
M
52
51
50
36

Figure 8

## REFERENCES CITED IN THE DESCRIPTION

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