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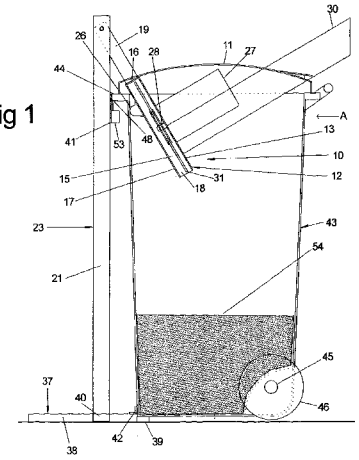
(54) Title: VOLUME REDUCING APPARATUS

Fig 1



(57) Abstract: Volume reducing apparatus (10, 11), particularly for use with a wheeled bin (43) for receiving cullet (54) reduced from empty waste glass bottles, comprises a machine (10) carried below a Hd (11) for closing the bin (43), the machine (10) including a cassette (12) extending an angle to the vertical downwardly inside the Hd (11), the cassette (12) housing a hammer assembly (31) which is secured to a shaft (28) of a motor (27) mounted on an upper surface of the cassette (12) and also located inside of the lid (11), the shaft (28) projecting into the cassette (12) through a central aperture in a casing thereof. The lid (11) and the casing are each provided with eccentric apertures for locating a tube (30) extending through the lid (11) parallel to a longitudinal axis of the shaft (28) so that, in operation, bottles fed successively into the tube (30) pass down the tube (30) and the glass of the bottles, on emerging from the tube (30) into the cassette (12), is struck by hammers of the hammer assembly (31) and is reduced to cullet (54), which passes through an outlet (18) of the cassette (12) and collects in the bin (43). The arrangement provides for an inexpensive and compact bottle breaking machine having low bottle entry access.

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Volume Reducing Apparatus.

This invention relates to volume reducing apparatus.

Generally, in the recycling of waste empty glass bottles, the bottles are temporally stored in wheeled bins which are standardised in that they have uniform dimensions and are provided with a common upper formation whereby they can each be engaged by mechanical handling equipment of collection trucks and lifted and tilted by the equipment so that contents of the bins are deposited into the trucks. The bins are normally located at sites and are visited by collection service providers who off-load the contents of the bins into their trucks and leave the emptied bins at the site. The trucks return to a depot where their loads are deposited for further processing. The procedure is repeated, generally at regular intervals.

However, the procedure is inefficient because the volume occupied by the bottles is mainly air and trucks, when full of empty bottles, are usually nowhere near their full load carrying capacity. Greater efficiency can be achieved by reducing the bottles to cullet so that it is cullet that is received in the bins ready for collection and not bottles. By transporting cullet instead of empty bottles, glass from more sites can be collected for each truck journey or the sites need be visited less frequently. Also, with regard to sites where wheeled bins are stored for receiving glass, by reducing bottles to cullet, fewer such bins would be required for any particular site without reducing cullet collection frequency, thereby freeing up storage space and reducing the cost of bin provision, or the frequency of cullet collection can be reduced, thereby reducing collection costs.

It is desirable, therefore, to provide volume reducing apparatus that can be located relative to a wheeled bin so that empty glass bottles can be fed into the apparatus and cullet issuing therefrom can be received within the bin, which apparatus is inexpensive to manufacture and which provides an inlet for the bottles which is of comparably low height.

In FR 2 687 132 A there is disclosed volume reducing apparatus comprising a lid for closing a container, the lid having an aperture. Extending through the aperture is a rod at the lower end portion of which is provided a compactor and at the upper end portion of which is provided a knob, there being located co-axial with the rod, between the knob and an upper surface of the lid, a helical compression spring. Operation of the apparatus is effected by manually depressing the rod relative to the lid, thereby compressing the spring and causing the compactor to apply a downward force to articles located inside the container.

A disadvantage of such volume reducing apparatus is that, if the articles located inside the container were to be empty glass bottles, it is unlikely that the downward force would be sufficient to break the bottles or, if it were to be so, the procedure would be so labour intensive that it would not be acceptable for commercial use.

According to the present invention, there is provided volume reducing apparatus comprising a lid for closing a container, the lid having an aperture, characterised in that there is provided a motor-driven mechanism for effecting volume reduction, the mechanism being carried below the lid so that, when the lid is positioned to close the container and the mechanism is active, articles entered through the aperture are reduced in volume by the mechanism and the issue is received in the container.

The invention thus provides volume reducing apparatus which is compact because, in use, a substantial portion of the apparatus is contained within the container while ensuring that the container is closed off by the lid and an inlet for receiving the articles is of comparably low height. The invention also provides volume reducing apparatus which is inexpensive to manufacture because the lid and side walls of the container provide an enclosure for the apparatus, which enclosure would otherwise need to be provided if the apparatus were to be outside of the container.

Also according to the present invention, there is provided a stand for a container comprising a lid for closing the container when supported on the stand characterised in

that the stand includes a transducer for controlling operation of a motor for driving a mechanism for processing material to be collected in the container and in that the stand also includes support means for supporting the container such that, as the lid closes relative to the container, a portion of the container is moved to activate the transducer thereby enabling the motor, the arrangement being such that the balance of the forces created by the weight of the lid of the one part and the weight of the container of the other part holds the container in contact with the lid so that the lid closes off the container until the weight of material issued into the container reaches a predetermined weight whereupon the weight of the lid of the one part is overcome by the combined weight of the container and the material contained therein of the other part causing the lid to move apart from the container, the said portion of the container to move away from the transducer and the motor thereby to be disabled.

The present invention thus also provides a stand suitable for the volume reducing apparatus wherein the stand includes a simple and inexpensive system for controlling operation of the motor-driven mechanism for processing material to be collected in the container

The invention will now be described, by way of example only and with reference to the accompanying drawings.

In the drawings:-

Figure 1 is a diagrammatic vertical cross section of one embodiment of volume reducing apparatus in accordance with the present invention, a lid of the apparatus being shown in a closed position in engagement with and closing a standardised wheeled bin mounted on a stand carrying the apparatus, such engagement causing the bin to be positioned, in accordance with the present invention, on the stand with its wheels raised from supporting ground and the bin shown having received therein an amount of cullet as a result of glass bottles having been fed into and been fragmented by the apparatus ;

Figure 2 is a diagrammatic front elevation viewed in the direction of the arrow "A" of Figure 1;

Figure 3 is a view corresponding to Figure 1 showing the lid in a position released, in accordance with the present invention, from engagement with the bin as a result of the weight of cullet received in the bin having increased to a predetermined weight and causing the bin to return to a position with its wheels on the ground;

Figure 4 is a view corresponding to Figure 3 showing the lid in a raised position so that the bin can be wheeled from the stand;

Figure 5 is a diagrammatic side elevation of an air switch and accompanying tubing for controlling operation of the apparatus;

Figure 6 is a diagrammatic front elevation viewed in the direction of the arrow "B" of Figure 5; and

Figure 7 is a view from below of a cassette of the apparatus, a lower plate of the cassette having been removed.

Referring now to the drawings, there is shown volume reducing apparatus in the form of a glass bottle breaking machine 10 in combination with a lid 11. The machine 10 comprises a cassette 12 formed from a rectangular top plate 13 having downwardly extending spaced parallel side walls 14, 15 and a downwardly extending upper wall 16 against which walls 14, 15 and 16 is detachably bolted a rectangular lower plate 17. The top plate 13 and the lower plate 17 together form a hollow box configuration having a lower outlet 18. The side walls 14, 15 are each detachably bolted to a corresponding one of a pair of elongate, spaced parallel struts 19, 20 which extend through corresponding slits (not shown) in the lid 11 and upper end portions of which are each pivotally connected to a corresponding one of a pair of spaced parallel upright members 21, 22 of a stand, generally designated 23. The top plate 13 is provided with a central circular

aperture 24 and a larger eccentric circular aperture 25. An outer rear surface of the lower plate 17 is provided with a pair of spaced parallel outwardly extending lugs, one of which is shown at 26. The top plate 13 has secured to an outer upper surface thereof an electric motor 27 such that a remote end portion of a shaft 28 thereof extends through the central aperture 24 of the top plate 13 and into the interior of the cassette 12. The shaft 28 is provided with a keyway (not shown). The lid 11 is also provided with an eccentric circular aperture 29 through which extends a tube 30, a lower end portion of which is received in a collar (not shown) secured to the top plate 13 and coaxial with the eccentric aperture 25 of the top plate 13 such that the tube 30 is in communication with the interior of the cassette 12 and a central longitudinal axis of the tube 30 extends parallel to a central longitudinal axis of the shaft 28 of the motor 27. The diameter of the tube 30 is such that bottles can slide longitudinally down the tube 30 without deviating substantially from the central longitudinal axis of the tube 30.

The cassette 12 includes a hammer assembly, generally designated 31, comprising a pair of complimentary, elongate, cranked hammer carriers 32, 33 having formations whereby the hammer carriers 32, 33 are bolted one to another to provide an aperture 34 for receiving the keyed shaft 28 of the motor 27 such that the hammer assembly 31 is non-rotatably secured relative to the shaft 28. Each of the hammer carriers 32, 33 has pivotally connected thereto, at an end portion thereof remote from the corresponding end portion of the other hammer carrier 32, 33, a corresponding one of a pair of hammers 35, 36, each being in the form of a plate of substantially semi-circular configuration and the pivotal connection with the corresponding hammer carrier 32, 33 being at the end of a diameter of the semi-circular configuration.

The arrangement is such that, when the motor 27 is operative, the shaft 28 rotates causing the hammer assembly 31 to turn on the central longitudinal axis of the shaft 28 resulting in the hammers 35, 36 rotating in a plane transverse to that axis in an anti-clockwise direction when viewed in Figure 7. The hammers 35, 36 sweep past the large eccentric aperture 25 in the top plate 13, the curved edges of the hammers 35, 36 leading.

The cranked configuration of each of the hammer carriers 32, 33 provides for pivoting of each corresponding hammer 35, 36 in a rearward clockwise direction, when viewed in Figure 7, relative to the corresponding hammer carrier 32, 33 to a position in which a rectilinear edge of the hammer 35, 36 is in alignment with a corresponding rectilinear surface of the corresponding hammer carrier 32, 33.

The stand 23 comprises a base support, generally designated 37, formed of two elongate spaced parallel ground engaging members, one of which is shown at 38, front and rear spaced parallel cross members 39 and 40 traversing the ground engaging members 38, the two elongate spaced parallel upright members 21, 22 upstanding from the rear cross member 40, and an upper rear elongate, transverse pressure plate 41 extending between and secured to the two upright members 21, 22. The base support 37 has secured thereon a transverse locating plate 42 of L-shape transverse cross section.

The stand 23 is intended for use with a bin 43 of standardised configuration in that such bins 43 have common dimensions and each is provided with an upper circumferential rim 44 and, at a lower rear thereof, with a transversely extending axle 45 at each end portion of which is rotatably mounted a corresponding one of a pair of wheels, one of which is shown at 46. The spaced parallel members 38 of the base support 37 of the stand 23 are spaced apart at sufficient distance that the bin 43 can be wheeled into position with a front portion of a base of the bin 43 seating on the front cross member 39 of the stand 23 and with a lower front edge of the bin 43 in engagement with the locating plate 42.

The pressure plate 41 has secured thereto three transversely spaced vertically extending contact tubes 47, 48 and 49 of flexible material, each being open at an upper end portion thereof and each being in communication, at a lower end portion thereof, with a communication tube 50. One end portion 51 of the communication tube 50 is closed off and a remote end portion 52 of the tube 50 is connected to a foot operative air compressor (not shown) which would be located on ground on which a person would stand to load bottles into the machine 10. The communication tube 50 is also in communication with an air pressure operative switch 53. The arrangement is such that the three contact tubes

47, 48 and 49 are positioned on the pressure plate 41 such that they are engaged by a leading edge of the rim 44 of a bin 43 when located on the stand 23.

Starting from a situation with the lid 11 in a raised position and an empty bin 43 having been wheeled into place on the stand 23 at an initial position in which the front edge of the base of the bin 43 seats on the front cross member 39 of the stand 23 and the lower front edge of the front wall of the bin 43 is in engagement with the locating plate 42, the bin 43 being inclined away from the pressure plate 41 with its wheels 46 remaining in contact with the ground, as the lid 11 is pivoted, by hand, downwardly relative to the upstanding members 21, 22, an upper inner surface of the front wall of the bin 43 is engaged by the lugs 26 of the cassette 12 causing the bin 43 to be tilted towards the upright members 21, 22. As a result of these relative movements, by the time that the lid 11 is in a position closing off the bin 43, as shown in Figure 1, the bin 43 is firmly positioned in an upright, but balanced, condition with the rim 44 pressing against the pressure plate 41 with its wheels 46 off the ground. The forces applied by the lugs 26 cause the rim 44 of the bin 43 to engage and squeeze the three contact tubes 47, 48 and 49, as indicated in Figure 5, thereby closing off their upper ends.

When a person subsequently approaches the machine 10 with glass bottles to be smashed by the machine 10, the person stands on the foot operative air compressor thereby causing air pressure within the communication tube 50 to increase resulting in operation of the air switch 53, thereby effecting start-up of the motor 27 and rotation of the hammer assembly 31. The bottles are then successively fed longitudinally into the tube 30 and slide down the tube 30 towards the cassette 12. As each bottle projects into the cassette 12, it is struck by the flailing hammers 35, 36 of the rotating hammer assembly 31 causing the glass of the bottles to be reduced to cullet 54, the cullet 54 issuing through the outlet 18 of the cassette 12 and collecting in the bin 43.

When the weight of cullet 54 received in the bin 43 reaches a predetermined weight, the moment of the force acting downwardly between the locating plate 42 of the stand 23 and the wheels 46 of the bin 43 overcomes the restraining force exerted by the lugs 26

bearing against the inner surface of the upper leading edge of the bin 43 resulting in the lid 11 springing open and release of the bin 43, which thereupon pivots away from the pressure plate 41 and returns to the initial position with its wheels 46 on the ground, as shown in Figure 3, thereby releasing pressure on the three contact tubes 45, 48 and 49, releasing pressure applied to the air switch 53, thereby operating the switch 53, and disabling the motor 27.

The lid 11 is then lifted to open the bin 43, as shown in Figure 4. The bin 43 may then be withdrawn from the stand 23 and replaced by a corresponding empty bin 43.

The position of the locating plate 42 on the base support 37 may be adjustable towards and away from the upstanding members 21, 22 so as to effect release of the lid 11 at different desired load weights of cullet 54 received in the bin 43.

It will be appreciated that the arrangement is such that the motor 27 will not operate if the lid 11 is lowered when no bin 43 is present on the stand 23 since, in such a situation, the air switch 53 will remain open, there being no force present to close off the contact tubes 47, 48 and 49, and, in consequence, no power will be supplied to the motor 27.

It will also be appreciated that the control system comprising the combination of the contact tubes 47, 48 and 49, the air switch 53 and the foot operative air compressor provides advantages of low maintenance and low cost compared with a control system including multiple electrical devices.

Furthermore, it will be appreciated that the cranked configuration of the hammer carriers 32, 33 facilitates swinging back of the hammers 35, 36 into an arc of reduced radius in the event that they should strike an object without shattering it, thereby reducing possible jamming.

It will also be appreciated that the stand 23 may be free-standing or may be attached to a structure, such as a wall. In the latter arrangement, the upright members 21, 22 may be of minimum length and may not extend downwardly as far as the base support 37.

Claims

1. Volume reducing apparatus (10,11) comprising a lid (11) for closing a container (43) the lid (11) having an aperture (29) therein **characterised in that** there is provided a motor-driven mechanism (31) for effecting volume reduction, the mechanism (31) being carried below the lid (11) so that, when the lid (11) is positioned to close a container (43) and the mechanism (31) is active, articles entered through the aperture (29) are reduced in volume by the mechanism (31) and the issue (54) is received in the container (43).

2. Apparatus (10, 11) as claimed in claim 1 **characterised in that** there is provided a hinged component (19,20) whereby the component (19,20) is co-operable with another component (21,22) such that the lid (11) is pivotable relative to the other component (21,22).

3. Apparatus (10, 11) as claimed in claim 2 **characterised in that** the other component (21,22) is a component of a stand (23) for locating the container (43).

4. Apparatus (10,11) as claimed in claim 3 **characterised in that** the stand (23) includes a transducer (47,48,49) for controlling operation of a motor (27) for driving the mechanism (31), the transducer (47,48,49) being responsive to presence of the container (43) relative to the stand (23).

5. Apparatus (10,11) as claimed in any one of claims 1 to 4 **characterised in that** the mechanism (31) is included within a cassette (12) which is detachable from the lid (11).

6. Apparatus (10, 11) as claimed in claim 5 **characterised in that** the motor (27) is attached to an upper plate (13) of the cassette (12).

7. Apparatus (10, 11) as claimed in claim 6 **characterised in that** there is provided a tube (30) extending through the lid (11) and in communication with the cassette (12) through which tube (30) articles are fed to the mechanism (31).

8. Apparatus (10,11) as claimed in any one of the preceding claims **characterised in that** the mechanism (31) includes an elongate hammer carrier (32,33) adapted to be pivotally connected at one end portion thereof to a hammer (35,36).

9. Apparatus (10, 11) as claimed in claim 8 **characterised in that** the hammer carrier (32,33) is cranked at the end portion thereof where it is pivotally connectable to the hammer (35,36).

10. Apparatus (10, 11) as claimed in claim 9 **characterised in that** the hammer (35,36) is of lamina semi-circular configuration.

11. Apparatus (10, 11) as claimed in claim 10 **characterised in that** the mechanism (31) comprises two hammer carriers (32, 33) and two corresponding hammers (35, 36).

12. Apparatus (10,11) as claimed in claim 11 **characterised in that** the hammer carriers (32,33) are secured parallel one to another and combine to form an aperture (34) for receiving a shaft (28) of the motor (27).

13. A stand (23) for a container (43) comprising a lid (11) for closing the container (43) when supported on the stand (23) **characterised in that** the stand (23) includes a transducer (47,48,49) for controlling operation of a motor (27) for driving a mechanism (31) for processing material (54) to be collected in the container (43) and in that the stand (23) also includes support means (39,42) for supporting the container (43) such that, as the lid (11) closes relative to the container (43), a portion (44) of the container (43) is moved to activate the transducer (47,48,49) thereby enabling the motor (27), the arrangement being such that the balance of the

forces created by the weight of the lid (11) of the one part and the weight of the container (43) of the other part holds the container (43) in contact with the lid (11) so that the lid (11) closes off the container (43) until the weight of the material (54) issued into the container (43) reaches a predetermined weight whereupon the weight of the lid (11) of the one part is overcome by the combined weight of the container (43) and the material (54) contained therein of the other part causing the lid (11) to move apart from the container (43), the said portion (44) of the container (43) to move away from the transducer (47,48,49) and the motor (27) thereby to be disabled.

14. A stand (23) as claimed in claim 13 **characterised in that** the transducer (47,48,49) comprises at least one open flexible tube (47,48,49) in combination with a pressure-responsive switch (53) and a compressor whereby, as the lid (11) closes the container (43), the said portion (44) of the container (43) closes off the tube (47,48,49) and subsequent operation of the compressor activates the switch (53).

15. A stand (23) as claimed in claim 14 **characterised in that** the compressor is foot operative.

Fig 1

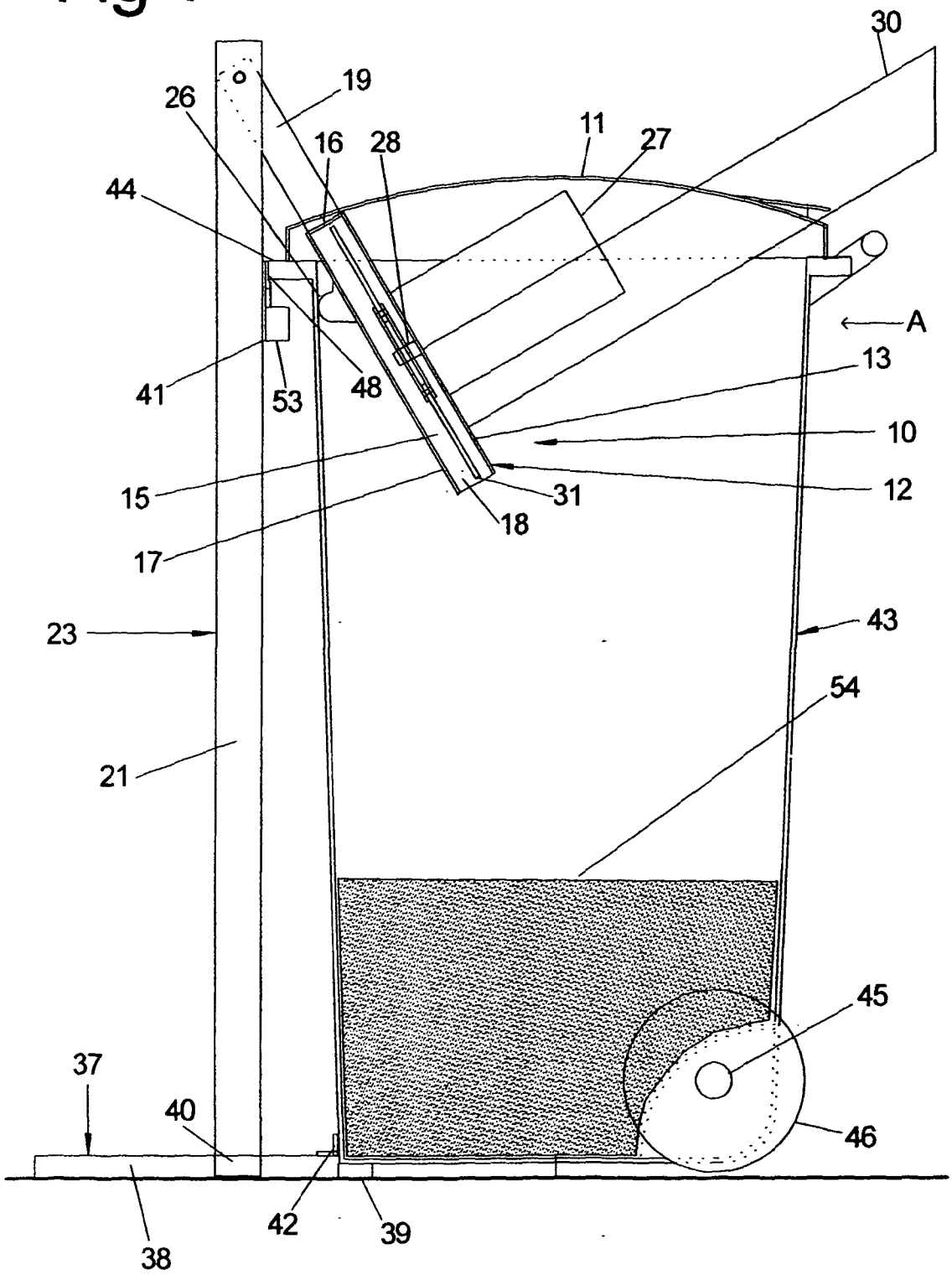
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Fig 2

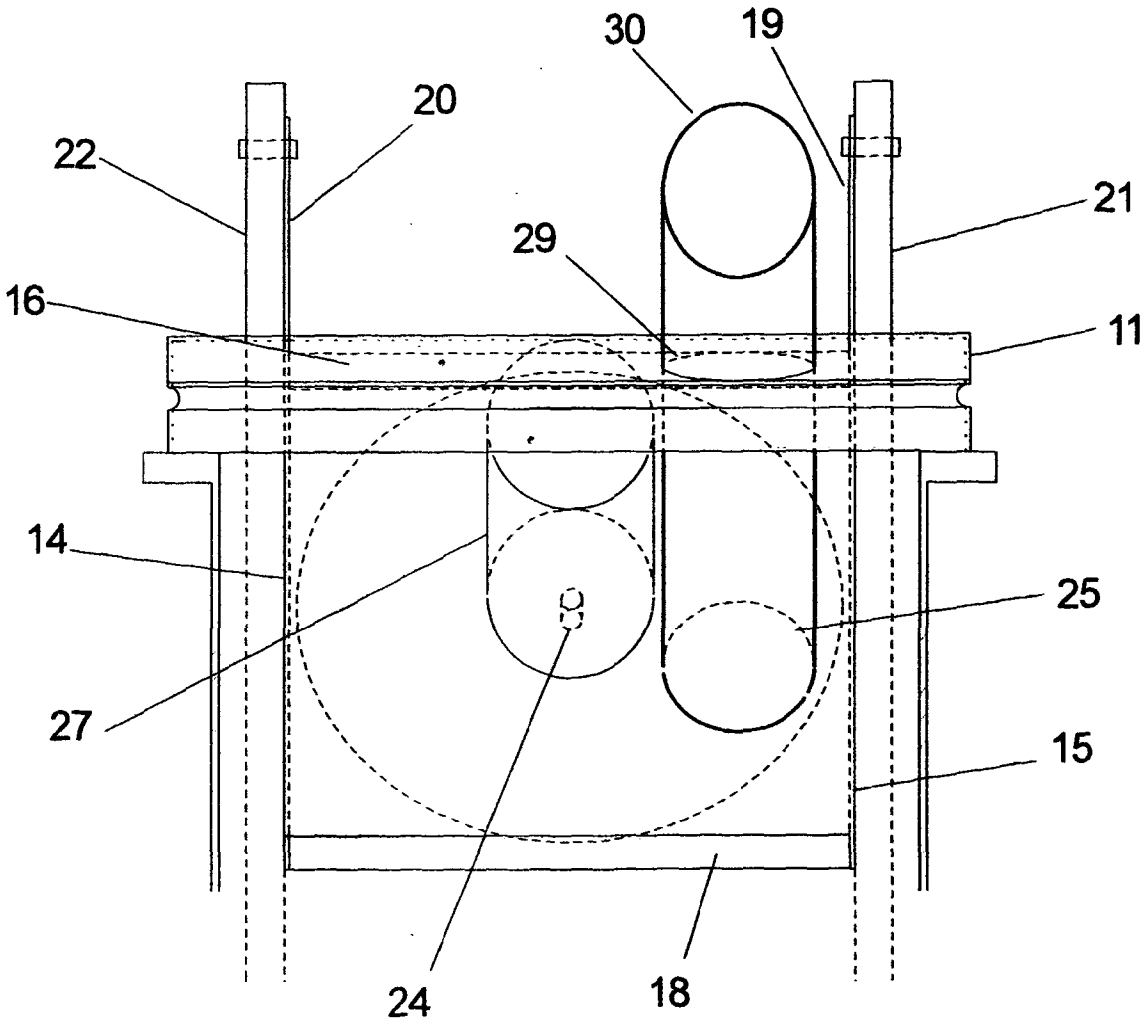

Fig 3

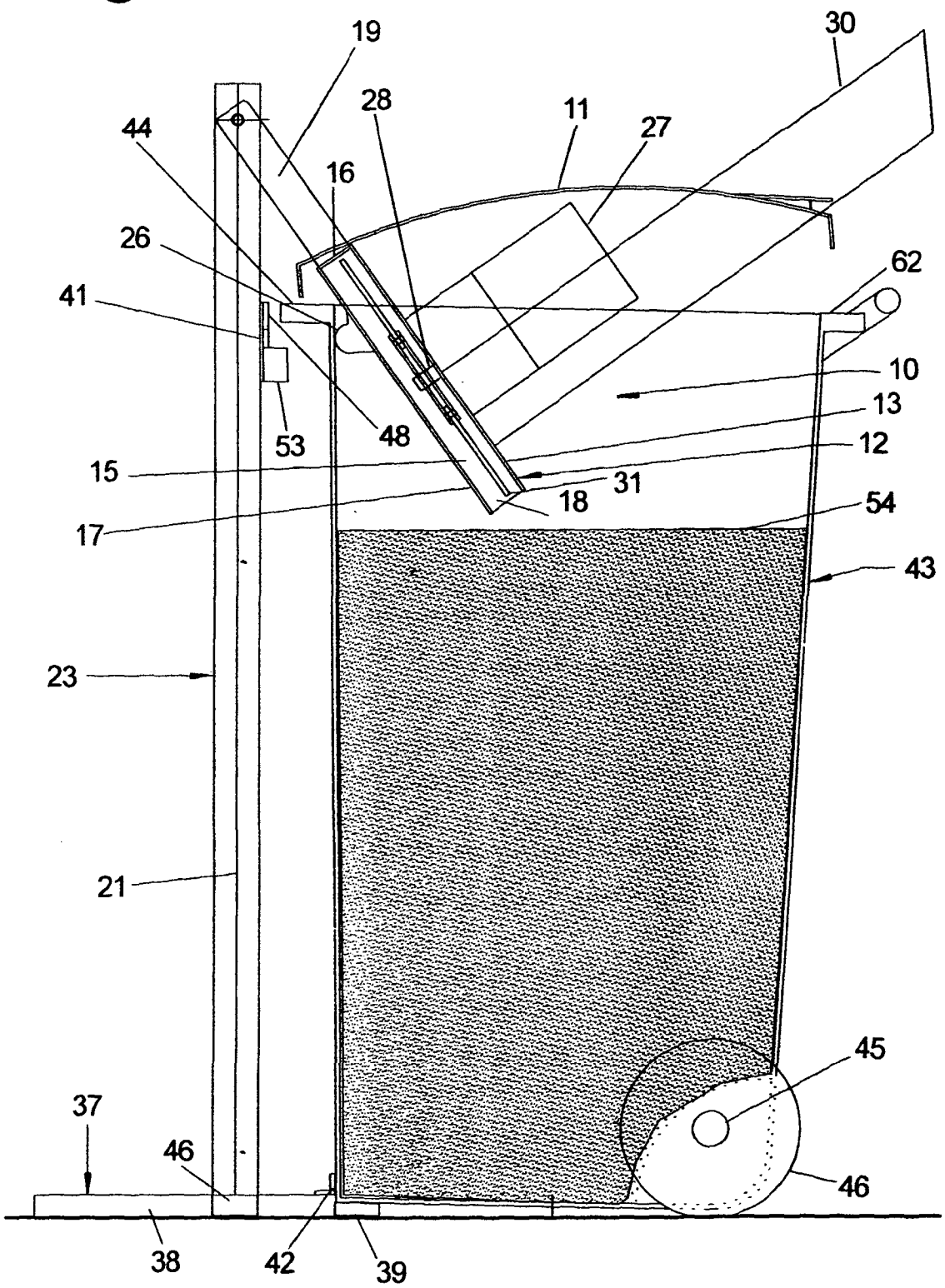
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Fig 4

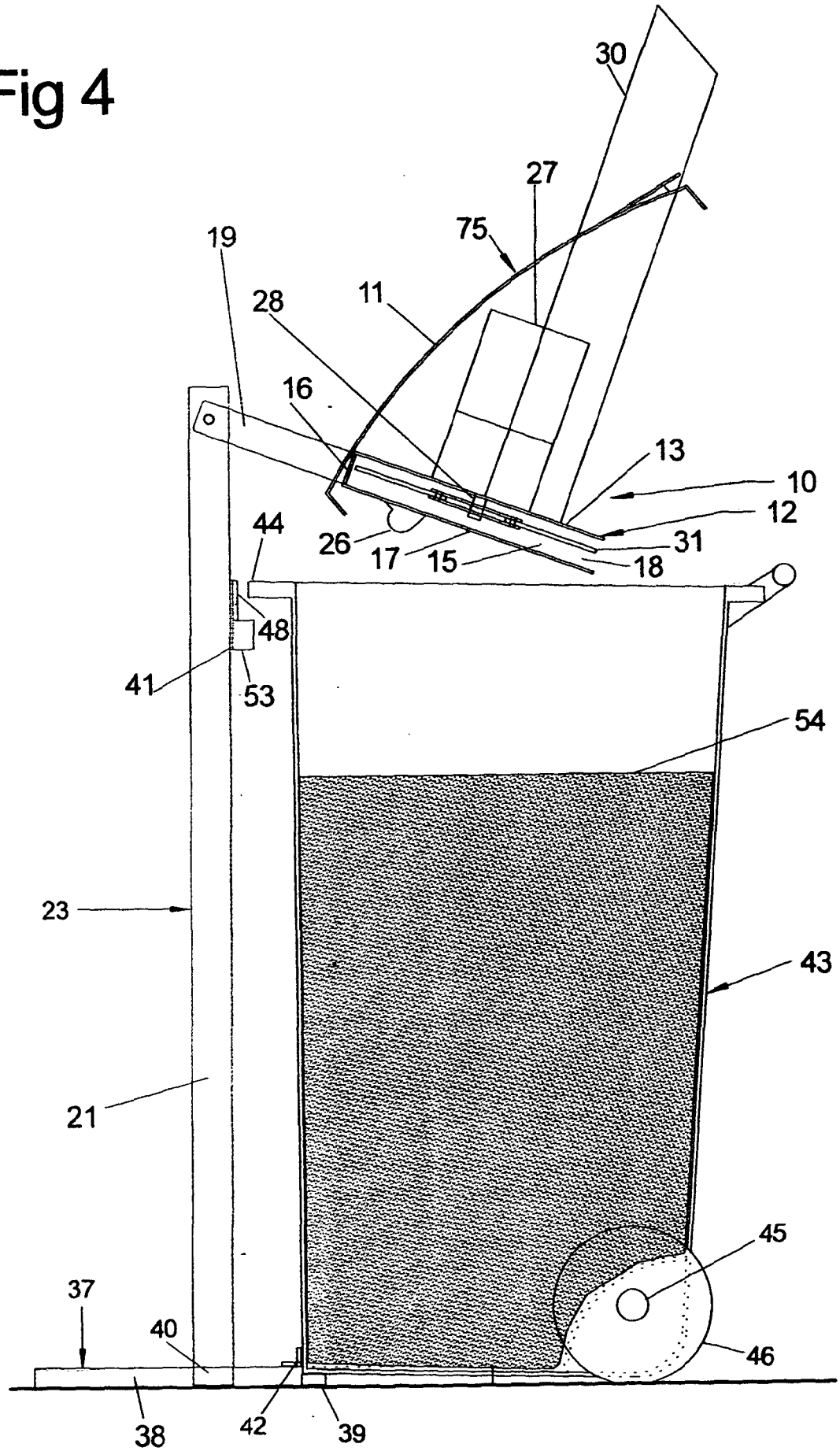
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Fig 6

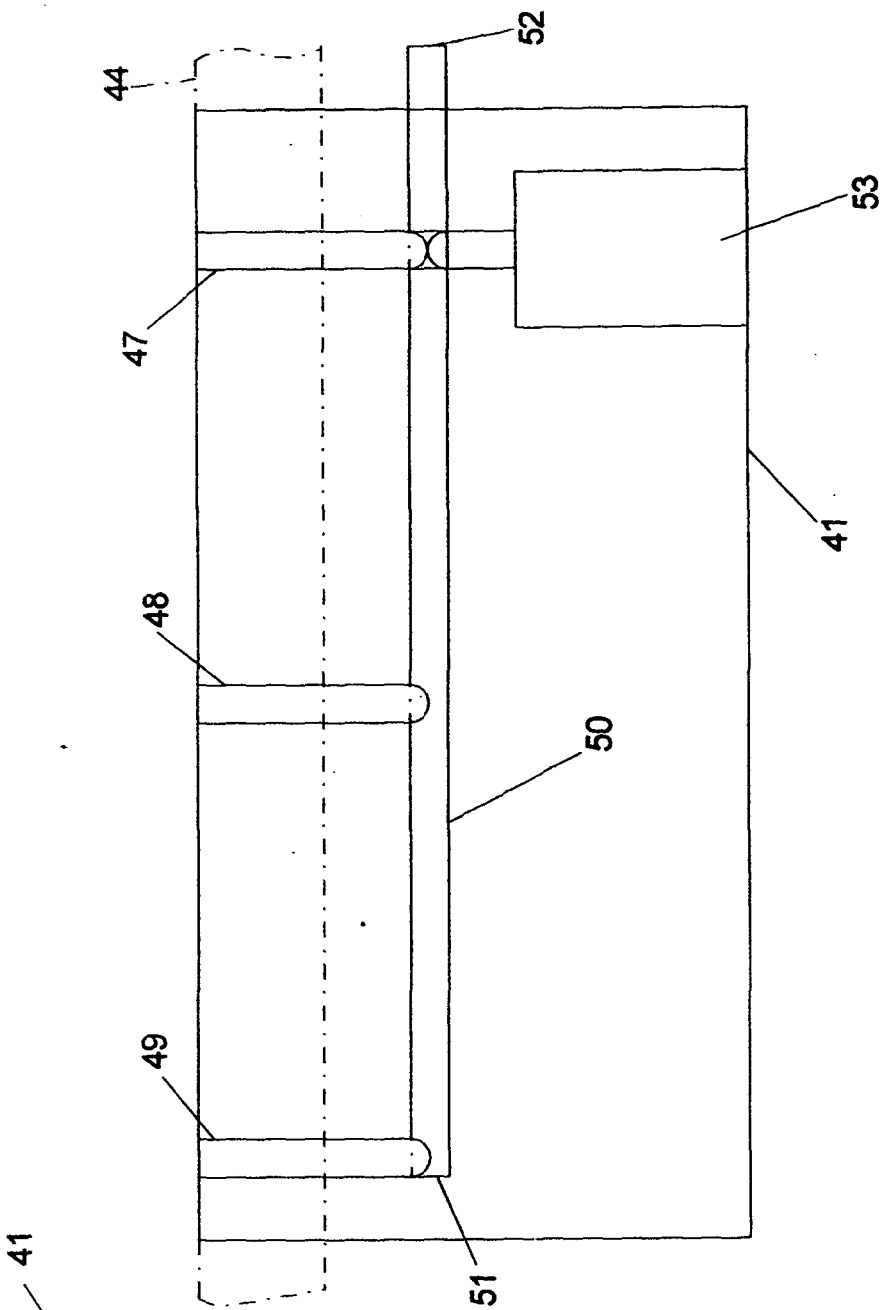

Fig 5

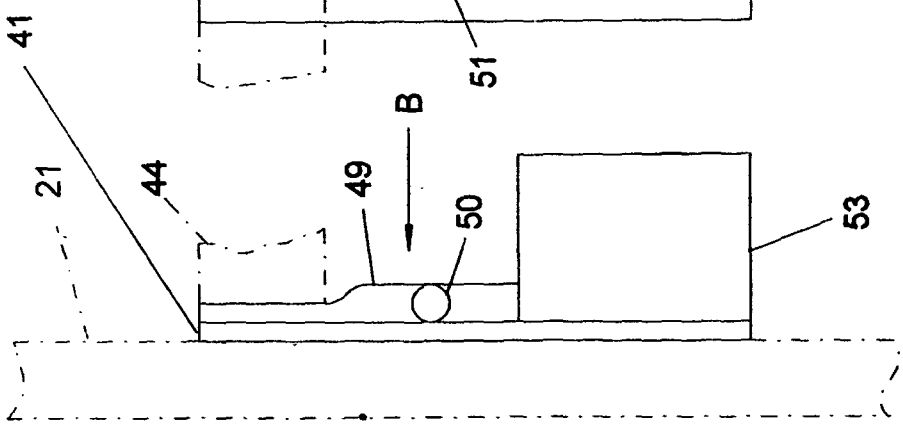
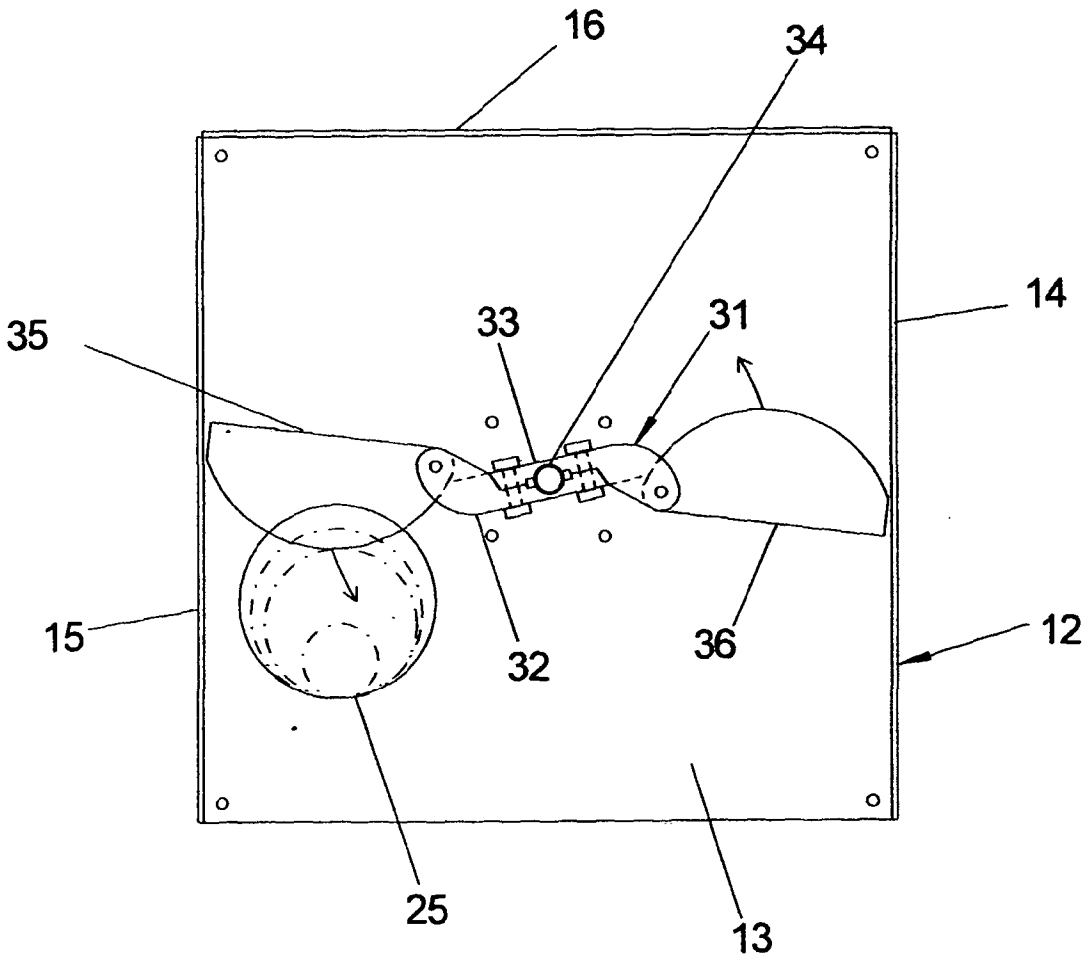
Fig 7