

**TRANSPORTERS FOR REFUSE CONTAINERS**

**FIELD OF INVENTION**

5 This invention relates to transporters for refuse containers and more particularly to mobile devices which will transform a stationary compactor or storage container into a mobile collection vehicle.

**BACKGROUND ART**

10 For the sake of convenience, the invention will be described in relation to refuse compactors of the kind described in International Patent Application PCT/AU96/00205 filed on 4 April 1996.

The refuse compactor described in International Patent Application PCT/AU96/00205 consists of a storage chamber having an opening thereto, a lid for closing the opening and a compaction blade arranged to compact waste material or refuse deposited in the storage chamber.

15 **SUMMARY OF INVENTION**

20 According to one aspect of the invention there is provided a vehicle adapted to transport a refuse container, said vehicle comprising a frame, ground engaging wheels mounted on the frame, said frame having a forwardly projecting draw-bar and a rearwardly facing recess and lifting means mounted on the frame adapted to engage and lift the refuse container.

Preferably, the lifting means consists of a pair of tynes spaced apart by the width of the refuse compactor and an hydraulic cylinder or cylinders adapted to lift the tynes.

25 According to another aspect of the invention there is provided a self-propelled vehicle adapted to transport a refuse container, said vehicle comprising a frame having a rearwardly facing recess, ground engaging wheels mounted on the frame, lifting means mounted on the frame adapted to engage and lift the refuse container, and a prime mover connected to the  
30 main frame by a swivel joint.



**BRIEF DESCRIPTION OF THE DRAWINGS**

Fig. 1 is a plan view of a trailer-type vehicle adapted to transport a refuse container according to one embodiment of the invention,

5 Fig. 2 is a front view of the trailer shown in Fig. 1,

Fig. 3 is a partial side elevational view of the trailer shown in Figs. 1 and 2,

10 Fig. 4 is a side elevational view of the trailer shown in Figs. 1 to 3 attached to a prime mover and being reversed to engage a refuse container,

Fig. 5 is a view similar to Fig. 4 showing the lifting arms of the trailer engaged with the refuse container,

Fig. 6 is a view similar to Fig. 5 showing the refuse container in use,

15 Fig. 7 is a simplified plan view of a self-propelled vehicle adapted to transport a refuse container according to a second embodiment of the invention,

Fig. 8 is a front view of the frame of the vehicle shown in Fig. 7,

20 Fig. 9 is a partial side elevational view of the prime mover shown in Figs. 7 and 8,

Fig. 10 is a front elevational view of the vehicle shown in Figs. 7 and 8,

Fig. 11 is a side elevational view of the vehicle shown in Figs. 1 to 10 carrying a refuse container,

25 Fig. 12 is a view similar to Fig. 11 showing the refuse container in use,

Fig. 13 is a side elevational view of a modified version of the vehicle shown in Figs. 7 to 12,

30 Fig. 14 is a side elevational view of a further embodiment of the invention incorporating rotating hooks which engage

the refuse container,

Fig. 15 is a side elevational view of a further embodiment of the invention incorporating locking bars which engage the refuse container,

5 Fig. 16 is a side elevational view similar to fig. 15 with the trailer not yet engaged with the container,

Fig. 17 is a view similar to Fig. 16 with the trailer engaged with the container,

10 Fig. 18 is an enlarged, partly broken away end view of the trailer and container of Figs. 14 to 17,

Fig. 19 is a side elevational view of a modified version of the trailer of Figs. 15 to 18 which incorporates a lifting cylinder for emptying the container,

15 Fig. 20 is a side elevational view of a further embodiment of the invention,

Fig. 21 is a side elevational view of a still further embodiment of the invention,

20 Fig. 22 is a partly cut-away side elevational view of another embodiment of the invention incorporating an hydraulic suspension for the trailer,

Fig. 23 is a side view similar to Fig. 22 with the trailer lowered,

Fig. 24 is a schematic top view of a joystick control for the vehicle of Figs. 7 to 13, and

25 Fig. 25 is a schematic front view of the joystick control shown in Fig. 24.

#### MODES FOR CARRYING OUT THE INVENTION

The vehicle or trailer 10 shown in Figs. 1 to 6 includes a main frame 11 having a cross member 12 and a pair of spaced apart side members 13 and 14 which define a rearwardly facing U-shaped recess 15. A draw-bar 16 is connected to the cross member by frame members 17 and 18. The

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frame 11 is supported by ground wheels 19 fitted with torsion bar type suspension and brake hubs on axle 20.

Adjacent each end of the cross member 12 there is an upstanding location member 21 and 22. Lifting means 23 includes a frame 24, a pair  
5 of lifting arms 25 and hydraulic cylinder 26. The frame 24 has a cross member 27 and downwardly depending tubular members 28 and 29 which receive the locating members 21 and 22 respectively. Power to the cylinders 26 is provided by a small D.C. power unit (not shown) which can be fitted to the draw-bar 16.

10 The trailer 10 is designed to straddle the refuse compactor 30 which has a pocket 31 on each side to receive one of the lifting arms 25.

As can be seen in Fig. 4, the trailer 10 is reversed by the prime mover 40 so that the arms 25 enter the lifting pockets 31. Each arm 25 has a locking lug 32 adapted to engage the rear of the pocket 31 as shown  
15 in Fig. 5. Once the trailer 10 has been correctly located in relation to the refuse compactor 30, the arms 25 are hydraulically raised to lift the refuse compactor 30 clear of the ground ready for transportation as shown in Fig. 5.

The trailer 10 and the refuse compactor 30 have, in this instance, a  
20 maximum combined loaded mass of 1,500kg and can easily be towed by conventional light duty highway vehicles or special application vehicles such as electric golf cars or small tractors.

The operation of the refuse compactor 30 is shown in Fig. 6 where the lid 33 has been opened to allow the bin 34 to be emptied by the  
25 mechanism 35 which includes a lifting arm 36 operated by ram 37. The compactor 38 (Fig. 6) is driven by cylinder 39.

The self-propelled vehicle 50 shown in the embodiment of Figs. 7 to 12 has a frame 51 which is substantially similar to the frame 11 of the first embodiment of the invention. The frame 51 has a rearwardly facing recess  
30 52 and a swivel joint 53 at the midpoint of cross members 54.

As shown in Figs. 8, 11 and 12, the frame 51 has lifting means 55 which includes a frame 56, a pair of lifting arms 57 and a hydraulic cylinder and ram 68. The frame 56 has downwardly depending tubular members 58 which receive locating members 59 projecting upwardly from the corners of the frame 51 in the same manner as shown in the first embodiment of the invention.

The frame 51 is connected to the prime mover 60 by means of the swivel joint 53 and a pair of hydraulic cylinders and rams 61 and 62 which are extended or retracted to effect steering of the vehicle 50.

The prime mover 60 has an operator's cabin 63, an electric power unit 64, differential 65 and ground wheels 66. Electric power unit 64 provides power to the electric motor 67 connected to the differential 65. The electric drive could be replaced by an internal combustion engine and hydraulic drive system.

The vehicle 50 of Figs. 7 to 12 is a self contained self-propelled version of the trailer 10 shown in Figs. 1 to 6. The vehicle 50 has the same straddle-type rear frame and lifting tynes as the trailer 10 but instead of being towed by separate vehicle it is capable of propelling itself.

As mentioned above, the vehicle 50 is fitted with a small D.C. motor 67 and a battery pack 64. This power system propels the vehicle and provides power to the cylinder that raises and lowers the lifting frame 56.

The battery pack 64 can also provide the power necessary to operate the packer of the compaction unit 30.

In this embodiment, the vehicle 50 has a maximum combined mass of about 2,000kg, is capable of speeds up to 20kph and can handle grades up to 20%.

The vehicle 50 is controlled by the means of a joystick type lever which provides, one handed, proportional control over forward and reverse travel as well as steering functions. The joystick control can be positioned either in the driver's cabin at the front of the vehicle or at the loading

position at the rear of the vehicle. This allows a single operator to load and drive the vehicle simultaneously. The joystick control is described below in relation to Figs. 24 and 25.

5 The steering of the vehicle by the hydraulic cylinder 61 and 62 produces a small turning circle and substantial manoeuvrability in restricted areas.

Fig. 13 shows a larger version of the vehicle 50 in which the trailer 51 has a pair of ground wheels to enable the vehicle to handle a much larger refuse compactor.

10 In the embodiment of Fig. 14, non-standard refuse container 70 can be transported using hydraulically powered rotating hooks 71 which locate into lifting lugs 72 on each side of the container 70. By rotating the hooks 71 upwards they engage the lug 72 and the container 70 is lifted clear of the ground. The hooks 71 are driven by hydraulic cylinder and piston  
15 arrangement 76. A pair of fixed secondary hooks 73 locate into a recess 74 in the leg 75 of the container 70 providing a secure lock for the container 70 during transportation.

In the embodiment of Fig. 15 the locating and lifting arm 25 of the embodiment of Figs. 1 to 6 is replaced by an angle iron lifting frame 80  
20 which in the retracted position lays along the stradle frame 81 of the trailer 82 providing clearance for the mating members 83 located on the sides of the refuse container 85.

The angle iron lifting frame 80 is fitted with a number of locating pins 84 which lock into mating recesses 87 in the lifting members 83 on  
25 the side of the refuse container 85 to provide a more secure location. The angle bars 80 are raised and lowered by cylinder and piston arrangements 86. Locating pins 88 and bushes 89 at each end of the frame 81 stabilise the angle bar lifting frame 80 as it is raised and lowered.

The arrangement of Figs. 15 to 18 allows the frames 80 and the lift  
30 members 83 to be located on all four sides of the containers thereby

providing the ability for it to be carried facing sideways rather than front or rearward only as is the case with other styles of lifting apparatus.

The major advantage of this style of lifting apparatus is the fact that it locates positively into the lower sides of the container, thereby providing support for the stradle frame using the container and support for the container using the stradle frame.

In Fig. 19, the cylinder and piston arrangement 88 of Figs. 15 to 18 is replaced by a telescopic cylinder 90 and the frames 80 are pivotally mounted onto the stradle frame 81 by pins 91 in upright members 92. Thus, the lifting frames 80 can be locked into a pivot point at one end of the frame and the lift cylinder 90 further extended using its telescopic stages to tip the container 85 rearwards for emptying.

Fig. 20 is a view similar to Fig. 13 showing the use of two sets of lifting frames 80, one at each end of the frame 81. In Fig. 21, two separate containers 85 which are carried by the frame 81 are raised and lowered by the lifting frames 80.

In the embodiment of the invention shown in Figs. 22 and 23, the frame 81 is supported by ground wheels 80 carried by pivot arms 101 which are raised and lowered by the cylinder and piston arrangement 102. This arrangement has the advantage of being able to provide a lifting and lowering system for the stradle frame 81 thereby allowing the lifting members 80 to be fixed to the stradle frame rather than requiring separate hydraulic cylinders for raising and lowering.

The propulsion unit can be powered by a range of alternative power sources such as internal combustion engines using either a generator set and the D.C. drive system or a hydraulic transmission. The latter option provides for longer duty cycles because use is not limited by the battery life. The internal combustion engine option also provides the ability to install hydraulically powered wheels in the trailer frame thereby providing the option of multiple wheel drive for all terrain applications.

Figs. 24 and 25 show in schematic form the joystick control for the vehicle of Figs. 7 to 13. The vehicle 50 is driven using a single axis electronic control lever or joystick 110 which can be located at the front control position, the rear collection position or via a remote control position thereby providing the ultimate versatility for the machine. The joystick 110 is simply plugged and unplugged into various adaptors where required.

The joystick 110 provides precise proportional control over the acceleration rate, deceleration rate and speed in each direction by moving the lever through its axis of travel. The further the joystick 110 is moved, the higher the signal and the greater the speed. An in-built ramp controls the rate of deceleration even if the joystick 110 is released completely, thereby eliminating the risk of damage due to sudden stopping.

The button 111 on the top of the joystick 110 provides an emergency stop facility if required.

A deadman function is also incorporated in the design of the control system. This is achieved by means of a weight sensor under the drivers seat and the rear control station platform. If neither of these sensors indicate the presence of the driver, then the machine will automatically decelerate and stop.

Braking of the vehicle 50 and the trailer frame is achieved by means of proportional electric coils which progressively activate the brake pads until the machine is stopped. The deadman function provides automatic park braking when the operator is not present.

The control joystick 110 also incorporated a twist-grip facility in the handle. This operation provides proportional control over the steering cylinders via the directional control valve.

The combined effect is that the driver has one handed control over drive speed, direction of travel and emergency stopping.

**INDUSTRIAL APPLICABILITY**

The vehicles of the invention may be used to transport refuse containers which may or may not incorporate its own compactor.



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### CLAIMS

1. A vehicle adapted to transport a refuse container comprising a frame, ground engaging wheels mounted on the frame, said frame having a forwardly projecting draw-bar and a rearwardly facing recess and lifting means mounted on the frame adapted to engage and lift the refuse container.
2. A vehicle according to claim 1 wherein the lifting means consists of a pair of arms spaced apart by the width of the refuse compactor and an hydraulic cylinder or cylinders adapted to lift the arms.
3. A vehicle according to claim 1 wherein the lifting means consists of a lifting bar on each side of the frame and cylinder and piston means adapted to raise and lower the lifting bars.
4. A vehicle according to claim 3 wherein each lifting bar has a plurality of spaced apart upwardly directed lugs adapted to engage in recesses formed in lifting members on the container.
5. A vehicle according to claim 3 wherein the lifting bars are pivotally mounted on the frame.
6. A vehicle according to claim 3 wherein the cylinder and ram is connected to the mid portion of the lifting bar and thus is provided at each end of the lifting bar locating pins adapted to move within brushes mounted on the frame.
7. A vehicle according to claim 1 wherein there is a pair of lifting means at each end of the frame.

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8. A vehicle according to claim 1 and further including a prime mover connected to the frame by a swivel joint.
9. A vehicle according to claim 1 which is self propelled.
10. A vehicle according to claim 1 wherein the lifting means comprises a support frame pivotally mounted on each side of the frame, the ground engaging wheels being mounted on the support frames, and means for pivoting the support frame to raise and lower the frame.
11. A vehicle according to claim 9 which is propelled by an internal combustion engine.
12. A vehicle according to claim 9 wherein the vehicle is controlled by a joystick control.
13. A vehicle according to claim 9 and including fail-safe means operative to render the power source inoperative when the operator is not in a correct operating position.
14. A vehicle according to claim 1 wherein the lifting means consists of a rotatable hook on each side of the frame adapted to engage lugs on each side of the container.

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