July 15, 1969 K. L. MERTHER 3,455,471

REFUSE COLLECTING VEHICLES

Filed April 17, 1967 6 Sheets-Sheet 1

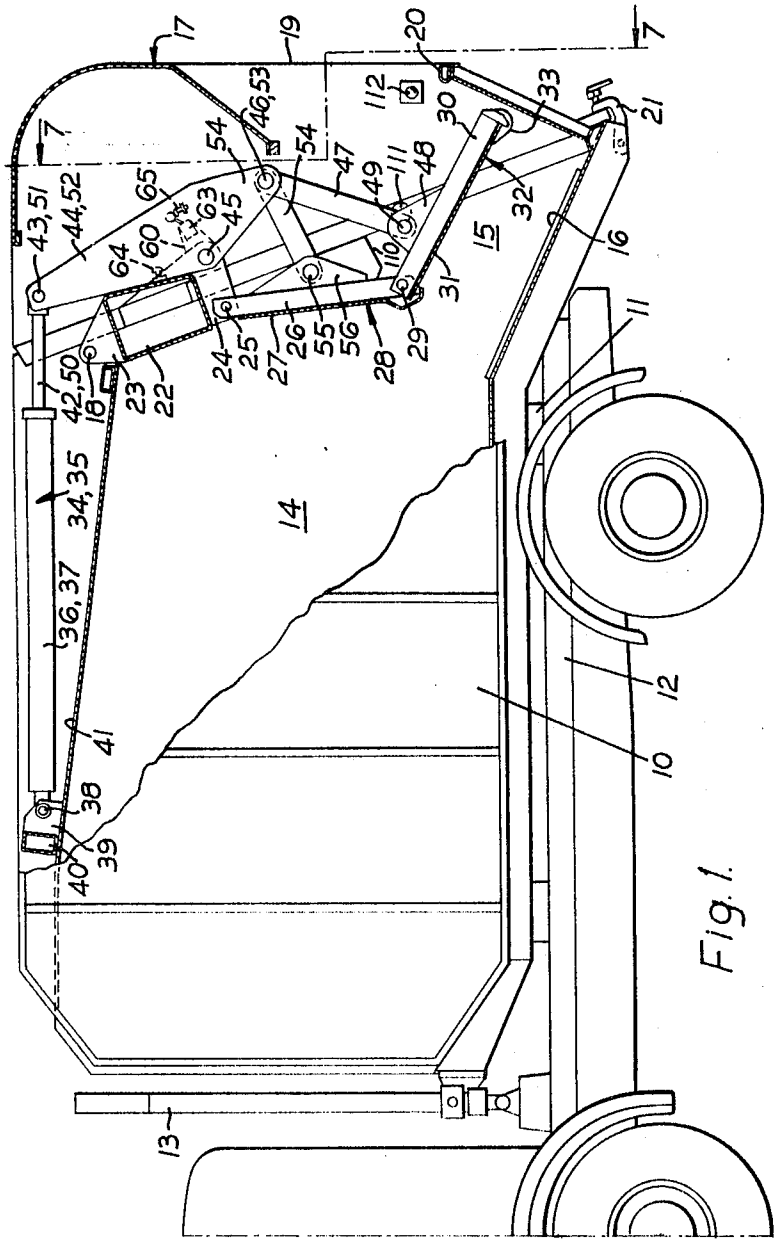


Fig. 1.

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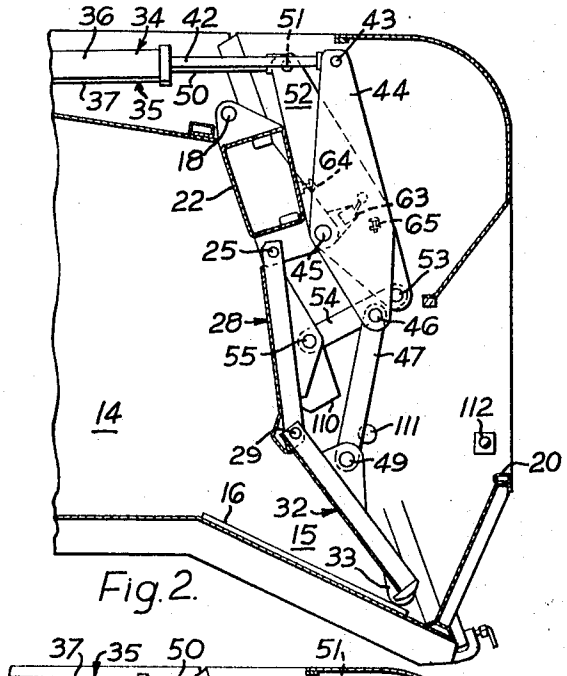


Fig. 2.

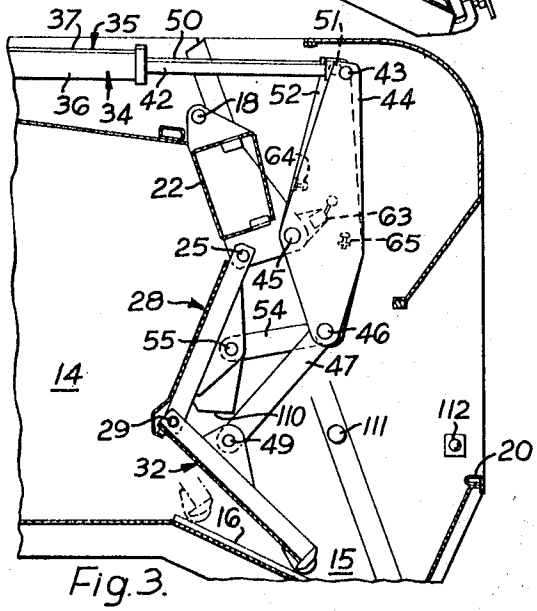


Fig. 3.

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REFUSE COLLECTING VEHICLES

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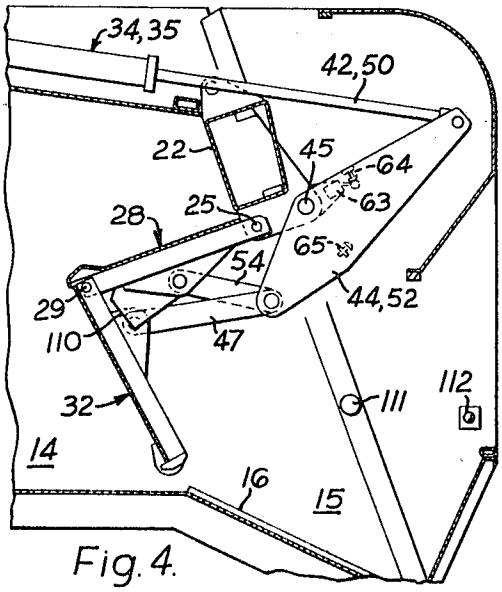


Fig. 4.

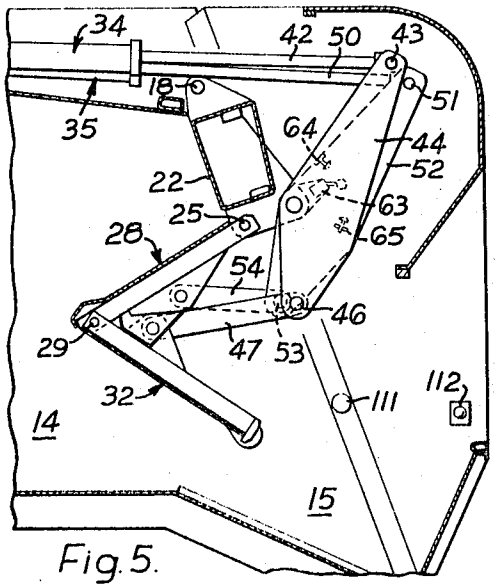


Fig. 5.

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REFUSE COLLECTING VEHICLES

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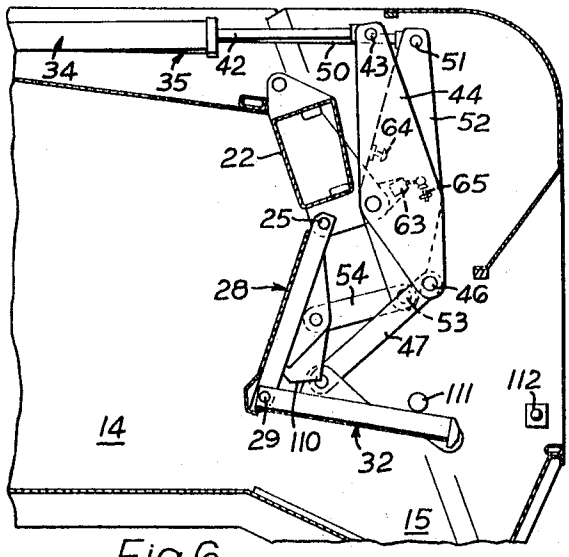


Fig. 6.

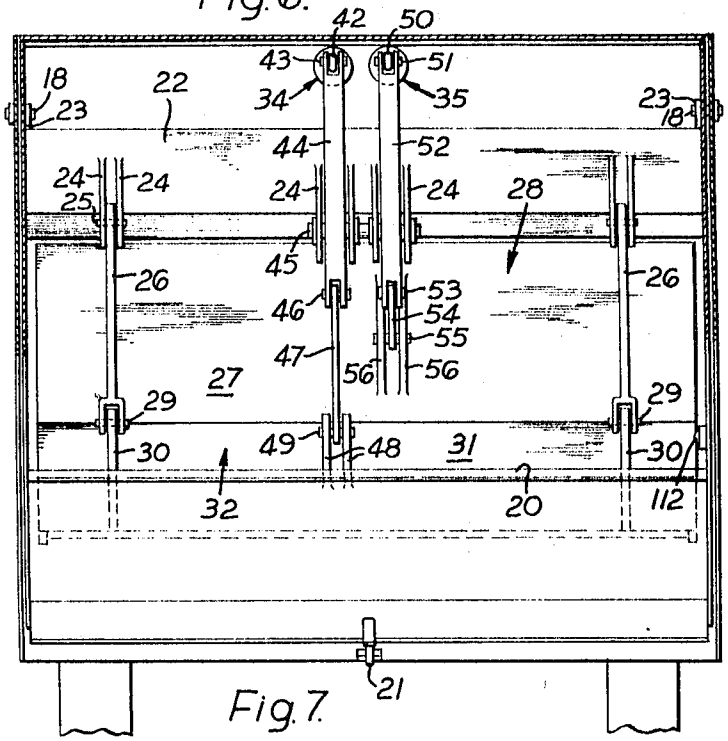


Fig. 7.

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REFUSE COLLECTING VEHICLES

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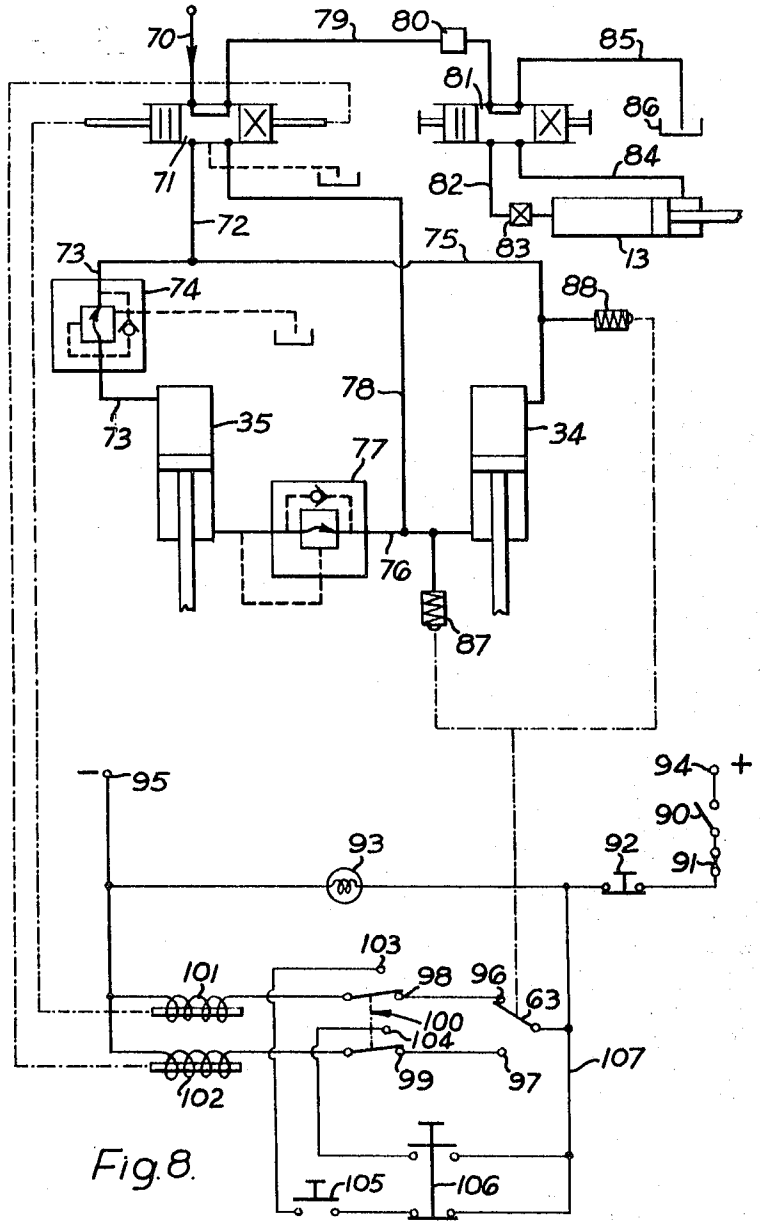


Fig. 8.

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REFUSE COLLECTING VEHICLES

Filed April 17, 1967 6 Sheets-Sheet 6

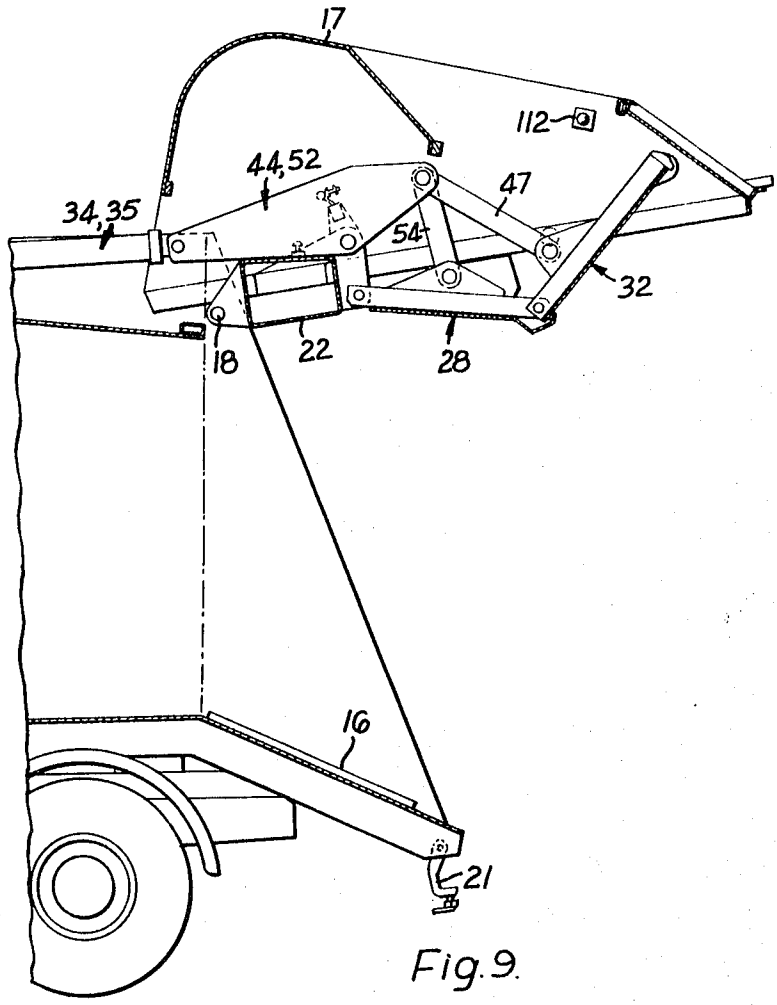


Fig. 9.

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3,455,471

REFUSE COLLECTING VEHICLES

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Int. Cl. B65f 3/04
U.S. Cl. 214—83.3 12 Claims

ABSTRACT OF THE DISCLOSURE

Refuse collection vehicle body comprising a compression lever pivotally mounted on the lower end of a dependant swinging arm for crushing refuse in a depository and thence displacing the crushed refuse into a collection chamber.

This invention relates to refuse collection vehicles of the kind having a body incorporating mechanism for crushing refuse in a depository at one end of the body and thence displacing the crushed refuse into an adjoining collection chamber in the body.

The principal object of the invention is the provision of a body for a refuse collection vehicle of the above kind wherein the moving parts of the mechanism are mounted above the position of the deposited refuse so that the danger of the mechanism being jammed by the refuse is significantly reduced and the need for seals to isolate the refuse from the mechanism is abolished.

In accordance with the invention, a refuse collection vehicle body comprises a refuse depository, a collection chamber, a dependant arm mounted on the body for swinging motion, and power means for effecting the swinging motion, characterised by a compression lever pivotally mounted on the arm both to swing relative to the arm to crush refuse in the depository and to swing with the arm to displace the crushed refuse into the collection chamber.

A preferred example of the invention is now described with reference to the accompanying drawings wherein:

FIGURE 1 is a side elevation of a refuse collection vehicle according to the invention with parts broken away to expose the refuse crushing and displacing mechanism.

FIGURES 2, 3, 4, 5 and 6 are detail views illustrating five successive stages in a cycle of operation of the mechanism of FIGURE 1.

FIGURE 7 is a section on line 7—7 FIGURE 1.

FIGURE 8 is a combined hydraulic and electrical circuit diagram relating to the control of the aforesaid mechanism and

FIGURE 9 is a detail view of the vehicle of FIGURE 1 but illustrating the aforesaid mechanism in a raised position.

Initially referring principally to FIGURES 1 and 7 the refuse collection vehicle comprises a body **10** pivotally mounted adjacent its rear end at **11** on a vehicle chassis **12** with a hydraulic ram **13** connected between the front end of the body and the chassis for tipping the body for rear discharge. The body comprises a collection chamber **14** occupying the forward and major part of the volume of the body, and a depository **15** above a downwardly and rearwardly inclined reinforced floor **16**. The rear end of the body is closed by a canopy **17** pivotally mounted on the body at **18** on a horizontal axis with an open window **19** above a rubber cushioned sill **20** provided in the rear end of the canopy through which window refuse is directed into the depository. The lower part of the canopy beneath the sill defines the rear wall of the depository and clamps **21** serve to lock the lower part of

the canopy to the lower rear end of the floor **16** in the working position of the canopy.

Mechanism for cyclically crushing refuse in the depository and thence displacing the refuse into the collection chamber **14** has its principal parts pivotally mounted on a box section cross member **22** forming part of the frame of the canopy and carrying brackets **23** which are pivotally mounted on the aforesaid pivots **18**. More specifically the mechanism comprises a barrier **28** including a plurality of transversely spaced dependant swinging arms **26** pivotally mounted at **25** on brackets **24** fixed to the underside and rear of the cross member **22**, and a facing plate **27** fixed to these arms **26**. Fulcrummed at **29** adjacent the lower end of the swinging arms **26** is a plurality of transversely spaced apart dependant arms **30** carrying a facing plate **31** to constitute a compression lever **32** which trails behind the lower edge of the barrier **28** into the depository **15**. The lower free edge of the compression lever carries toe pieces **33**.

The compression lever **32** and barrier **28** are respectively powered by two rams **34** and **35**, hereinafter respectively called the primary and secondary rams wherein the cylinders **36** and **37** of the two rams are connected to pivots **38** on brackets **39** fixed to a strong box section cross member **40** of the roof **41** of the chamber **14**. The piston rod **42** of the primary ram **34** is pivotally connected at **43** to the upper end of a first order lever **44**, hereinafter called the primary lever, which is fulcrummed on a horizontal shaft **45** carried by the substantially central brackets **24**. The lower end of the primary lever is pivotally connected at **46** to the upper end of a primary link **47** pivotally connected at **49** adjacent its lower end to brackets **48** rearwardly projecting from the compression lever **32**. The piston rod **50** of the secondary ram **35** is pivotally connected at **51** to the upper end of a first order lever **52** of similar construction to the primary lever **44**, and hereinafter called the secondary lever. The secondary lever is fulcrummed at **45** co-axially with the primary lever and has its lower end pivotally connected at **53** to a secondary link **54** projecting forwardly to a pivotal connection at **55** with rearwardly projecting brackets **56** on the barrier **28**.

Mounted on a bracket **60** projecting from the rear face of the cross member **22** is a single-pole two-way trip switch **63** which is actuated by strikers **64** and **65** on the primary or secondary levers **44** and **52** respectively.

The hydraulic circuit for controlling the refuse crushing and displacing mechanism is illustrated in the upper part of FIGURE 8 wherein oil under pressure from a pump (not shown and driven, for example, by the vehicle engine crankshaft) is fed to the imput line **70** of a double solenoid controlled valve **71**. One output line **72** from the one port of valve **71** is connected through line **73** containing a sequence valve **74** to the underside of the piston of the secondary ram **35**, and through a parallel line **75** direct to the underside of the piston of the primary ram **34**. The piston rod sides of the two rams are interconnected by line **76** containing a counterbalance valve **77**, and a branch line **78** connected between the primary ram **34** and the counterbalancing valve **77** is also connected to another port of the valve **71**. Another port of valve **71** is connected through line **79** and check-valve **80** to the input port of a valve **81** of similar type to valve **71** excepting that it has a double manual control. Another port of valve **81** is connected through line **82** and a slow-return valve **83** to the underside of the piston of the tipping ram **13** having its piston rod side connected through the return line **84** back to a third port of valve **81**. A fourth port of valve **81** is connected through an exhaust line **85** to a tank **86**. The lines **75** and **76** on the two sides of the primary ram **34** incorporate pressure trip

switches 87 and 88 which mechanically actuate the same trip switch 63 as is actuated by the strikers 64 and 65 of the levers 44 and 52.

The electrical control circuit is illustrated in the lower port of FIGURE 8 and comprises an ON/OFF switch 90, fuse 91, emergency break circuit switch 92, and warning light 93 connected in series between the supply terminals 94 and 95. In parallel with the warning light 93 is the moving contact of the trip switch 63 whose alternative fixed contacts 96 and 97 are respectively connected to one pair of fixed contacts 98 and 99 of a two-pole two-way rotary switch 100 having its moving contacts respectively connected to the solenoids 101, 102 controlling the valve 71. The alternative pair of fixed contacts 103, 104 of the rotary switch are connected respectively one through a normally open circuit push-button switch 105 and through the normally closed pair of contacts of a two-pole push switch 106 provided for lowering and raising the canopy respectively. The other contact 104 is connected to line 107 via the normal open contacts of the switch 106.

The operation of the above described mechanism and further constructional features and advantages will be best appreciated from a description of a complete cycle of operation commencing with the mechanism in the position shown in FIGURE 1 and refuse present beneath the compression lever 32. Initially referring to FIGURE 8, operator's switch 90 is manually closed and trip switch 63 is set at the end of the previous cycle to energise solenoid 101 thereby to connect line 70 with line 72 across valve 71 (and simultaneously line 78 with line 79 leading to tank 86). Line 72 provides pressure to the underside of the pistons of both rams 34 and 35 but only the primary ram 34 is able to move because, at this stage, the counterbalance valve blocks the exhaust of the secondary ram 35. Turning now to FIGURES 1 and 2 the primary ram applies power through the primary lever 44 and link 47 whereby the compression lever 32 is forcibly swung forwardly and downwardly relative to the carrier 28 so as to crush the refuse between the compression member and the floor 16. Contact of the toe 33 of the compression member 32 against the floor 16, or of the lever 32 generally upon refuse on the floor, produces a build-up of the pressure in the primary ram 34. Reverting to FIGURE 8 this pressure build-up continues until a pre-determined value is reached above which the counterbalancing valve permit exhaust from the secondary ram 35 back through line 78. As seen in FIGURE 3 the secondary lever is now turned to displace through the secondary link 54 the barrier 28 whilst the pressure is maintained on the compression lever 32. Thus the compression member continues to compress the refuse and is simultaneously swung with the barrier 28 to displace the crushed refuse forwardly along the floor 16 from the depository 15 into the collection chamber 14. This operation continues until the parts reach the position shown in FIGURE 4 at which position the striker 64 on the primary lever 44 actuates the trip switch 63.

Actuation of trip switch 63 de-energises solenoid 101 and energises solenoid 102 producing change in the valve 71 so that the pressure input line 70 is now connected through line 78 to the piston rod side of both rams 34 and 35, and lines 72, 73 and 75 are connected to exhaust line 79. Consequently ram 34 contracts and the primary lever 44 is turned anti-clockwise whilst corresponding movement of the secondary ram 35 and lever 52 is as yet prevented by the blocking of the ram exhaust by the sequencing valve 74. Continued contraction of the primary ram 34 causes the compression lever 32 to turn anti-clockwise from the position shown in FIGURE 4 to that of FIGURE 5 until the compression lever 32 abuts a stop face 110 on the back of the barrier 28 so preventing further relative movement. This abutment produces build-up of pressure in both rams 34 and 35 until a predetermined value is reached at which the sequencing valve 74 permits exhaust from the secondary ram 35 so that the secondary lever 52 is now able to follow up the return anti-clockwise movement of the primary lever 44. This stage is illustrated in FIGURE 6 wherein it will be seen that the barrier 28 and compression lever 32 are returned rearwardly towards their FIGURE 1 position whilst a cam plate on the back of the compression lever bears upon a diverter 111 on the canopy to direct the compression lever downwardly during part of this return movement whilst also preserving the oil pressure necessary to continue the contraction of the ram 35. Movement of the primary lever 44 continues until it abuts the canopy cross member 22 and the secondary lever 52 follows up this movement until its striker 65 actuates the trip switch 63 to de-energise solenoid 102 and energise solenoid 101 for the automatic commencement of the next cycle.

During the entire cycle refuse can be continuously loaded into the depository so that a new batch of refuse is embraced beneath the compression lever 32 during each of its return strokes.

As appears especially from FIGURE 7 both the barrier 28 and the compression lever 32 have appreciable clearance from the sides of the body without any need for seals since there is no particular need to prevent escape of refuse to the rear of these parts which feature represents a considerable improvement over the prior art arrangements where such seals are necessary to prevent fouling of the working parts and in consequence require frequent servicing.

Throughout each cycle the barrier 28 fulfills an important function in promoting continuous agitation of the refuse in the collection chamber 14, especially in the vicinity of the zone of admission of fresh crushed refuse and hence improves the overall efficiency of loading. It is also to be noted that the primary lever 44 approaches alignment with the primary link 47 during the main compression of the refuse (see FIGURE 2) and hence produces great power resulting in very considerable reduction in volume of the refuse prior to its admission into the collection chamber 14 so that, unlike many prior art vehicles, the vehicle does not depend for its efficiency on further compression of the refuse in the collection chamber.

A further important feature is the operation of the pressure trip switches 87 and 88 arranged to actuate the trip switch 63 and so over-ride the lever strikers 64 and 65. As a result, if either of the levers fails to execute its allotted movement, for example due to a substantial resistance by the load to the compression lever 32, then the resultant rise in pressure in the ram circuits initiates a new cycle of operation so that the mechanism is able to make repeated attempts to crush and transfer obstructive refuse.

To raise the canopy the clamps 21 are undone, bypass valves (not shown) across the sequence and counterbalancing valves are opened, the rotary switch 100 is manually operated to energise contacts 103 and 104, and switch 106 is then manually operated to complete a circuit through solenoid 102. This in turn produces further contraction in both rams 34 and 35 causing the levers 44 and 52 to bear against the canopy cross-member 22 to raise the canopy about its pivots 18 until the parts assume the position shown in FIGURE 9. To lower the canopy, switch 105 is operated to energise solenoid 101 and change over valve 71 to produce extension of the rams. It is to be noted that this operation also effects raising of the entire compressing and displacing mechanism and so permits particularly free discharge from the body and access to the body and mechanism.

The tipping of the body is controlled by valve 81. To raise the body both solenoids 101 and 102 are de-energised so that valve 71 supplies oil pressure from input line 70 to line 79, and valve 81 is manually operated to connected line 79 via line 82 to the underside of the piston of ram 13 which exhausts through the valve to the tank 86. To lower the body the opposite manual control of valve 81 is operated to connect pressure to the upper end

of the ram **13** whose underside now exhausts to the tank.

In a modification a non-tipping body incorporates a ram operated front wall whose rearward movement within the body serves to eject refuse. To facilitate this type of ejection the floor **16** upon which the refuse is crushed forms an underside part of the canopy.

Preferably a photo-electric interlock **112** is incorporated for safety purposes. This comprises a light beam and photo-cell scanning across the window **19** so that if the beam is broken by a refuse bin being emptied into the depository during the rearward return movement of the compression lever, then this movement is arrested until the light beam is restored.

Whilst the invention has been described with reference to an entire refuse collection vehicle, nevertheless the invention comprehends the provision of a body alone for example where this is intended for subsequent installation upon a vehicle chassis.

I claim:

1. A refuse collection vehicle body comprising a collection chamber and a refuse depository having a floor disposed rearwardly of said collection chamber, dependent arm means swingably mounted on said body, a first power means connected for swinging said arm means, a compression member pivotally mounted on said arm means above said floor and extending rearwardly from said pivot on said arm means, a second power means, and motion transmitting mechanism extending between said second power means and said compression member, said mechanism being connected to said compression member rearwardly of said pivot, whereby said compression member may be swung relative to said arm means by said second power means to crush refuse on said floor and may move with swinging of said arm means by said first power means to displace crushed refuse into said collection chamber.

2. A refuse collection vehicle according to claim **1**, wherein said mechanism comprises a lever pivoted on said body and connected to said second power means, and a link pivotally connecting said lever and said compression member.

3. A refuse collection vehicle body according to claim **2**, characterised in that said lever and link closely approach alignment with downward and forward angular movement of said compression member during said compression of refuse.

4. A refuse collection vehicle body according to claim **3**, characterised in that said second power means is a ram disposed substantially horizontally over the roof of said body to which it is connected at the front end.

5. A refuse collecting vehicle body according to claim **3**, characterised in that said lever extends substantially vertically above said compression member and is fulcrummed on a normally stationary cross member in the body.

6. A refuse collection vehicle according to claim **1**,

characterised in that said first and second power means are side by side first and second rams and the connection between said first ram and said dependent arm comprises a first pivoted lever side by side with a second pivoted lever in said mechanism connecting the second ram to the compression member.

7. A refuse collecting vehicle according to claim **6**, characterized in that a control system is provided for actuating said rams in predetermined manner and said system contains a trip switch actuated by and controlling movement of at least one of said levers.

8. A refuse collecting vehicle according to claim **6**, characterized in that a control system is provided for actuating said rams and said system includes a fluid pressure circuit for said rams, said circuit containing at least one fluid pressure responsive device for controlling movement of at least one of said levers.

9. A refuse collection vehicle according to claim **6**, characterized in that a control system containing a hydraulic power circuit is provided for actuating said rams in predetermined manner, said system including a mechanically operated electric trip switch mechanically actuated by at least one of said levers, and said circuit contains at least one fluid pressure responsive device responsive to circuit pressure in excess of a given amount to override control by said trip switch.

10. A refuse collection vehicle body according to claim **9** characterized in that said hydraulic power circuit includes sequence type valves which ensure that a certain one of said levers leads the other lever in alternate direction of movement.

11. A refuse collection vehicle body according to claim **1**, characterized in that a canopy movably mounted on said body normally closes the rear end of said body, at least said second power means being mounted on said body forwardly of the canopy and said depending arm and said compression member being mounted on said canopy, whereby said second power means may be actuated to raise the canopy to discharge refuse from said body.

12. A refuse collection vehicle body according to claim **11**, characterized in that said canopy includes a rigid cross member and said motion transmitting mechanism includes a lever moved into abutment with said cross member during raising of said canopy.

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ALBERT J. MAKAY, Primary Examiner

U.S. Cl. X.R.

100—233; 214—503