Jan. 11, 1966 J. W. BOLLINGER ETAL 3,228,545

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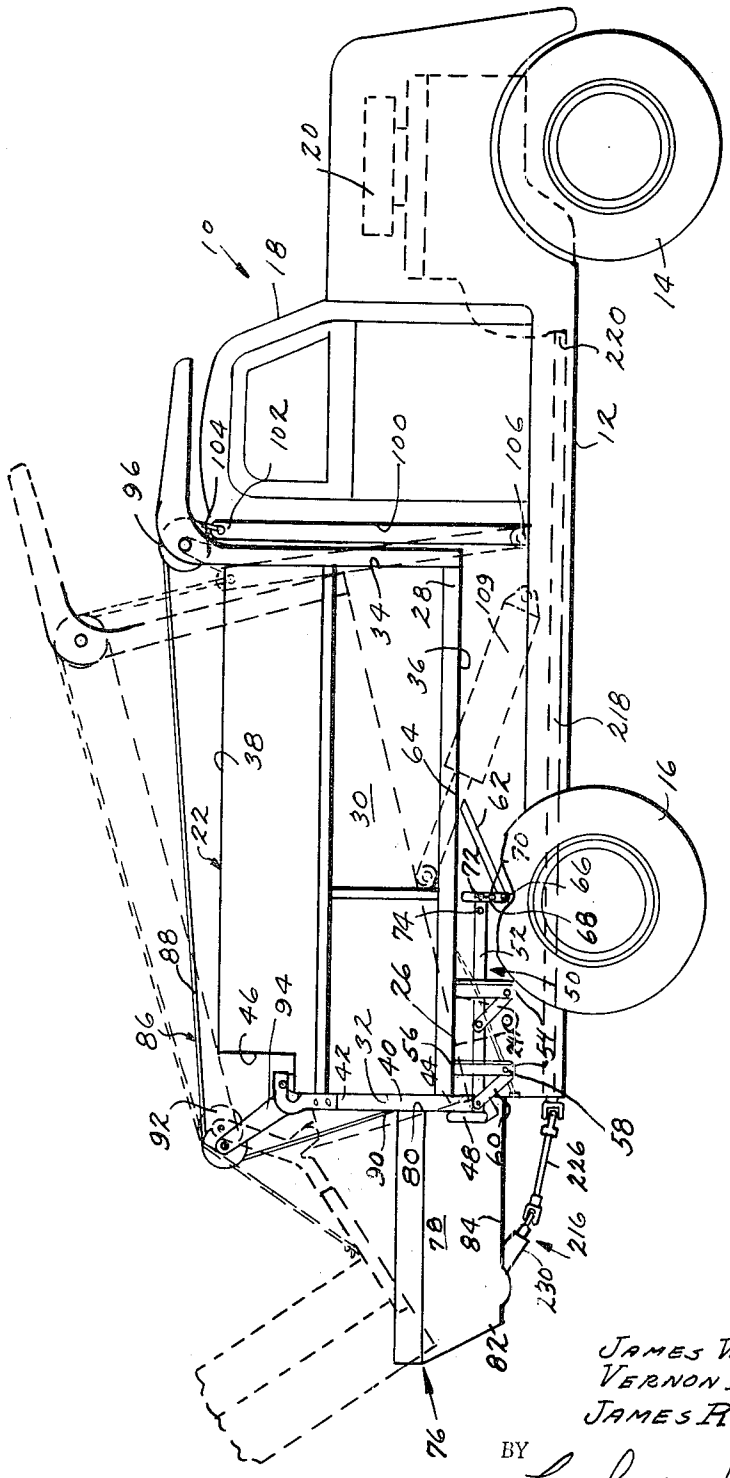


Fig. 1.

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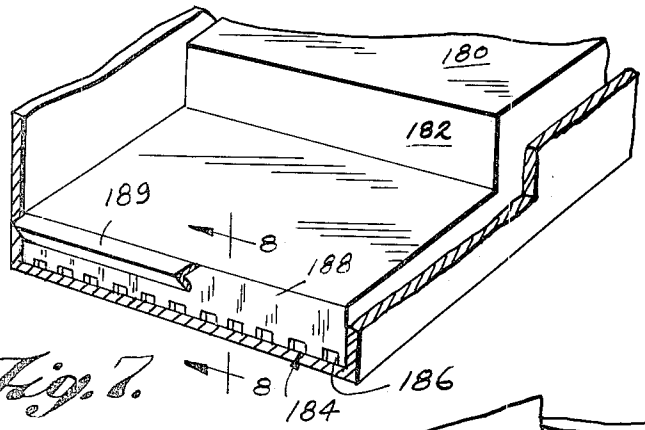
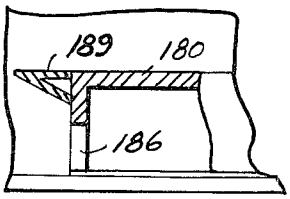


Fig. 7.

Fig. 8.



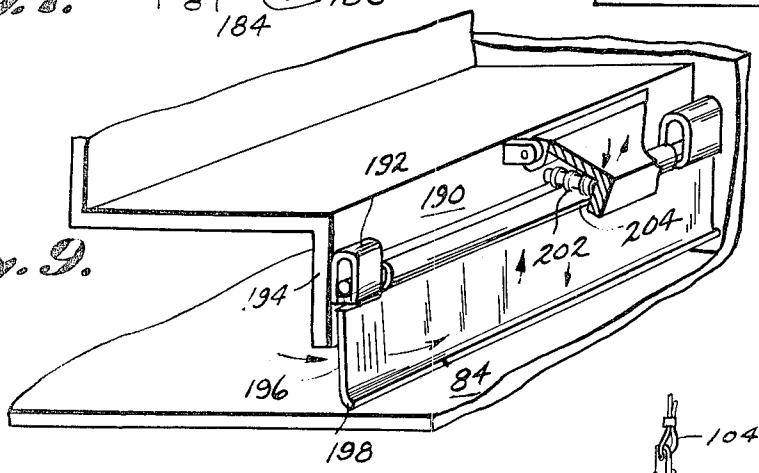


Fig. 9.

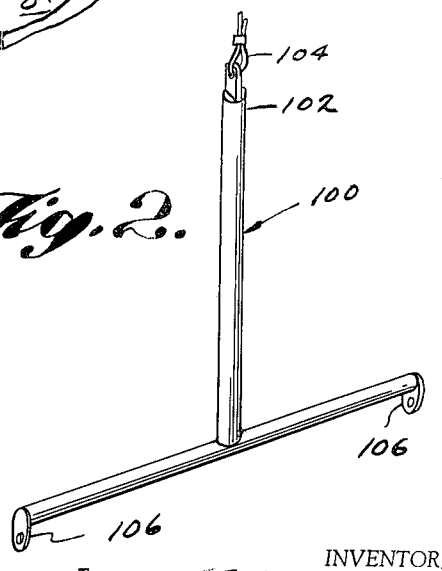


Fig. 2.

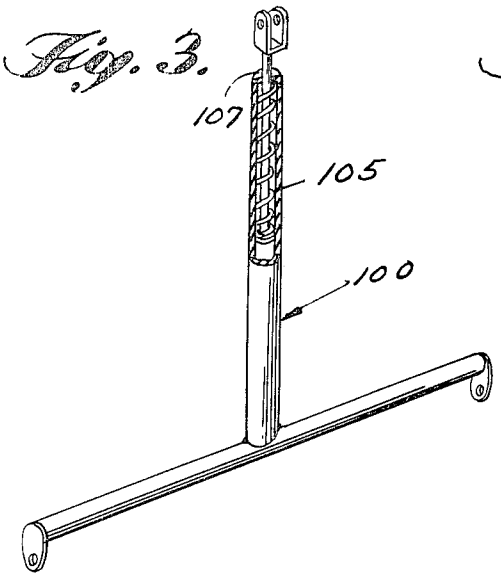


Fig. 3.

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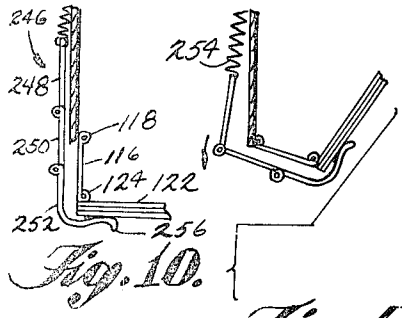


Fig. 10.

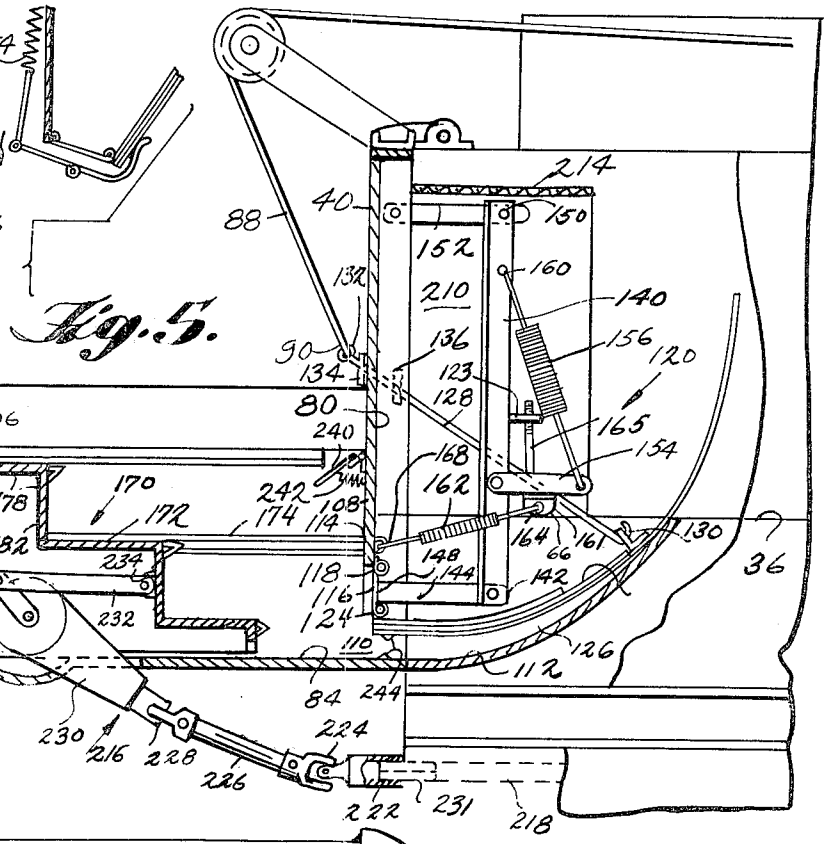
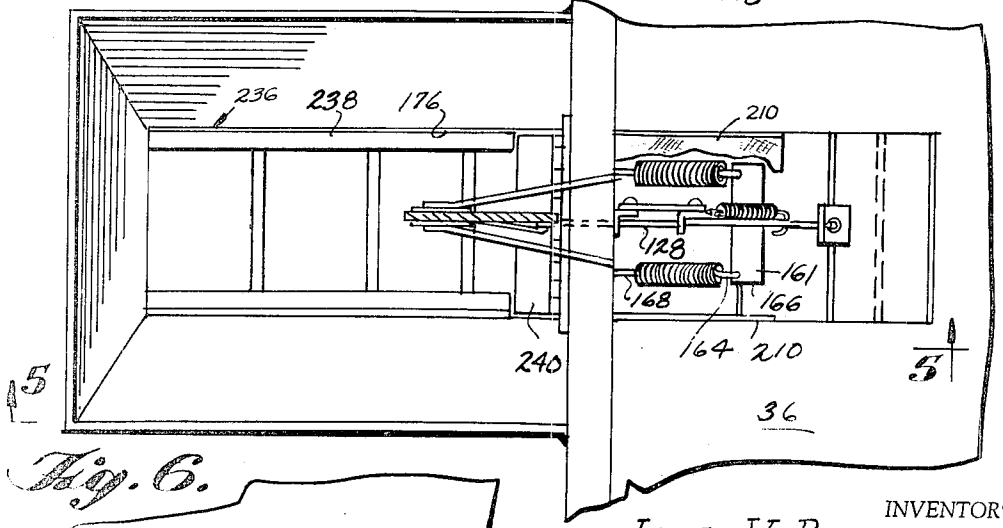


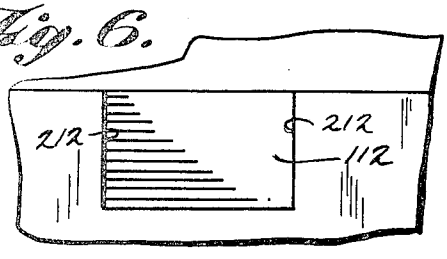
Fig. 5.

Fig. 4.



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Fig. 6.



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Fig. 11.

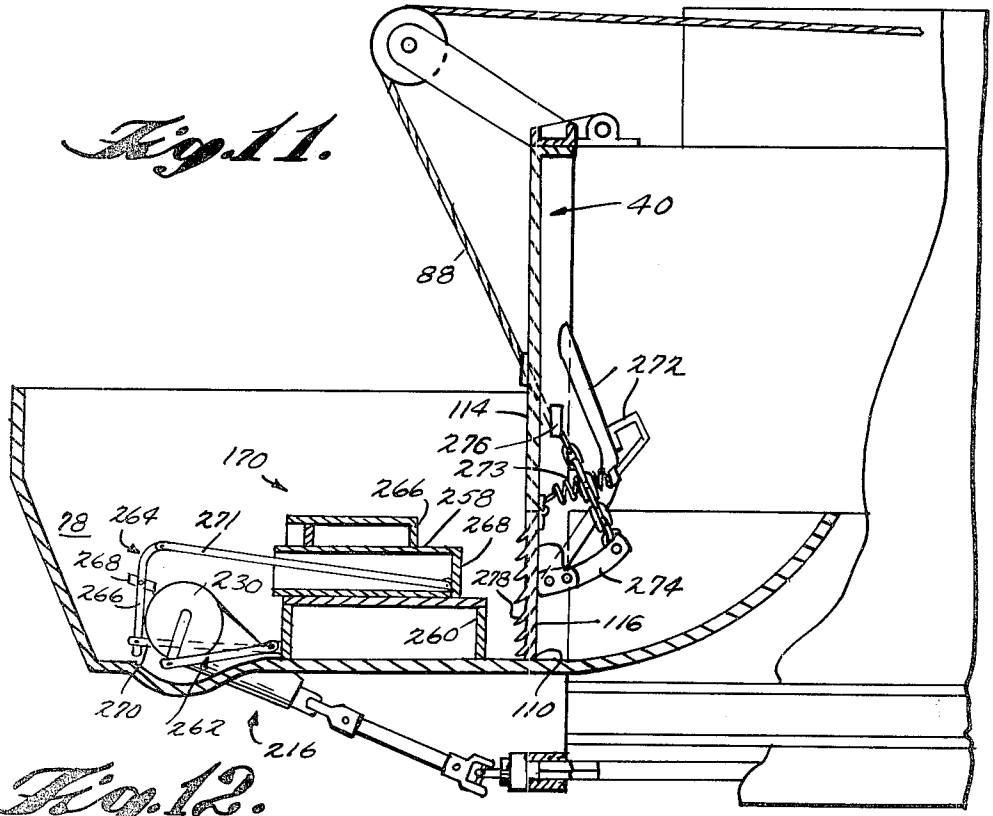
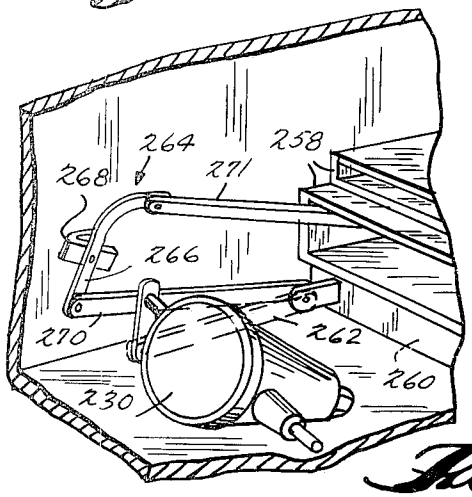


Fig. 12.



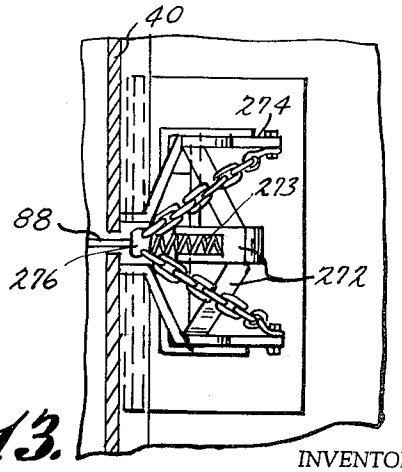


Fig. 13.

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United States Patent Office 3,228,545 Patented Jan. 11, 1966

3,228,545

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Filed Aug. 2, 1965, Ser. No. 478,028
20 Claims. (Cl. 214—503)

The present invention is a continuation-in-part of my application, Serial No. 387,885, filed August 6, 1964, now abandoned.

This invention relates to a refuse vehicle and more particularly it relates to an improved packing mechanism therefor.

An effective refuse vehicle is one which can be loaded completely and will crush the refuse while being loaded so that the complete capacity of the storage compartment will be utilized. Difficulties have been encountered, however, in filling the capacity of the storage compartment due to the fact that previous packer mechanisms were unable to crush metal cans and other containers sufficiently so as to increase the payload while minimizing the use of heavy mechanisms.

Therefore, it is an object of this invention to provide a refuse vehicle having an improved crushing mechanism which will effectively crush metal cans and other refuse prior to pushing them into the storage compartment.

It is a further object of this invention to provide a crushing means which will operate rapidly so as to crush and push refuse into the storage compartment as quickly as the refuse is brought to the truck. The crushing mechanism contemplated by this invention involves a reciprocally driven packer means located within a packer compartment which will progressively compress the refuse and push the refuse once compressed into the storage compartment. Therefore, it is within the scope of this invention to drive the packer means at a rate of speed which sufficiently enables the packer compartment to be emptied of refuse as rapidly as refuse is dumped into it.

In effectively using the space provided in a refuse vehicle, it is desirable to use a minimum of space for the packing mechanism and a maximum of space for storing the refuse once crushed. Heretofore, some refuse vehicles have utilized valuable space in the storage compartment for housing elaborate crushing or packing mechanisms. It is an object of this invention, therefore, to use only a minimum of space in the storage compartment for housing part of the packer mechanism, thus assuring that the storage compartment of the refuse vehicle can be filled to approximately complete capacity.

Furthermore, by so positioning the crushing mechanism at the rear of the refuse vehicle and positioning the crushed refuse between the axles of the vehicle, the load is more evenly distributed.

It is a further object of this invention to have a crushing or packing mechanism of proportionately less weight than packing mechanisms utilized by other refuse vehicles.

Similarly, it is an object of this invention to have a crushing mechanism which will have more crushing capacity than comparable packing mechanisms found in other refuse vehicles.

It is a further object of this invention to provide a packing means comprising a stepped plunger slidably positioned for reciprocal movement within a packer compartment in which each step sizes the refuse load for the next step by compressing the refuse against a compression surface. Once compressed, the refuse is pushed into the storage compartment by the bottom step which includes avoiding means for permitting small particles of refuse to pass under the step in order to prevent the step from binding on these small particles of refuse during the reciprocal

movement of the stepped plunger. Additionally, it is an object of the invention to provide deflection means on the stepped plunger for enabling the stepped plunger to deflect the refuse downwardly, to grip the refuse more easily as it is being crushed, and to exert an uneven crushing force against the refuse. It is a further object of the invention to provide means by which the bottom portion of the stepped plunger can be pivoted to allow refuse caught behind the plunger to be moved into a position forward of the plunger.

It is a further object of this invention to provide a refuse vehicle having an elongated chassis mounted on front and rear wheels with a cab and a motor mounted on a forward end thereof, an enclosed storage compartment for carrying the refuse, a packer compartment for receiving the refuse, a reciprocally driven packer means located within the packer compartment for progressively compressing the refuse and pushing the refuse once compressed into the storage compartment with an effective means for dumping the refuse once the storage compartment is filled and means for driving the packer means. Basically this dumping means comprises means for removing a latch which secures the end gate of the storage compartment to the body of the compartment in a leak-proof manner and means for effecting the pivotable movement of the end gate sufficient distance from the body of the storage compartment so that refuse can be dumped from the vehicle without interference.

It is a further object of this invention to provide shield means in order to provide safe operation.

It is still a further object of this invention to provide an auxiliary pushing means to aid in pushing the refuse into the storage compartment.

Another object of this invention is to provide a packer means comprising a pair of plungers, one of which is positioned on top of the other, and a means for driving the plungers so that they reciprocate in opposite directions with respect to each other.

Another object of the invention is to provide a plurality of downwardly extending fins transversely secured to the lower compression surface for gripping the refuse as it is being crushed.

These and other objects of this invention are more clearly depicted in the following detailed description having specific reference to the attached drawings in which the embodiments of the invention are shown, not to limit the scope of the invention in any respect but that the principles thereof might be more clearly demonstrated.

In the drawings:

FIGURE 1 is a side elevation of the improved refuse vehicle;

FIGURE 2 is a perspective view of the guide arm;

FIGURE 3 is a perspective view of a modification of the guide arm partly in section to show the interior thereof;

FIGURE 4 is a fragmentary top plan view of the packer compartment;

FIGURE 5 is a sectional view taken substantially along the lines 5—5 of FIGURE 4:

FIGURE 6 is a front elevational view of the ramp in the storage compartment floor;

FIGURE 7 is a fragmentary perspective view of part of the stepped plunger;

FIGURE 8 is a fragmentary sectional view taken substantially along the lines 8—8 of FIGURE 7;

FIGURE 9 is a fragmentary perspective view of the stepped plunger showing a modified bottom vertical portion of the plunger;

FIGURE 10 is a diagrammatic illustration showing a modified embodiment of the invention;

FIGURE 11 is a sectional side elevated view of the packer compartment taken substantially along the same

lines as FIGURE 5 and showing a modification of the invention;

FIGURE 12 is an enlarged fragmentary perspective view of the packer drive means; and

FIGURE 13 is a fragmentary plan view of the spring biasing means.

A refuse vehicle **10** is shown in FIGURE 1 having an elongated chassis **12** supported on front **14** and rear **16** wheels. A cab **18** and a motor **20** are mounted on the forward end of the chassis **12** with an enclosed storage compartment **22** mounted on the rear portion of the chassis. The enclosed storage compartment is designed to carry refuse and the rear end **26** is pivotally mounted, as at **24**, on the transverse rear end of the chassis **12** so that forward end **28** of the storage compartment can be pivoted upwardly in order to dump the refuse out of the storage compartment.

The storage compartment **22** is defined by a pair of opposed side walls **30**, a rear transverse end wall **32**, a forward transverse end wall **34**, and a bottom wall **36**. In view of health regulations it is also desirable to enclose the storage compartment with a top wall **38**. The rear transverse end wall **32** is in part comprised of an end gate **40** which has transverse upper **42** and lower **44** ends. The end gate **40** is pivotally connected at its upper transverse end **42** to the storage compartment. As shown, the end gate comprises only a portion of the rear transverse end wall **32**. It will be appreciated, however, that within the scope of the invention the end gate could comprise substantially all of the rear transverse end wall **32** and as such encompass the upper portion **46** of the rear end wall **32**.

A removable latch means **48** is operatively associated with the end gate **40** and the storage compartment **22** for holding the end gate against the rear end **26** of the storage compartment. The latch means is connected to the storage compartment such that it is automatically removed when the forward end **28** of the storage compartment is pivoted upwardly.

As shown, the means **50** for removing the latch means so as to allow the end gate to pivot about its upper transverse end **42** during the upward movement of the front end of the storage compartment comprises a bar **52** rigidly secured to the latch means **48** and which is positioned beneath the storage compartment by support arms **54** attached at one end **56** to the storage compartment with the other end **58** pivotally connected to arms **60** which in turn are connected to bar **52**. When a longitudinal movement is imparted to bar **52**, arms **60** confine the movement of the latch means to a rearward and downward direction thus freeing the latch means from the end gate. A longitudinal movement is imparted to the bar **52** by means of arm **62** pivotally attached to the storage compartment at one end **64** and to connecting rod **68** at the other end **66**. The connecting rod **68** is pivotally connected at its midpoint **70** to the chassis **12** and has its other end **72** pivotally connected to the bar **52**.

In operation, as the forward end of the storage compartment pivots upwardly, the arm **62** is carried upwardly by the storage compartment thereby pivoting the connecting rod about point **70**. The other end **72** of the connecting rod begins to pivot about its connection. However, a stop means **74** is formed on the bar **52** slightly to the rear of the pivotal connection between the connecting rod and the bar **52**. Consequently, as the end **72** of the connecting rod rotates, it abuts the stop means **74** thereby driving the bar **52** rearwardly and downwardly.

It is within the scope of the invention to use any known mechanical or electrical means for operating the latch means in order to free the end gate.

A packer compartment **76** for receiving refuse and subsequently crushing the refuse is carried by end gate **40**. The packer compartment has a pair of opposed packer side walls **78**, a packer surface means **80** defining an end wall adjacent to the storage compartment, a rear

packer end wall **82** disposed opposite the packer surface means **80** and a bottom packer surface **84**.

As the storage compartment is pivoted about point **24**, it will be seen that the latch means **48** will be removed from the end gate so that the end gate will be slightly disposed from the rear end **26** of the storage compartment. Inasmuch as the packer compartment adds weight to the rear of the end gate, it pushes the gate slightly forward so that there is not sufficient opening through which refuse can pass. Therefore, it is desirable to provide an assisting means **86** to assist the movement of the lower transverse ends **44** of the end gate **40** away from the rear end of the storage compartment.

The assistant means **86** comprises a chain means **88** operatively attached at one end **90** to the center of the gate, as will be explained more fully hereinafter, and preferably to the transverse center of the lower portion of the gate. The chain means is positioned over a first pulley **92** rigidly supported from the end gate by first support means **94** at a position spaced rearwardly from the end gate. The chain extends longitudinally on top of the storage compartment and over a second pulley **96** rigidly supported as by second support means **98** at a position spaced above said storage compartment. A guide arm **100**, shown in FIGURE 2, has one end **102** connected to the other end **104** of the chain means. The other end **106** of the guide arm is pivotally connected to the chassis **12** rearwardly adjacent to the cab **18** so as to enable the guide arm to assume a more axial extension of the chain thus limiting the moments of force set up around the end **102** of the guide arm **100**. Inasmuch as the chain has a fixed length, the upward movement of the forward end of the storage compartment will cause the end gate and packer compartment to be moved upwardly and away from the rear end of the storage compartment.

Inasmuch as only relatively slight upward movement of the forward end of the storage compartment causes a rather substantial displacement of the end gate and packer compartment from the rear end of the storage compartment, it may be desirable to provide a chain means with a length longer than is necessary to join the center of the end gate to the guide arm by passing over the pulleys. Thus it is contemplated within the scope of this invention that such extra length of chain as might be desirable in order to limit the displacement of the end gate could be spring retained to prevent it from flopping around.

As illustrated in FIGURE 3, the same effect may be accomplished by having a telescoping member **105** secured and spring biased inwardly within the guide arm. In the dumping operation the telescoping member **105** will be extracted from the guide arm until retained by the top stop means **107** of the guide arm. At this point further upward movement of the storage compartment will impart a displacement movement to the end gate and packer compartment. Furthermore, depending on the position of the pulley means and the extent to which the first pulley means is pivoted, it is within the scope of the invention to provide a longitudinal recess within the top wall **38** of the storage compartment in which the chain means and/or pulley means may be positioned.

It will be appreciated that any means, such as hydraulic means **109**, may be employed to move the forward end of the storage compartment upwardly.

As shown more particularly in FIGURES 4 and 5, the packer surface means **80** may in part be defined by the end gate **80**. The surface means broadly comprises a compression surface **108** which in part comprises an upper rigid compression surface **114** defining an opening **110** between its lower transverse extent and the bottom packer surface **84**. The passage of refuse through the opening **110** is hindered by a lower compression surface **116** having its upper transverse edge **118** pivotally attached to the upper rigid compression surface **114** and defining a further part of the compression surface **108**. The lower compression surface is spring biased into a

position of interference with the passage of refuse through the opening **110**, and, in the illustrated embodiment, the lower compression surface is spring biased into substantial alignment with the upper rigid compression surface by spring means **120**. It is not necessary, however, that the lower compression surface be aligned with the upper compression surface. Moreover, as illustrated, the lower compression surface does not completely block off the opening **110**, but it does provide a variable opening inasmuch as it can be biased upwardly and away from the bottom wall of the packing compartment as refuse is being pushed therethrough. It will be appreciated, however, that the opening could be completely blocked by the lower compression surface.

As shown in FIGURES 5 and 6, a ramp **112** is recessed in the rear portion of the bottom wall **36** of the storage compartment. The ramp, being recessed in the bottom wall **36** of the storage compartment, extends upwardly form a point below the bottom wall and inwardly into the interior of the storage compartment. The outer extremity of the ramp lies in a plane coextensive with the bottom packer surface **84** so as to form an extension thereof. It will be appreciated that the disclosure as illustrated involves forming a recess in the bottom wall of the storage compartment. As such the packer surface means **80** extends below the end gate. It is within the scope of this invention, however, to have the packer surface means **80** substantially defined by the end gate **40** such that the ramp is positioned above the bottom wall of the storage compartment. In this form, the packing compartment can be more readily attached to existing vehicles. Furthermore, the ramp and packer compartment may extend substantially across the entire width of the storage compartment.

A flexible guide sheet **122** is pivotally connected to the lower transverse end **124** of the lower compression surface **116**. The flexible guide sheet extends inwardly and upwardly into the interior of the storage compartment in a plane above and disposed from the ramp **112** so as to define a variable throat area **126** therebetween through which refuse is transferred from the packing compartment to the storage compartment. The guide sheet prevents refuse from retreating through the opening **110** while further crushing the refuse. If the lower compression surface completely blocked off the opening **110**, the guide sheet could be eliminated.

The guide sheet, comprising a plurality of leafed sheets for flexibility, is supported by support means **128** secured at one end **130** to the guide sheet and slidably positioned through the end gate at the other end **132**. A first stop means **134** is secured to the support means **128** on the rear side of the end gate to position the guide sheet above the ramp. A second stop means **136** is secured to the support means **128** on the other side or forward side of the end gate. As shown, the second stop means **136** does not abut against the end gate in its normal position. However, as the forward portion of the storage compartment is raised, the chain means, being attached to the support member at end **132**, pulls the support member through the end gate until the stop means **136** abuts against the end gate. Then the entire end gate is pivoted away from the body of the storage compartment. The initial movement of the support member, however, enables the guide sheet to be pulled to a position where it can clear the ramp during the pivotal movement of the end gate.

As shown, the spring means comprises a force transfer bar **140** pivotally secured at one end **142** to brace bar **144** which is in turn rigidly secured to the lower compression surface **116** at one end **148**. The other end **150** of the force transfer bar is pivotally connected to arm **152** which in turn is pivotally connected to end gate **40**. A balancing arm **154** is pivotally secured to the force transfer bar **140** between the two ends of the force transfer bar. A first spring means **156** is attached to the free end of the balancing arm **154**. The other end of the first spring means **156** is secured to the force transfer bar **140** at a point **160** between the point at which the balancing arm is attached to the force transfer bar and the other end **150** so as to create a tension force between its connecting points. The balancing bar has a cross piece **161** rigidly secured thereto intermediate its two ends. A set of second spring means **162** are each secured at one end **164** to the free end **166** of the cross piece **161**. The other end **168** of each spring means **162** is attached to the upper compression surface **42** at a point adjacent to the lower compression surface **116**.

A bracket **163** is secured to the force transfer bar **140** above the balancing arm **154**. A rod **165** is threadably inserted through the bracket **163** and bears upon the balancing arm **154**. The rod may be adjusted to limit the upward movement of the balancing arm **154** according to the desired force intended to be put on the lower compressing sheet.

Accordingly, it will be seen that the second spring means **162** pulls the force transfer bar **140** downwardly through the pull on the balancing arm **154** and the spring means **156**. The downward pull on the force transfer bar **140** determines the resistance of the lower compression surface to movement out of a substantial alignment with the upper compression surface.

It will be seen that it is within the scope of the invention to mount the balancing bar **154** rigidly to the force transfer bar **140** and accordingly eliminate the first spring means **156**, and bracket **163** and the rod **165**. The strength of the second spring means in this design will determine the downward pull on the force transfer bar **140**.

Likewise, other spring biasing means within ordinary mechanical knowledge may be employed within the scope of the invention.

A packer means **170** is positioned within the packer compartment for progressively compressing the refuse and pushing the refuse once compressed through the opening and the throat area to the storage compartment. The packer means **170** comprises a stepped plunger **172** which is slidably positioned for reciprocal movement within the packer compartment and operatively associated with the compression surface **108**. The stepped plunger **172** is guided by guide means **174** secured to the inner surface **176** of the opposed side walls **78**. The stepped plunger **172** comprises a plurality of longitudinal steps **178** with each step extending transversely across the packer compartment. Each of the steps is formed with a horizontal plate **180** and vertical plate **182**.

The vertical plate of the bottom step has avoidance means **184** for permitting small particles of refuse to pass under the vertical plate so as to prevent these small particles from binding with the vertical plate and bottom packer surface during the reciprocal movement of the plunger. The avoidance means **184**, shown in FIGURE 7, comprises a series of openings **186** extending through the vertical plate adjacent to the bottom packer surface **84**. Consequently, the transverse configuration of the vertical plate illustrates a toothed plate such that the small particles can pass through the openings between the adjacent teeth. In the preferred embodiment of the invention the upper portion **188** of the vertical plate **182** of the bottom step has a deflection means **189** secured thereto. In FIGURES 7 and 8, the deflection means is shown as an approximately V-shaped member with the free ends of the legs of the V-shaped member being attached to the vertical plate. The deflection means extends transversely across the vertical plate and enables the stepped plunger to deflect refuse downwardly, to grip the refuse more easily as it is being crushed, such that the refuse is held in the appropriate crushing relation to the compressing surface, and finally, to exert a more uneven crushing force against the refuse.

It is within the scope of this invention to have a deflection means secured to the vertical portion of all these steps as shown in FIGURE 5 and to assume any appropriate configuration.

A modification of the avoidance means **184** is shown in FIGURE 9. This avoidance means comprises an upper transverse section plate **190** having a bushing means **192** secured to the lower portion **194** of the upper transverse section plate **190**. A lower transverse section plate **196** is received within the bushing means in a substantially vertical relation so as to be slidable therein. As shown, the lower transverse sectional plate has its lower portion **198** bent slightly forward of the stepped plunger so as to enable the lower transverse plate to catch and hold the refuse more easily as it is being pushed through the opening into the storage compartment. It is within the scope of the invention to position a compression spring means within the bushing so as to force the lower transverse plate downwardly into engagement with the bottom packer surface **84**. It will be seen that as small particles of refuse get trapped under the lower transverse section plate, these particles will force the plate upwardly so as to prevent the plate from binding on the particles during the reciprocal movement thereof. The upper transverse section plate extends partially downwardly behind the lower section plate so as to provide support therefor. It will be seen that the lower section plate is pivotally received within the bushing means; however, the vertically downward extension of the upper transverse section plate will prevent the lower section plate from pivoting in a rearward direction, thus allowing the plate to form a rigid surface for pushing the refuse into the storage compartment. Furthermore, on the rearward portion of the reciprocal movement of the stepped plunger, the lower transverse section plate will pivot forwardly to allow any refuse caught behind the plate to move to a position forward of the stepped plunger.

In the modification of the avoidance means shown in FIGURE 9 there is also included a deflection means which is pivotally connected to the upper portion of the vertical portion of the bottom step. As illustrated, the deflection means is approximately a V-shaped member. A second compression spring means **202** extends from the upper transverse section plate to the inside surface **204** of the deflection means so as to maintain the deflection means in a position disposed from the lower transverse section plate. It will be seen, therefore, that by maintaining the deflection means in such a disposed position, the lower section plate may be pivoted forwardly during the rearward movement of the plunger. During the forward movement of the plunger, the refuse forces the deflection means downwardly into engagement with the lower transverse section plate so as to place the deflection means in an effective position for accomplishing the objects heretofore set forth.

It is within the scope of the invention to include both avoidance means illustrated herein in the same embodiment. Accordingly, the toothed plate would be positioned to the rear of the bushing and slidable lower transverse section plate and would provide the support that the upper transverse section plate provides for the lower transverse section plate.

In addition, as shown in FIGURE 5, the packer compartment has a scrapper means **206**, such as a coarse hair brush or rubber piece, secured therein and positioned above and adjacent to the uppermost surface **208** of the plunger so as to prevent refuse from falling behind the plunger during the reciprocal movement thereof.

Opposed internal walls **210** are secured to the end gate above and approximately coextensive with the sides **212**, see FIGURE 6, of the ramp **112** so that the walls **210** will pivot with the end gate out of the way of refuse. An apron means **214** is secured across the top of the walls **210** and together with the walls prevent refuse from being commingled with the spring biasing means. The guide sheet **122** also serves to prevent refuse from being commingled with the spring biasing means through the forward opening between the two walls **210**.

The chassis additionally has means **216** for reciprocally driving the packer means secured thereto. The means **216** for driving the packer means comprises a drive shaft **218** connected at one end **220** to the motor means **20** and connected at the other end **222** through a first flexible coupling **224** to a link arm **226**. The link arm in turn is connected through a second flexible coupling **228** to a power transfer means **230** which translates the rotary packer of the drive shaft into rotary power at approximately 90° to the drive shaft. A crank arm **232** is driven by the power transfer means and is connected at one end **234** to the vertical plate of the step adjacent to the bottom step so that the main driving force will be substantially behind the surface which incurs the greatest compressing stress. Preferably there is a set of crank arms, each driven on one side of the power transfer means and connected to the stepped plunger at transversely disposed positions so as to prevent the packer means from binding due to unequal resistance on one side of the stepped plunger or another.

As illustrated, the power transfer means extends through the bottom wall **84** of the packer compartment. The power transfer means should be sealed tightly to the bottom wall **84** so as to prevent liquid from seeping through the wall.

The means for driving the packer means imparts a reciprocating longitudinally movement to the packer means thereby progressively crushing the refuse and once crushed forcing the refuse into the storage compartment. Thus, when the packer means comprises a stepped plunger, each stroke thereof sizes the refuse for the next step until the refuse is sufficiently crushed to be pushed into the storage compartment. It is also apparent that other means within the ordinary mechanical knowledge can be employed to drive the plunger.

The drive shaft has a spline arrangement **231** so that the shaft may be separated at approximately the rear end of the chassis during the dumping step. It is within the scope of the invention to employ any means within ordinary mechanical knowledge which will enable the drive shaft to be separated and put back together without removing a fastening device.

It is also within the scope of the invention to provide first shield means **236** which comprise a pair of plates **238** pivotally attached to the sides **176** of the packer compartment. The plates **238** are spring biased outwardly by spring means (not shown) so as to provide a catching means for any refuse which might fly out of the packer compartment. The pivotal connection will enable the shield means to pivot into a position continuous with the side wall **176** when refuse is dumped into the packer compartment. A second shield means **240** is pivotally connected on the packer surface means **80** for the same purpose as the first shield means. A spring means **242** holds the second shield means **240** at a position disposed from the packer surface means **80**.

It is also within the scope of this invention to include a set of restriction means **244**, see FIGURE 5, within the opening **110** so as to hold refuse on the rearward stroke of the rearward movement of the plunger.

Still further, it is within the scope of this invention to include an auxiliary pusher means **246**, as shown in FIGURE 10, for aiding the insertion of refuse into the storage compartment. The auxiliary pusher means comprises three separate metal sheets, **248**, **250** and **252**, extending transversely across the packing compartment. The lower sheet **252** is contour formed so as to be attached to the guide sheet **122** at one end and at the other end extending transversely across the packing compartment at a position disposed from the compression surface **116**. The sheet **252** is pivotally connected at its other end to an intermediate sheet **250**. The pivotal connec-

tion lies in a horizontal plane intermediate the horizontal planes intersecting the pivotal connections at the upper **118** and lower **124** edges of the compression surface **116**. The sheet **250** is in turn pivotally connected to the upper sheet **248** at one end in a horizontal plane above the horizontal plane intersecting the upper transverse edge **118**. The other end of sheet **248** is spring connected to the compression surface **108** below the shield means **240** so as to be spring biased upwardly. In operation, the refuse forces the guide sheet **122** and compression surface **116** upwardly, the auxiliary pusher means is pulled and rotated downwardly, through the give of the spring connector **254** and through the location of the pivotal connections of the three sheets so as to exert an auxiliary pushing force on the refuse when it is pushed into the storage compartment. In this embodiment of the invention the lower sheet **252** may be flared, as at **256**, in order to provide the restriction means **244**.

FIGURES 11 and 12 illustrate another embodiment of the means for progressively compressing the refuse and pushing it, once compressed, into the storage compartment. In this embodiment the packer means **170** comprises a pair of plungers, **258** and **260**, with one plunger **258** being positioned on top of the other plunger **260**. The plungers are so arranged that they can be reciprocated by the packer drive means **216** in opposite directions with respect to each other. Broadly, therefore, the packer drive means **216** in this embodiment comprises means **262** for reciprocally driving one of the plungers as at **260**, and linkage means **264** connected at one end to the reciprocally driven plunger **260** and at the other end to the other plunger **258** for transmitting the reciprocal motion of the first plunger to the other plunger but in a manner such that the plungers are moved in opposite directions with respect to each other. Preferably one of the plungers is stepped, and in the illustrated embodiment the upper plunger **258** is stepped, the top step **266** being connected to and supported on the bottom step **268** but not being connected to the linkage end.

More specifically, the means **216** for driving one of the plungers could comprise the drive means previously illustrated such as a power transfer means **230** which drives a crank arm **232** connected to one of the plungers, as at **260**. The linkage means **264** is shown comprising a pivot bar **266** pivotally attached intermediate its two ends to the side wall **78** of the packer compartment by a U-shaped bracket **263**. A first linkage bar **270** connects one end of the pivot bar to the reciprocally driven plunger **260**. A second linkage bar **271** connects the other end of the pivot bar to the other plunger **258**. Therefore, it will be seen that in operation the reciprocal movement of the first plunger causes the second plunger to move in the opposite direction. It will also be appreciated that the linkage could be arranged to multiply or reduce the movement of the second plunger.

As further shown in this embodiment in FIGURES 11 and 13, the lower compression surface **116** is spring biased into substantial alignment with the upper rigid compression surface **114** and substantially closes the opening **110** thereby eliminating the necessity of the guide sheet. A modified and simpler spring biasing means **120** is also shown in this embodiment and comprises a camming arm **272** attached to the means defining the lower compression surface **116** and extending upwardly into the storage compartment. A spring means **273** is attached between the camming arm **272** and the means defining the upper rigid compression **114** surface so as to force lower compression surface into substantial alignment with the upper rigid compression surface.

In addition, the chain means **88** is shown extending through the end gate **40** of the storage compartment and being attached to a bracket **274** secured at one end to the means defining the lower compression surface. A stop means **276** is secured to the chain intermediate the end gate and the bracket. When refuse is dumped from the refuse vehicle, the chain is tightened until the stop means abuts the end gate. Thereafter, the end gate is pulled away from the end of the storage compartment. It will be seen, however, that this initial tightening of the chain causes the means defining the lower compression surface to be pulled out of substantial alignment with the upper rigid compression surface so that any refuse trapped in the packer compartment can be dumped along with refuse from the storage compartment.

One further feature shown in this embodiment is the provision of a plurality of downwardly extending fins **278** transversely secured to the lower compression surface **116**. These fins cause the refuse to be gripped as it is being crushed.

While the invention has described primarily an improved refuse vehicle, it will be appreciated that the packing compartment can be added to any existing truck for the purposes described herein.

While a preferred form of the invention has been illustrated in the drawings and discussed above, it should be adequately clear that considerable modification may be made thereto without departing from the principles of the invention. Therefore, the foregoing should be considered in an illustrative sense rather than a limiting sense and accordingly the extent of this invention should be limited only by the spirit and scope of the claims appended hereto.

We claim:

1. A refuse vehicle comprising: an elongated chassis supported on front and rear wheels having a cab and a motor mounted on the forward end thereof and having an enclosed storage compartment for carrying refuse pivotally mounted on the transverse rear end of said chassis and located rearwardly of said cab, said storage compartment having at least a bottom wall and a rear transverse end wall, said rear transverse end wall comprising substantially an end gate with transverse upper and lower ends, said end gate being pivotally connected at its upper transverse end to said storage compartment and having removable latch means operatively associated therewith for holding said gate against the rear end of said storage compartment; a packer compartment for receiving refuse carried by said end gate, said packer compartment having at least a pair of opposed packer side walls, a bottom packer surface, and surface means defining a packer end wall adjacent to said storage compartment, said surface means comprising an upper rigid compression surface defining an opening between its lower transverse extent and said bottom wall of said packer compartment, and a lower compression surface pivotally connected to said upper rigid compression surface; spring biasing means for biasing said lower compression surface into a position at least partially interfering with the passage of refuse through the opening; packer means located within said packer compartment for progressively compressing the refuse and pushing the refuse once compressed into said storage compartment; and means for reciprocally driving said packer means.

2. The refuse vehicle defined in claim **1** additionally comprising means for pivoting the front end of said storage compartment upwardly with respect to its rear end; and means for removing said latch means so as to allow said end gate to pivot about its upper transverse end during the upward movement of said front end of said storage compartment to allow the refuse to be dumped.

3. The refuse vehicle defined in claim **2** wherein said means to remove said latch means is operatively connected to said storage compartment so that said latch means is automatically removed when said front end is pivoted upwardly.

4. The refuse vehicle defined in claim **2** additionally comprising assisting means to assist the movement of the lower transverse ends of said gate away from the rear end of said storage compartment during the upward movement of said front end of said storage compartment to allow the refuse to be dumped more easily.

5. The refuse vehicle defined in claim 4 wherein said assisting means comprises a chain means operatively attached at one end to the center portion of said gate, said chain means being positioned over a first pulley rigidly supported from said end gate by first support means at a position spaced rearwardly from said storage compartment and extending longitudinally on top of said storage compartment and over a second pulley rigidly supported on said storage compartment by second support means at a position spaced above said storage compartment; and a guide arm having one end connected to the other end of said chain means and having the other end pivotally connected to said chassis rearwardly adjacent to said cab so as to enable said arm to be substantially an axial extension of the other end of said chain thus exerting an axial holding force on said chain.

6. The refuse vehicle defined in claim 1 additionally comprising a pair of opposed internal walls attached to said end gate and positioned adjacent to said spring biasing means and an apron means secured to said walls for enclosing said spring biasing means so as to prevent said refuse from being commingled with said spring biasing means.

7. The refuse vehicle defined in claim 1 wherein said storage compartment has a ramp secured to the rear end of the bottom wall of said storage compartment and extending from the bottommost defined surface of said opening inwardly and upwardly into the interior of said storage compartment and a flexible guide sheet pivotally connected to the lower transverse end of said lower compression surface and extending inwardly and upwardly into the interior of said storage compartment in a plane above and disposed from said ramp so as to define a variable throat area therebetween for transferring said refuse into said storage compartment, said guide sheet being supported in said disposed position from said ramp by support means having two free ends, one end of said support means being secured to said guide sheet and the other end of said support means being operatively secured to said end gate of said storage compartment.

8. The refuse vehicle defined in claim 1 additionally comprising guide means secured to the inner surface of said opposed side walls for guiding said reciprocal movement of said packer means.

9. The refuse vehicle defined in claim 1 wherein said packer means comprises a stepped plunger slidably positioned for reciprocal movement within said packer compartment and operatively associated with said compression surface and said opening for progressively compressing the refuse and pushing the refuse once compressed into said storage compartment.

10. The refuse vehicle defined in claim 9 wherein said stepped plunger comprises a plurality of longitudinal steps with each step extending transversely across said packer compartment, each of said steps having a horizontal and vertical plate, the vertical plate of the bottom step of said plurality of steps comprising avoidance means for permitting small particles of refuse to pass under said vertical plate to prevent said small particles from binding with said vertical plate during the reciprocal movement of said plunger.

11. The refuse vehicle defined in claim 10 wherein said avoidance means comprises an upper transverse section plate; bushing means secured to said upper transverse section plate; and a lower transverse section plate substantially vertically slidably received within said bushing so as to be able to vertically rise over said small particles of refuse to prevent binding.

12. The refuse vehicle defined in claim 11 wherein said lower transverse section plate is pivotally mounted in said bushing means so that said lower transverse section plate will pivot only in a forward direction toward said cab to allow any refuse caught behind said lower transverse section plate to move to a position in front of said lower transverse section plate during the rearward portion of said reciprocal movement of said stepped plunger.

13. The refuse vehicle defined in claim 10 wherein said avoidance means comprises a vertical plate having a toothed transverse configuration formed by openings extending through said plate adjacent to said bottom surface whereby said small particles of refuse can pass through said openings in said vertical plate to prevent said vertical plate from binding thereon.

14. The refuse vehicle defined in claim 10 additionally comprising a deflection means secured to the front upper portion of each of said vertical plates of said steps and extending transversely across said vertical portion enabling said stepped plunger to deflect the refuse downwardly, to grip the refuse more easily as it is being crushed, and to exert an uneven crushing force against the refuse.

15. The refuse vehicle defined in claim 14 wherein said deflection means is pivotally connected to the upper portion of said vertical plate of the bottom step, said deflection means being spring biased away from said vertical plate to allow said vertical plate to pivot toward said deflection means.

16. The refuse vehicle defined in claim 7 additionally comprising means secured to said flexible guide sheet for assisting in pushing refuse into said storage compartment.

17. The refuse vehicle defined in claim 1 wherein said packer means comprises a pair of plungers, one of said plungers being positioned on top of the other of said plungers, and wherein said packer drive means reciprocates said plungers in opposite directions with respect to each other.

18. The refuse vehicle defined in claim 17 wherein at least one of said plungers is stepped.

19. The refuse vehicle defined in claim 17 wherein said packer drive means comprises means for reciprocally driving one of said plungers, and linkage means connected at one end to said reciprocally driven plunger and at the other end to said other plunger for transmitting said reciprocal motion of said first plunger to said other plunger and for reciprocally driving said other plunger in a direction opposite to that of said first plunger.

20. The refuse vehicle defined in claim 1 additionally comprising a plurality of downwardly extending fins transversely secured to said lower compression surface.

No references cited.

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