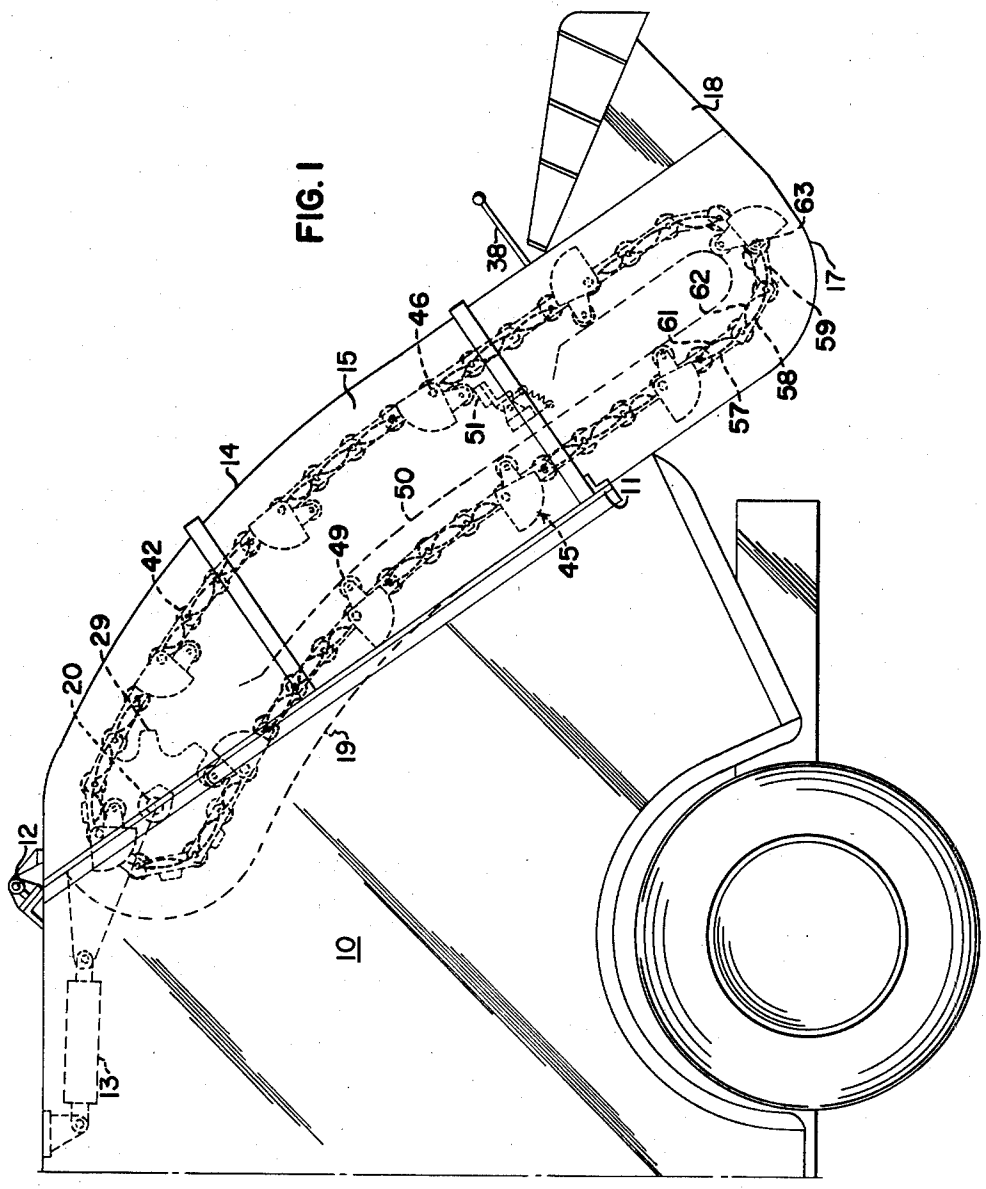
June 21, 1960 E. C. C. MILLER 2,941,679

REFUSE HANDLING APPARATUS

Filed June 24, 1953 7 Sheets-Sheet 1

FIG. 1



ERNEST C.C. MILLER

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REFUSE HANDLING APPARATUS

Filed June 24, 1953 7 Sheets-Sheet 2

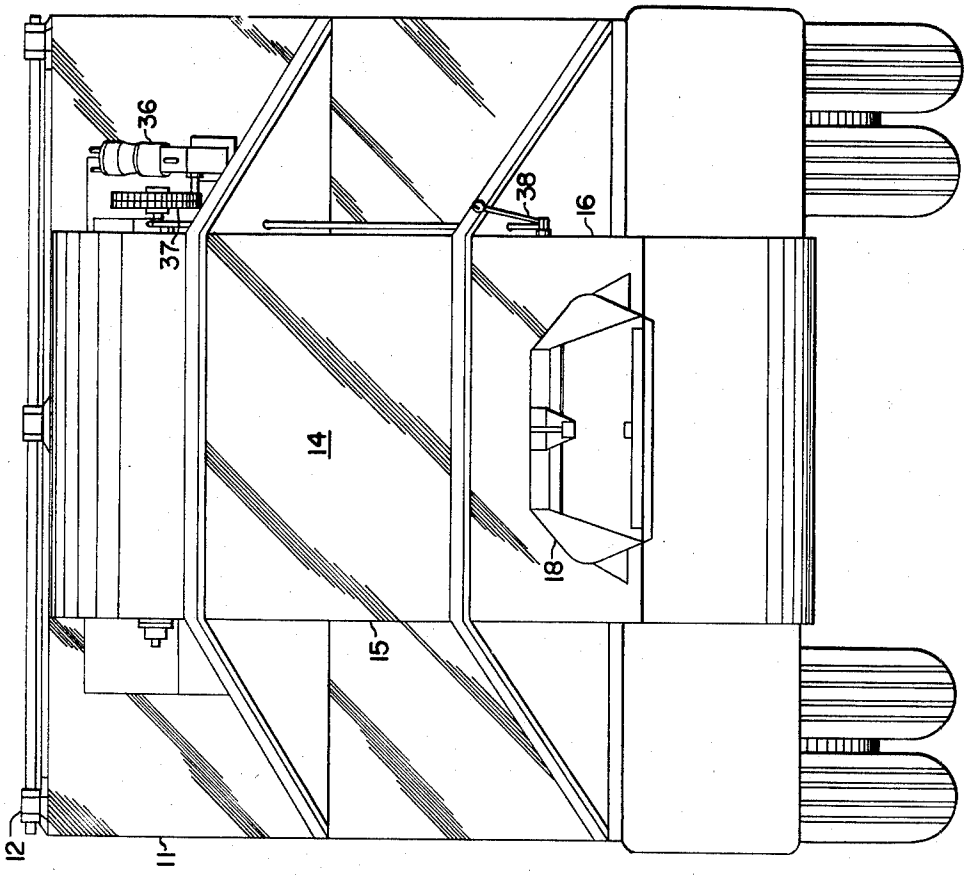

FIG. 2

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REFUSE HANDLING APPARATUS

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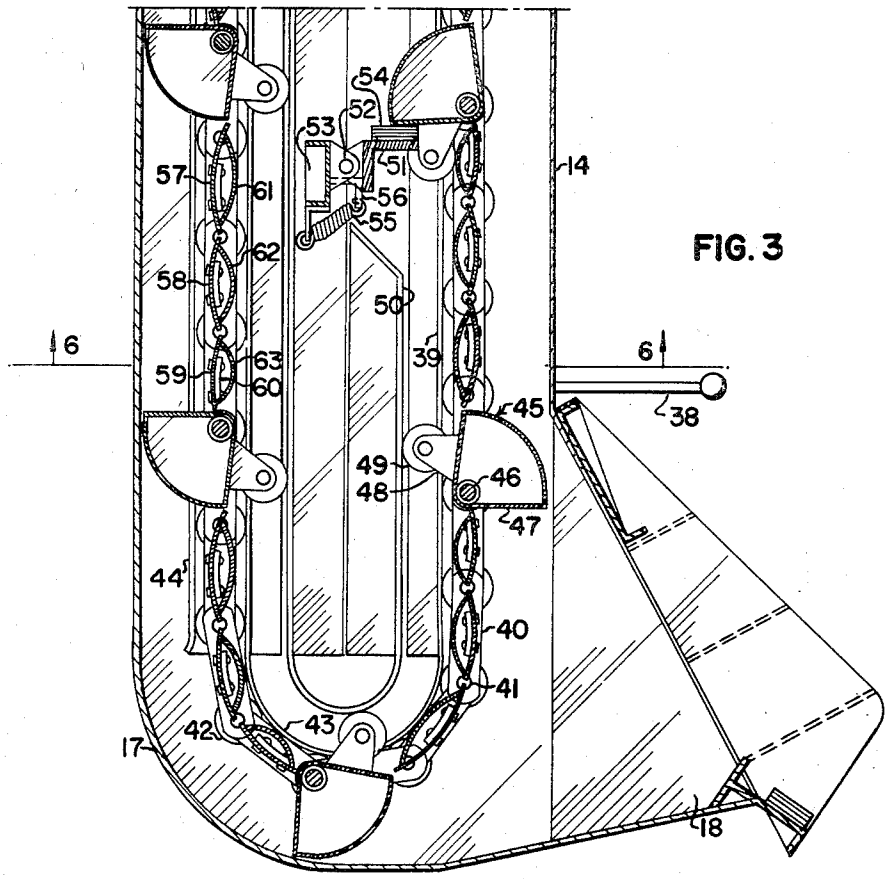

FIG. 3

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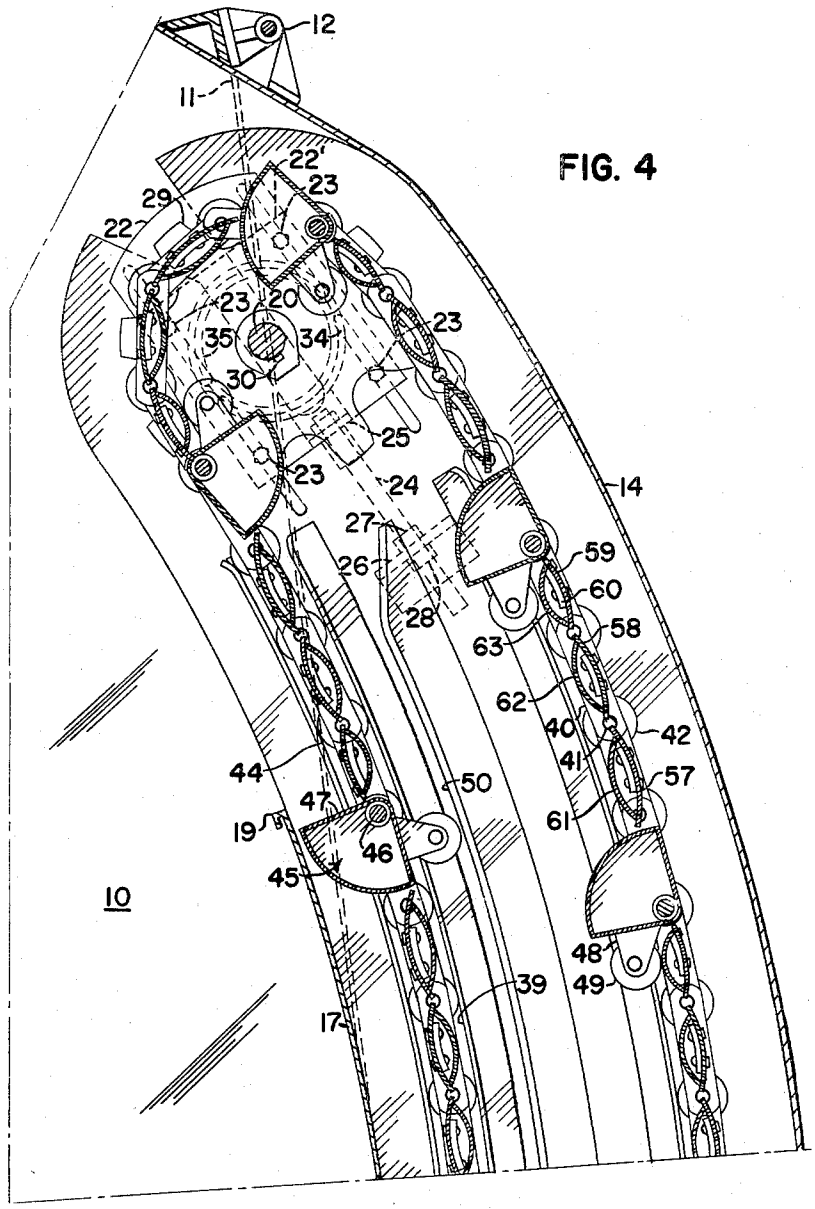

FIG. 4

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Filed June 24, 1953 7 Sheets-Sheet 5

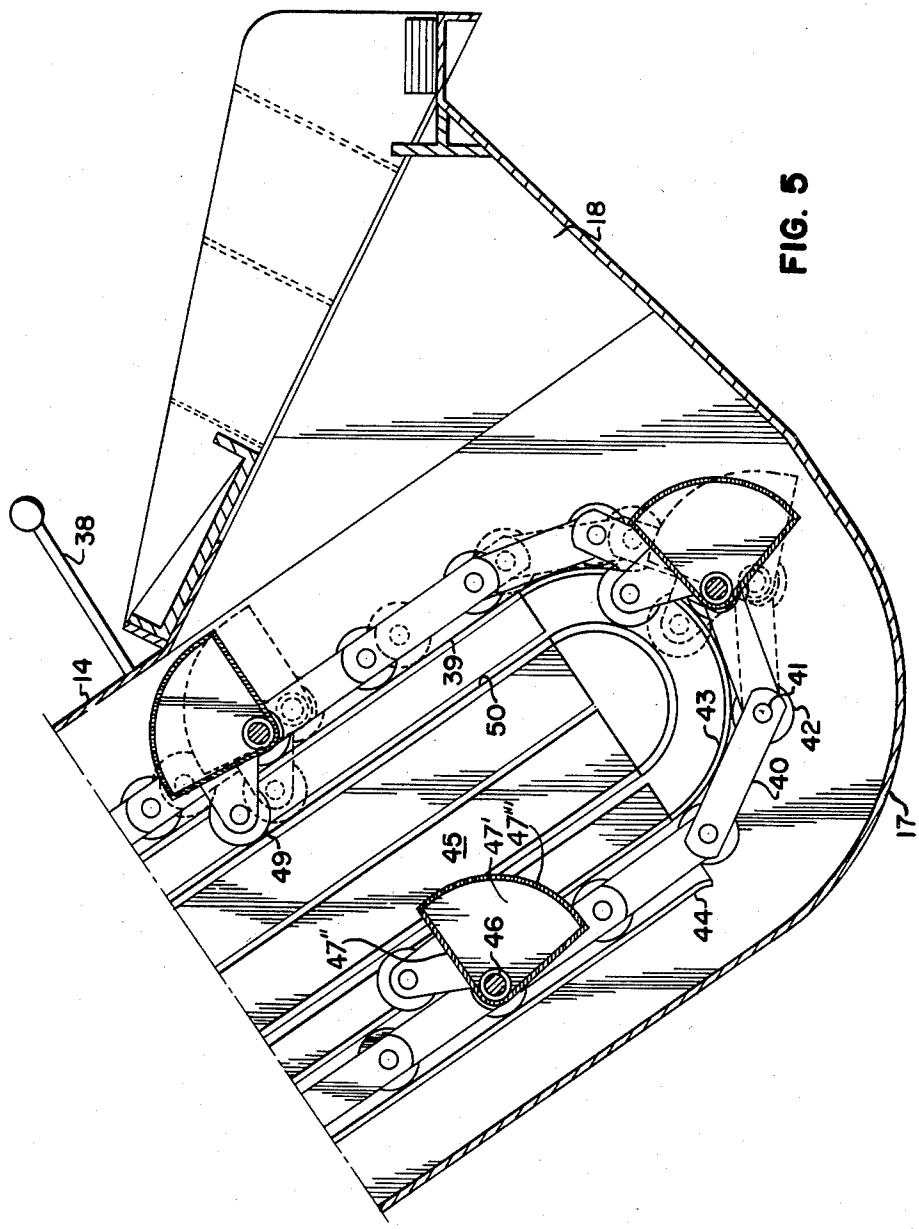

FIG. 5

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REFUSE HANDLING APPARATUS

Filed June 24, 1953 7 Sheets-Sheet 6

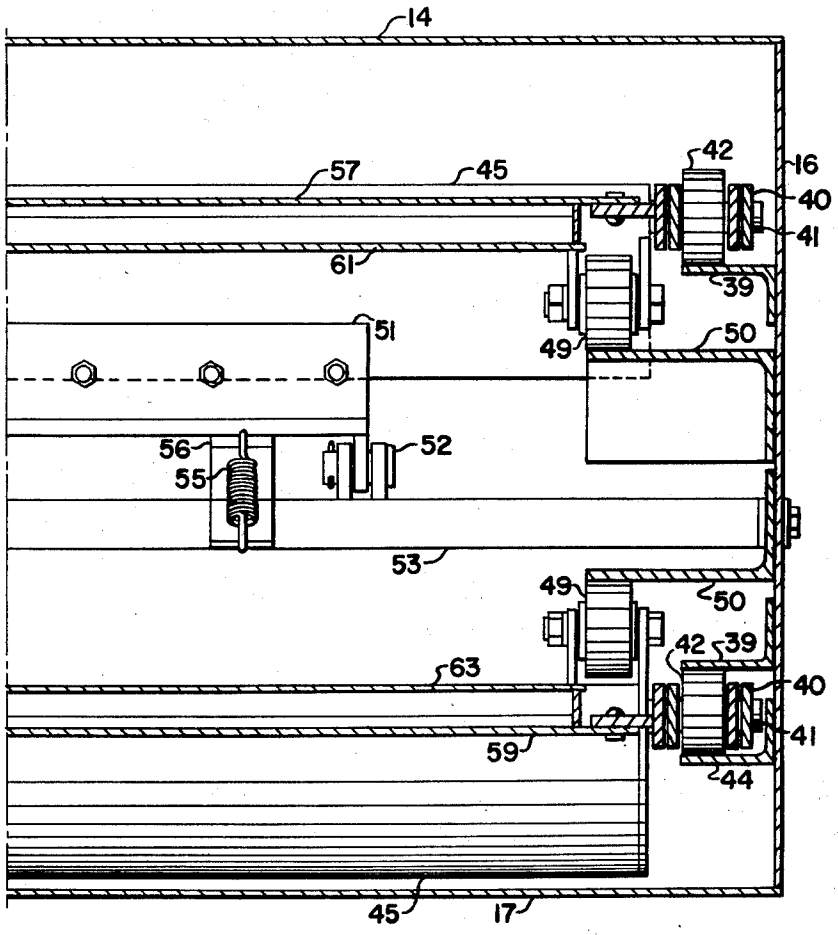

FIG. 6

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REFUSE HANDLING APPARATUS

Filed June 24, 1953 7 Sheets-Sheet 7

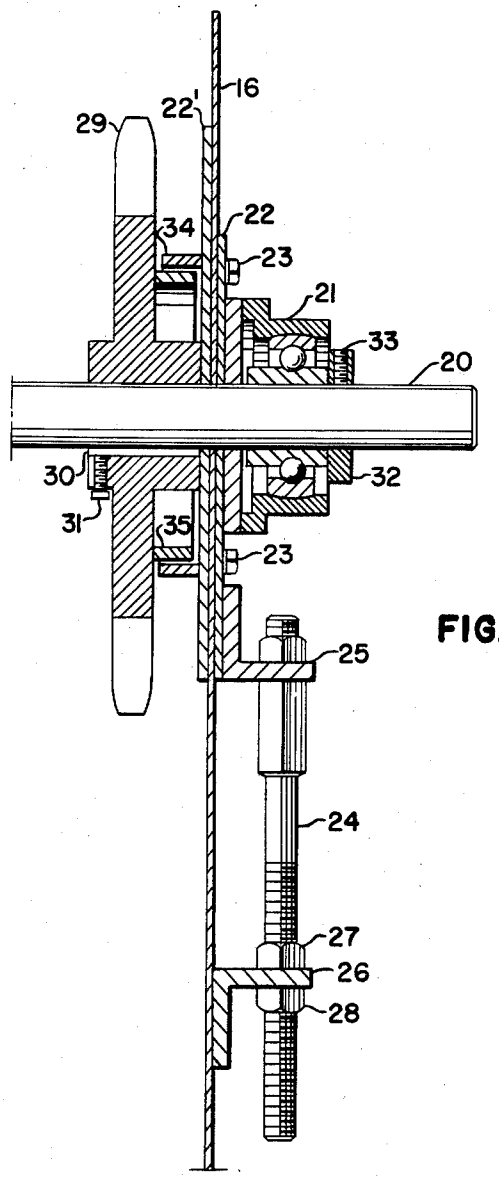

FIG. 7

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United States Patent Office 2,941,679 Patented June 21, 1960

2,941,679

REFUSE HANDLING APPARATUS

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Filed June 24, 1953, Ser. No. 363,901

8 Claims. (Cl. 214—83.36)

This invention relates to a loader and packer conveyor and more particularly, to such conveyor employed with refuse collecting vehicles for collecting and packing domestic and municipal refuse for transfer to a disposal area.

Generally, the problem of removing waste materials, generically known as refuse, is aggravated by the diverse nature of the objects concerned. Refuse may be said to include all waste products of a community other than sewerage, and may comprise bulky or fine materials in the nature of discarded building materials, packing cases, tin cans, plaster, ashes, etc., materials which vary in consistency from completely dry objects to the plasticity of water-laden food products, and further, materials which have a considerable variation in density ranging from ashes and rubble to rags, cartons and loosely confined waste paper. Ordinarily when the body of a truck is filled with such waste material, the actual weight of the material in the body of the truck, due to the fact that the material is loosely packed, is considerably less than the truck can carry if the material were tightly packed. The removal of such refuse for most efficient operation necessitates that the volume per unit of weight of refuse to be transported be reduced to the lowest practical value.

The present invention comprises a loader and packer conveyor of the type referred to for use with closed vehicle bodies and includes an endless conveyor member arranged at an angle with respect to the rear end of the vehicle body for transferring individual loads of material or refuse from an exterior hopper to the interior of the vehicle body. This endless conveyor member is provided with a plurality of retractable conveyor vanes, or flights, arranged to be projected from the conveyor member during its working pass but capable of retraction to a substantially coplanar arrangement with respect to said conveyor member. While in its projected position, the conveyor flights are adapted to cooperate with a hopper member for compacting the material or refuse placed in the hopper to a practical volume and to move, by positive displacement, the refuse from the hopper member to the body of the vehicle.

Accordingly, an object of the present invention is the provision of means for compacting material and transferring such compacted material by a positive displacement, from a loading to a storing position.

Another object of the invention is the provision of a lightweight, movable conveyor having stiffener members for reinforcing the lightweight, refuse confining members of the conveyor.

Still another object is the provision of a conveyor member for confining the refuse conveyed into a vehicle body of the forward interior of the vehicle body thereby preventing the accumulation of refuse adjacent the conveyor mechanism.

A still further object of the invention is the provision

of means for altering the convergent movement of a conveyor member in response to a force exerted on these members by the presence of some unusually large or particularly some incompressible material whereby the conveyor member will pass over the obstruction without disrupting, jamming or causing possible injury or breakage to the conveyor mechanism.

Other objects and features of the invention will become apparent to those skilled in the art as the disclosure is made in the following detailed description of a preferred embodiment of the invention as illustrated in the accompanying sheets of drawings.

With reference to the accompanying drawings, Fig. 1 is a side elevation of a portion of a refuse truck equipped with apparatus in accordance with this invention, and showing in dotted lines the general disposition of interior parts; Fig. 2 is a rear elevation of the refuse truck shown in Fig. 1; Fig. 3 is an enlarged longitudinal sectional view of the lower portion of the loading mechanism; Fig. 4 is an enlarged longitudinal sectional view of the upper portion of the mechanism and constituting a continuation of Fig. 3; Fig. 5 is a view similar to that of Fig. 3 and showing in dotted lines the positions of certain of the parts during one phase of operation; Fig. 6 is an enlarged cross-section of the sectional view shown in Fig. 3, taken on the line 6—6; and Fig. 7 is an enlarged fragmentary sectional view showing a headshaft mounting and conveyor driving sprocket.

Referring now to the drawings in detail there is shown a vehicle provided with a closed refuse body **10** having a tailgate **11** hingedly connected thereto, as at **12**. Hydraulic means **13** or the like are provided when required for raising the tailgate **11** and a conveyor mechanism attached thereto to an open, load-discharge position. Secured to the tailgate and forming an integral part thereof is a housing for a refuse loading and compacting mechanism including top wall **14** and side walls **15** and **16**. The lower portion of this housing may be formed by a refuse conveying surface **17**, which extends downwardly from the hopper **18** provided at the lower end of the top wall **14**. The conveying surface **17** is arcuately formed adjacent the intake end of the mechanism and thence extends longitudinally upwardly forwardly in a substantially straight line into the interior of the vehicle body to terminate along a forwardly arcuately extending line at the discharge lip **19** defining an opening in the vehicle body **10**.

A horizontally disposed headshaft **20** is rotatably mounted in anti-friction bearings **21**, each bearing being carried by a plate **22** mounted for adjustably slidable positioning on the outer face of side walls **15** and **16** and releasably secured thereto by screw threaded fastenings **23** or the like. Longitudinal grooves or slots adapted to receive the screw threaded fastenings **23** or the like are formed in the side walls **15** and **16** and extend longitudinally with respect to the conveyor system. A second set of adjustment plates 22^1 are mounted on the inner face of walls **15** and **16** in parallel relation to the plates **22**, and are adapted to receive the screw threaded fastenings **23** extended through the slots. As such, by loosening fastenings **23**, unitary movement of the plates **22** and 22^1 may be obtained. The side walls are also provided with a slot extending downwardly from the upper margin to permit slidable movement and removal of headshaft **20**. Movement of the plates **22** and 22^1 may be accomplished by a mechanism comprising rods **24** secured to angle brackets **25** fixed to plates **22**, each rod **24** being slidably received in an aperture in an angle bracket **26** secured to the side walls **15** and **16**. The

rods are screw threaded for a portion of their length and lock nuts 27 and 28 are threadedly received on this portion of the rod above and below the angle bracket 26. Adjustment of the nuts 27 and 28 will serve to move the plates 22 and 22^1, bearings 21, and headshaft 20 longitudinally of the refuse loader housing for a purpose to be later described.

Secured to the headshaft inwardly of and closely adjacent to the plates 22^1 are sprockets 29 which may be fixed against rotation relative to the shaft 20 by keys 30 and retained against axial movement by set screws 31. Endwise movement of the headshaft may be prevented by collars 32, secured thereon by set screws 33, or the like. Each plate 22^1 is provided with an annular inwardly extending flange 34, the inner periphery of which is substantially concentric with the axis of the headshaft, and each sprocket 29 is provided with a concentric annular flange 35 extending within the annular flange 34. These inter-engaging flanges provide a seal which prevents the entry of refuse and collection thereof about the hub of the sprockets.

Mounted on the tailgate is a motor 36 which is preferably driven by hydraulic pressure supplied by a pump (not shown) operated by the vehicle motor. Motor 36 is connected through a suitable gear train 37 to drive the headshaft 20, and operation of this motor may be controlled in either a forward or reverse direction by a three-way valve connected to control handle 38 disposed adjacent to hopper 18 in a position convenient to the operator.

Secured to the inner side of each side wall 15 and 16 is an elongated chain guiding and supporting trackway 39 disposed generally in the form of a U the upper ends of which terminate just below the adjacent sprocket 29. Trained around the sprockets 29 are a pair of horizontally spaced substantially parallel endless chains which may conveniently comprise pairs of elongated links 40 pivotally connected by pivot pins 41. Also mounted on each pivot pin is a roller 42 disposed between the pair of links for rolling engagement with the outer surface of trackway 39. It will thus be apparent that upon rotation of the headshaft in one direction linear motion will be imparted to the chains such that the individual links will travel in a generally elliptical orbital path the longitudinally extending ends of which may be defined by the sprockets at one end and the arcuate portion 43 (see Fig. 3) of the trackway 39 at the other. Furthermore, it will be observed that the relationship between the elliptical path of the chains and the various portions of the conveying surface 17 are such that relative movement between them is convergent in the direction of travel away from the hopper and relatively parallel thereafter towards the discharge end of the conveying surface. In order to maintain this relationship it is necessary to provide an auxiliary track 44, secured to the sidewalls 15 and 16 and disposed generally parallel with the conveying surface to bear against the side of the rollers 42 opposite the track 39. The auxiliary track 44 and the trackway 39 define a channeled trackway for the rollers 42 where the rollers 42 are guided by the channeled trackway and bear on the track 44 during the working pass of the conveyor member. It will also be apparent that adjustment of the position of the headshaft in a longitudinal direction with respect to the conveying surface will vary the force exerted by the rollers 42 against the arcuate track section 43 and thus determine the extent of the slack which exists in the chain as a whole.

A plurailty of horizontally disposed conveyor flights 45 are pivotally mounted at spaced intervals between the chains on cross shafts 46, the ends of which shafts are of reduced diameter to serve in place of pivot pins for connecting the chain links at that point. Each of the flights, or vanes, 45 comprises a generally rectangular refuse engaging face 47, end walls 47', an inside control wall 47'', and a substantially radial back wall 47'''. The engaging face 47 is of such shape and size to conform substantially to the cross-sectional area defined by the surface 17, walls 15 and 16, and the path of the chains which lie closest to surface 17. Each of the flights is also provided with means to assist in rotatably positioning the flight during the course of its travel while in operation and this may include a pair of spaced inwardly and rearwardly extending elements 48 having rollers 49 pivotally mounted at their extremity for operative engagement with a cam track 50 which is attached to the inner side of each of the walls 15 and 16. The cam track extends inwardly from the side walls beyond the track 39 in order to be engaged by the rollers 49 which are positioned inwardly relative to the rollers 42 and are disposed in a spaced parallel relation to the track 39.

Cam tracks 50 are of substantially U shape and extend from the lower end of the conveyor member above the hopper entrance, past the lower portion of the conveyor member adjacent side wall 17 and upwardly to a point near the sprocket 29. The length of the cam tracks 50 define the extent of the working pass of the conveyor member including the conveyor chains and the flights 45. In order for the flights to be properly positioned during compacting and refuse moving phases of the cycle of operation it is essential that when a flight is disposed with its refuse engaging face 47 normal to the direction of travel then the distance in a vertical plane between track 39 and cam track 50 should be somewhat less than the distance from the axis of rotation of the flight to the point of contact between roller 49 and cam track 43, and the position of said point of contact should be slightly to the rear of the axis of rotation of the flight as compared with the direction of travel of the flight.

In normal operation the direction of movement of the flights is clockwise as viewed in Fig. 3. As they travel downwardly from the sprocket 29 along track 39 they will remain in the retracted position as exemplified by the flight positioned at the upper right in Fig. 3. However, before engaging the refuse deposited in the hopper the flights should be forwardly rotated to their projected position as exemplified by the remaining flights shown in Fig. 3, and to obviate excessive shock to the mechanism a trip bar 51 is provided, extending transversely of the conveyor system, which comprises an angle member pivotally supported by a cross rod which is in turn connected to a cross member 53 secured to the side walls 15 and 16. The face of the trip bar which normally engages with the back of a retracted flight, as shown in Fig. 3, may be provided with a facing 54 of resilient material such as rubber, leather, or the like. The trip bar is normally maintained in the position shown in the drawing by means of a tension spring 55, acting against a stop member 56 which limits clockwise rotation of the trip but permits counter-clockwise rotation of the trip bar in the event it becomes engaged by a flight being moved upwardly at this point during a temporary reversal of normal direction.

The conveyor chain means assembly is completed by the provision of one or more conveyor pans 57, 58 and 59 to be transversely disposed between successive flights 45, and are secured by rivets to small flanges 60 welded to opposing pairs of links 40 of the respective chains. The exposed surfaces of the pans 57, 58 and 59 are so disposed that they remain at all times substantially in the plane of the path of travel of the chains, and these surfaces are preferably arcuately formed so that as they are carried over the sprockets 29 for reversal of direction at the upper end of the conveyor means they will individually define segments of an arc of a cylinder of revolution concentric with the axis of the sprockets whereby the tendency for refuse to be carried back over the top of the conveyor at this point will be minimized. The pans are so constructed that they will, in multiple numbers, provide a closed working or impervious face for

the conveyor member relative to conveyor surface 17 and the vehicle body, and serve to seal the opening between the vehicle body and the conveyor mechanism. For additional strength semi-tubular elements 61, 62 and 63 may be welded on the back sides of pans 57, 58 and 59 respectively.

In operation hydraulic fluid may be supplied to the motor 36 in response to movement of the control handle 38 to drive the headshaft 20 in a clockwise direction as viewed in Fig. 4. Rotation of the headshaft and its associated sprockets 29 will drive the conveyor flights 45 and pans 57, 58 and 59 in a clockwise direction about the elliptical orbital path defined by the tracks 39. As previously noted, the flights passing downwardly from the sprockets will normally remain in retracted position, as shown in Fig. 4, until they engage the trip bar 51, as shown in Fig. 3. Further downward movement of a flight, past the trip bar will result in a clockwise rotation of the flight about the axis of its supporting cross shaft 46, until the guide roller 49 becomes engaged in rolling contact with cam track 50 to normally maintain the flight in its projected position at which point it is in readiness to engage refuse which has been deposited in the hopper 18. Further downward movement of the flight will then bring it into engagement with the arcuate portion 43 of the track, and at this point it will be observed that the relationship between the track and the lower arcuate portion of conveying surface 17, having a generally greater radius of curvature than that of the track, will develop convergent relative motion between the approaching flight and the pans preceding it and the conveying surface which will compress the refuse confined between these elements. Furthermore, this primary compressive action will continue until a point is reached at which the forward face 47 of the flight substantially extends transversely across the trough-like surface which is defined by the side walls 15 and 16 and the conveying surface 17. Some further small compressive action will continue to be exerted on the refuse which is thereafter confined within the moving enclosure defined by surfaces 15, 16, 17 and the preceding pans 57, 58 and 59, this additional compressive force being a resultant of the relative movement between the flight and the preceding pan 59 as these elements move upwardly around the arcuate track portion 43 into the straight portion of the track 39. This general location may also be conveniently defined as the intake of the loading mechanism.

As the flight moves thereafter upwardly adjacent the conveying surface toward the discharge end it will be apparent that the driving force exerted by the tension of the chain will be applied to the flight in alignment with the pivotal cross shaft 46 and, that the resistance of refuse being pushed upwardly by the face 47 of the flight will produce a counterclockwise turning moment which is resisted during this upward travel of the flight by a combination of the roller 49 in engagement with cam track 50 and roller 42 in engagement with auxiliary track 44. At the same time the force exerted by refuse confined between the conveying surface and one of the pans 57, 58 and 59 will be resisted solely by engagement of the rollers 42 of the pans in engagement with the upwardly extending straight portion of track 39. On the other hand, it should be borne in mind that at the beginning of a cycle of operation, or when the chain is moving under no-load conditions, the force exerted by the sprocket 29 on the chain will, due to the arcuate configuration of the upper portion of the path of travel, be resisted almost entirely by engagement of roller 42 of the flights and pans with auxiliary track 44.

During normal operation the upwardly moving flights, coacting with the conveyor pans and the trough-shaped means defined by the side and bottom walls of the conveyor housing, continuously move the compacted refuse in confined moving enclosures so formed, toward the discharge lip 19, beyond which the compacted refuse will drop down into the interior of the vehicle body. Furthermore, even when the accumulated refuse within the body reaches a level near the top of the body, the fact that the discharge end of the loading mechanism extends arcuately forwardly is effective to exert a forwardly directed thrust on the accumulated refuse rather than to push it further upwardly toward the top of the body.

As soon as an upwardly moving flight passes beyond the discharge lip 19 and its guide roller 49 is no longer in engagement with the cam track 50, the turning moment exerted on the flight by refuse causes counterclockwise rotation of the flight so as to position its refuse engaging face in alignment with the surfaces of the adjacent conveyor pans to minimize the possibility of carrying refuse over the top of the sprockets and back down into the hopper, as the flight reverses direction in preparation for another cycle of operation.

Fig. 5 illustrates the operation of the invention under conditions such as when an obstruction of the nature of an excessively large or incompressible object becomes engaged between a flight and the bottom surface of the hopper which would tend to prevent the convergent relative movement between the conveying surface 17 and the adjacent edge of a flight during the usual compaction cycle of operation. As previously stated, the force of refuse against the face of a flight acting against the tensional force of the driving chain creates a turning moment tending to rotate the flight into retracted position. It has also been noted that in the case of the flights moving upwardly toward the discharge point this turning moment is resisted by the presence of the cam track 50 and the auxiliary track 44. However, no auxiliary track is provided in connection with the lower arcuate portion 43 of track 39 for this purpose. Instead, because the chain which is connected to the lowermost flight, as shown in Fig. 5, extends angularly upwardly about the track section 43 both in front of, and behind, the flight the resultant force exerted by both of the upwardly extending legs of the chain acts in an upward direction and coacts with the engagement of guide roller 49 with cam track 50 to resist the turning moment exerted by refuse against the flight. However, the effectiveness of the resultant force of resistance is variable, and counterclockwise rotation of the flight at this point is not positively prevented as is the case when the flight travels adjacent the auxiliary track 44.

It has been stated that the distance between the axes of the two rollers 42 and 49 of a flight should be slightly greater than the distance between the tracks on which these rollers ride. Bearing this in mind it will be seen that in order for the lowermost flight of Fig. 5 to be rotated counterclockwise to the retracted position, it will be necessary for roller 42 to be outwardly displaced from the track inasmuch as the path of travel of roller 49 is limited by engagement with the cam track. However, any displacement of the flight away from the track at this point must also be accompanied by an appreciable displacement of the chain as well due to the angular relation of the links about the arcuate portion 43 of the track. Such a displacement and consequent counterclockwise rotation of the flight is shown in dotted lines in Fig. 5. If it were not for the fact that tension is being exerted in the left hand upwardly extending leg of the chain by the driving sprocket 29 there might be an equal displacement of the links on either side of the lowermost flight. As it is no displacement of the flight can take place downwardly except as a result of the taking up of slack at some point in the chain and under the circumstances attending the usual operation of the device this slack will exist in the right hand leg of the chain, resulting in downward displacement of all of the individual elements, including the flights and pans supported by this portion of the chain whenever counterclockwise rotation of a flight is caused by unusual force being exerted against its forward face.

Of particular advantage is the fact that the presence

of a certain amount of slack in the chain permits the flights to yield slightly when moving in engagement with refuse in the hopper and to adjust themselves to minor irregularities in the character of the materials present by slight displacement of position without subjecting the driving mechanism to a succession of shock forces which would be the case if the flights were maintained inflexibly in position during their travel through the hopper. Furthermore, the more the slack in the chain is taken up by an increase in displacement of a flight the greater is the force of resistance offered, until a certain predetermined value is reached, at which point the flight will retract completely.

In Fig. 5, the rotation is shown at about dead-center with the effects of displacement shown in dotted lines. The amount of force, caused by an obstruction, or any other reason, which can be resisted to prevent this counterclockwise rotation will be dependent on the amount of slack existing in the chains, and the amount of this slack, and thus the amount of force which may be offered by the flights before retracting, may be varied by longitudinal adjustment of the position of the headshaft **20**, as previously explained. It will therefore be evident that means has been provided in conjunction with the conveying means for relieving overloads which might otherwise cause the apparatus to become jammed. In the present case, no stoppage of the conveying system occurs by reason of such overload relief inasmuch as the relieved flight proceeds upwardly toward the discharge end of the system in its retracted position as is shown in Fig. 5. Also, a continuation of this process, whereby each succeeding flight or vane engages the obstruction and retracts, will usually dislodge the object by turning or otherwise whereby the object will pass through the mechanism into the vehicle body.

I claim:

1. Apparatus for elevating refuse into a truck body including, a horizontally disposed adjustably positioned headshaft provided with a pair of spaced sprocket wheels, a pair of horizontally spaced fixed flange means disposed generally in the form of an upright U, a pair of horizontally spaced fixed cam means disposed generally in the form of a U similar to the first mentioned U, a pair of endless linked chain means depending downwardly in driving engagement with said sprocket wheels and in slidable engagement with the outer face of the flange means for upward traversal along one of the legs of the U to elevate refuse downward traversal along the other leg and reversal of direction during travel along the apex of the U, a plurality of conveyor pans secured at their ends to opposite links of the chain means, a plurality of conveyor flights extending between the chain means and pivotally connected thereto for oscillatory movement about a first axis parallel to the headshaft axis, each of said flights being also provided with means for slidable and rotatable contact with the cam means, said contact determining a second axis for oscillatory movement of the flight parallel to the first axis, the distance between said axes being greater than the lateral distance between the flange means and the cam means, said first axis being forwardly disposed with respect to the second axis when the flight is in forwardly oscillated position and vice versa, said transposition of the second axis being accomplished when in contact with the cam means only by lateral displacement of the first axis away from the flange means, and second flange means spaced from the first flange means for slidable engagement with the chain means during said upward traversal to prevent said lateral displacement of the first axis, said lateral displacement being resisted during travel of the flights along the apex of the U by residual tension existing in the chain means, said residual tension being variable by adjustment of the position of the headshaft with respect to said apex to permit said displacement and rearward oscillation of a flight in response to rearwardly directed force exerted on the flight by refuse in excess of a predetermined amount.

2. Apparatus for elevating refuse into a truck body including, a horizontally disposed headshaft provided with a pair of spaced sprocket wheels, a pair of endless linked chain means depending downwardly in driving engagement from said sprocket wheels for longitudinal upward traversal toward the headshaft to elevate refuse downward longitudinal traversal away from the headshaft and reversal of direction in a semi-circular path spaced from the headshaft, an arcuate surface mounted to bear outwardly on the chain means during travel in said semi-circular path, an arcuate cam surface mounted concentrically with respect to the first mentioned surface, a plurality of conveyor pans secured at their ends to opposite links of the chain means, a plurality of conveyor flights extending between the chain means and pivotally connected thereto for oscillatory movement about a first axis parallel to the headshaft axis, said flights being also provided with means to bear inwardly in contact with the arcuate cam surface during travel of a flight along said semi-circular path, said contact determining a second axis for oscillatory movement of the flight parallel to the first axis, said first axis being forwardly disposed with respect to the second axis when the flight is in forwardly oscillated position and vice versa, said transposition of the second axis being accomplished when bearing against the cam surface only by lateral outward displacement of the first axis away from the first mentioned arcuate surface, said lateral displacement being resisted by residual tension existing in the chain means whereby when refuse exerts rearwardly directed force against a flight during refuse elevating movement of the chain means said flight will be rearwardly rotated when the resultant force of refuse urging displacement of the first axis exceeds the resultant force of said residual tension in resistance thereto.

3. Loading apparatus for refuse trucks including, hopper means placed adjacent the lower part of the rear panel of a truck body, a conveying surface extending longitudinally upwardly from the hopper means terminating adjacent the rear of the truck body interior, endless travelling segmental surface conveyor means to coact with the conveying surface to compact and move refuse from the hopper means to the truck body interior, certain of the segmental surfaces comprising conveyor pans and other segmental surfaces comprising oscillatory conveyor flights, said conveyor means including headshaft means disposed above and beyond the termination of the conveying surface and guide means to direct the segmental surfaces in a generally longitudinal path from the headshaft means to the hopper means to direct reversal of direction of the segmental surfaces adjacent the hopper means and to positively direct traversal of the segmental surfaces from the hopper means toward the headshaft means in a path uniformly spaced from the conveying surface to discharge refuse into the truck body, and camming means disposed to engage with the conveyor flights during travel adjacent the hopper means and the conveying surface, said conveyor flights being provided with pivot means to allow rotation about a first axis at the forward edge and rotation when in engagement with the camming means about a second axis parallel to and spaced from the first axis, said rotation about the second axis including lateral outward displacement of the first axis, said guide means of the conveyor means being disposed adjacent the hopper means to restrict only inward displacement of the first axis of a flight, whereby the camming means may position a flight in forwardly oscillated position for travel adjacent the hopper means and conveying surface and thereafter the flight may be rotated about the second axis to the rearwardly oscillated position while adjacent the hopper means.

4. In a refuse vehicle, a closed compartment, a hopper open to the exterior and mounted adjacent a lower portion

of the compartment, an opening extending from the hopper to the compartment, a chain conveyor extending from the hopper upwardly into the compartment, said chain conveyor having a plurality of material moving vanes thereon each of which is pivotally connected to the conveyor for movement from an operative position projecting at right angles thereto to a retracted position, a plurality of plates extending the full width of the chain conveyor and attached to the sides thereof for forming with said vanes a continuous impervious wall to prevent passage of material from one side of the plane of the chain conveyor to the other, wall members cooperating with said plate means and said vanes of the chain conveyor for forming a completely enclosed passageway leading from the hopper to the compartment, said vanes having an area in their projected positions which is substantially equal to the cross section of the passageway, means for projecting the conveyor vanes into operative position to engage material in the hopper, said means being effective to hold the vanes in projected position until after they have discharged material in the upper inner end of the passageway, and a stiffener plate secured on the inner side of each of said plates to provide longitudinal stiffness for the plates, said stiffener plates being elongated transversely of the chain conveyor.

5. In a refuse vehicle, a closed compartment, a hopper open to the exterior and mounted adjacent a lower portion of the compartment, an opening extending from the hopper to the compartment, a chain conveyor extending from the hopper upwardly into the compartment, said chain conveyor having a plurality of material moving vanes thereon each of which is pivotally connected to the conveyor for movement from an operative position projecting at right angles thereto to a retracted position, a plurality of plates extending the full width of the chain conveyor and attached to the sides thereof for forming with said vanes a continuous impervious wall to prevent passage of material from one side of the plane of the chain conveyor to the other, wall members cooperating with said plate means and said vanes of the chain conveyor for forming a completely enclosed passageway leading from the hopper to the compartment, said vanes having an area in their projected positions which is substantially equal to the cross section of the passageway, means for projecting the conveyor vanes into operative position to engage material in the hopper, said means being effective to hold the vanes in projected position until after they have discharged material in the upper inner end of the passageway, a stiffener plate secured on the inner side of each of said plates to provide longitudinal stiffness for the plates, said stiffener plates being elongated transversely of the chain conveyor, and a wall of the hopper converging toward the conveyor in the region where the vanes are projected to cause the conveyor and the vanes of the conveyor to compress material against said wall.

6. In a refuse vehicle, a closed compartment, a hopper open to the exterior and mounted adjacent a lower portion of the compartment, an opening extending from the hopper to the compartment, a chain conveyor extending from the hopper upwardly into the compartment, said chain conveyor having a plurality of material moving vanes thereon each of which is pivotally connected to the conveyor for movement about a first axis from an operative position projecting at right angles thereto to a rearwardly retracted position, plate means extending the full width of the chain conveyor and attached to the sides thereof for forming with said vanes a continuous impervious wall to prevent passage of material from one side of the plane of the conveyor to the other, wall members cooperating with said plate means and said vanes of the conveyor for forming a completely enclosed passageway leading from the hopper to the compartment, said vanes having an area in their projected

position which is substantially equal to the cross section of the passageway, cam means for projecting the vanes into operative position to engage material in the hopper, and means to adjust the tension on said chain conveyor so that the cam means will exert a force on the vanes effective to hold the vanes in an outwardly projected position against normal loads received during movement of the vanes into the hopper and through said passageway, said force being insufficient to hold the vanes projected in the event they encounter abnormal loads.

7. Refuse handling apparatus including hopper means to receive refuse and conveyor means coacting with the hopper means to discharge refuse therefrom, said hopper including spaced vertical side walls, a curved bottom wall and upwardly diverging refuse-receiving and refuse-discharging walls merging with the curved bottom wall, each of the side walls having an inwardly projecting generally U-shaped trackway, the upstanding leg portions of the trackway extending generally parallel with the discharging wall of the hopper, said conveyor means including a pair of horizontally spaced endless chains arranged each to slide over the outer periphery of one of said trackways to provide a return path for one end of the conveyor, support means to provide a return path for the other end of the conveyor, power drive means to exert a force in tension to pull the chains around the curved section of trackway along the leg portion adjacent the discharging wall and away from the hopper, a vane having a working surface extending between said chains and pivotally connected thereto in alignment with the leading edge of the working surface to oscillate between an inoperative position with the working surface in the plane of movement of the chains and an operative position with the working surface disposed angularly with respect to said plane of movement, each of the hopper side walls also having an inwardly projecting U-shaped cam track of lesser radius than said first-mentioned trackway, said vane having a cam arm positioned for engagement with said cam track in trailing relation to the leading edge of the vane in said operative position and in leading relation to the leading edge in inoperative position, said vane being retractible from operative to inoperative position while the cam arm is in engagement with the cam track by outward displacement of the leading edge away from the first-mentioned trackway in response to excessive force exerted against the working surface by refuse in the hopper, the amount of resistance to said force being determined by the amount of slackness in that portion of the chains trailing behind the vane.

8. Loading apparatus for refuse trucks including, hopper means having a trough-shaped refuse receiving surface, the forward portion thereof providing a refuse conveying surface extending angularly upward above the hopper means to elevate refuse into the rear of the truck body, said surface terminating at its upper end in an arcuately forwardly direction portion, endless conveyor means to coact with said hopper means and conveying surface including a plurality of horizontal pivotal flights adapted to be projected substantially at right angles to the direction of movement of the conveyor means and a plurality of horizontal fixed pan elements disposed between said flights to provide a substantially impervious moving wall substantially coextensive in width with the width of the refuse conveying surface spaced from said conveying surface during upward travel of the conveyor means, the lower end of said endless conveyor means being disposed within said hopper means to coact with said trough-shaped surface to compact refuse deposited therein, guide means to position the projected edges of said flights closely adjacent said conveying surface and to maintain said pan elements uniformly spaced from said conveying surface during upward travel, and drive means to position the upper end of the conveyor means forwardly beyond the upper termination of said refuse conveying surface, whereby compacted refuse is elevated from the

hopper means and delivered into the truck body in a forward direction.

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