United States Patent [19]

Smith

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[45] **Reissued Date of Patent: Jun. 4, 1991**

[54] **REFUSE COLLECTION APPARATUS**

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[73] Assignee: **Sargent Industries, Inc.**, Los Angeles, Calif.

[21] Appl. No.: **77,431**

[22] Filed: **Jul. 24, 1987**

Related U.S. Patent Documents

Reissue of:

[64] Patent No.: **3,899,091**
Issued: **Aug. 12, 1975**
Appl. No.: **264,021**
Filed: **Jun. 19, 1972**

[51] **Int. Cl.**[5] **B65F 3/00**

[52] **U.S. Cl.** **414/525.4**; 100/295; 60/431; 414/917

[58] **Field of Search** 414/917, 518, 501, 502, 414/525.1-525.9; 100/295; 60/431

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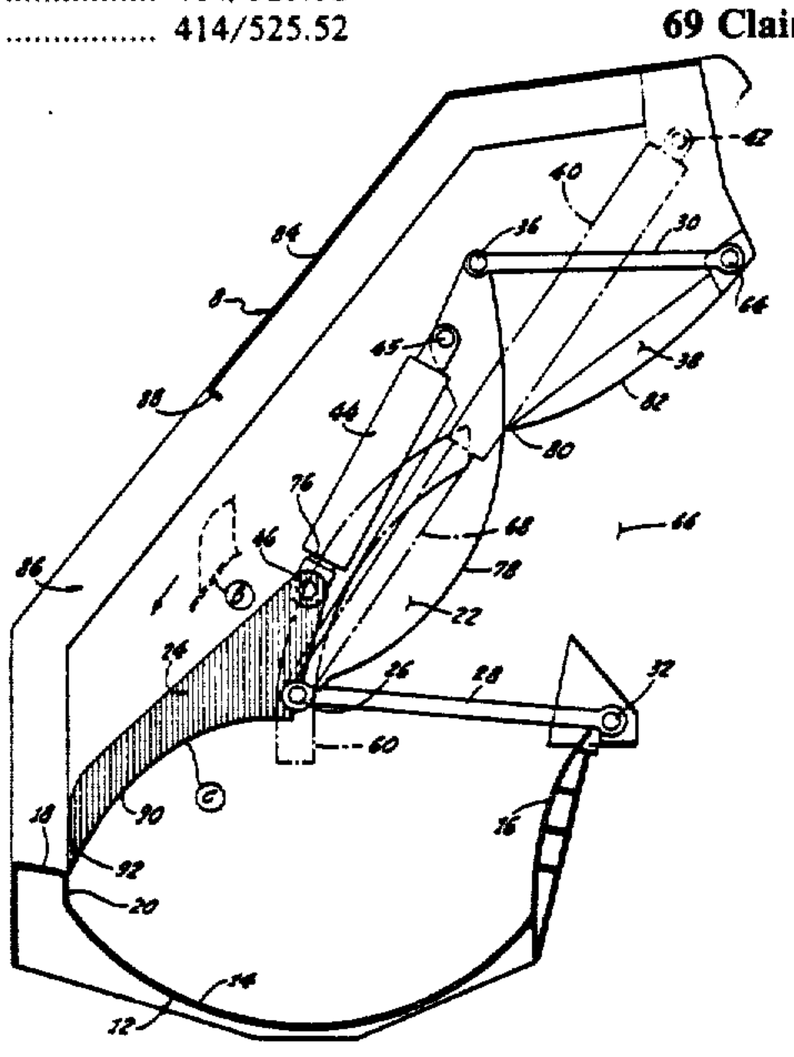
Primary Examiner—Frank E. Werner
Attorney, Agent, or Firm—Ellsworth R. Roston; Charles H. Schwartz

[57] **ABSTRACT**

The upper panel of a tailgate assembly is moved in a downward and rearward convexly curved path between an upward and forward position and a rearward and lowered position and the lower panel is rotated forwardly and rearwardly with respect to the upper panel. Linkages are included in the tailgate assembly to provide this movement. A lower surface of the fixed panel may have an upwardly curved lower surface which imparts a forward direction of movement to refuse which is packed against it. The upper panel may have a curved forward surface in close proximity to a rearward surface of the fixed panel. During movement of the upper panel, the rearward surface of the fixed panel removes refuse from the curved forward surface. The upper panel is tilted as it moves and during its upward movement the lower portion of the upper panel is tilted forwardly. This imparts a forward movement to refuse which is moved through the opening into the storage body. The hopper may include a vertically inclined forward packing surface so that refuse is packed between the curved packing surface and the vertically inclined forward packing surface of the hopper. The hopper may include a straight rearward wall portion with the packing panel having a narrowed lower edge. During its movement into the hopper, the packing panel may be moved so that its narrowed lower edge is in contiguous relation to the straight rearward wall portion of the hopper. The packing panel may include one or more upstanding ribs on its curved packing surface which provide a reduced area for application of high localized pressures to refuse contacted by a rib.

69 Claims, 14 Drawing Sheets



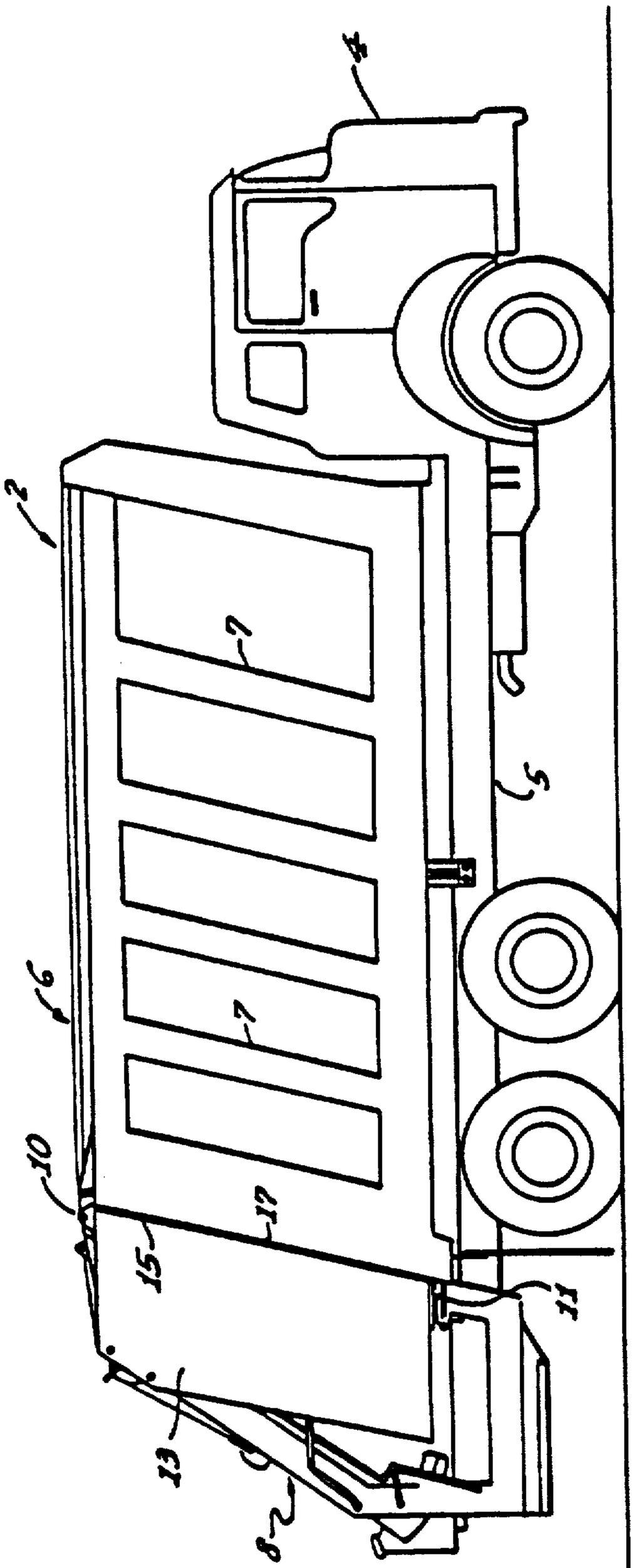


Fig. 1

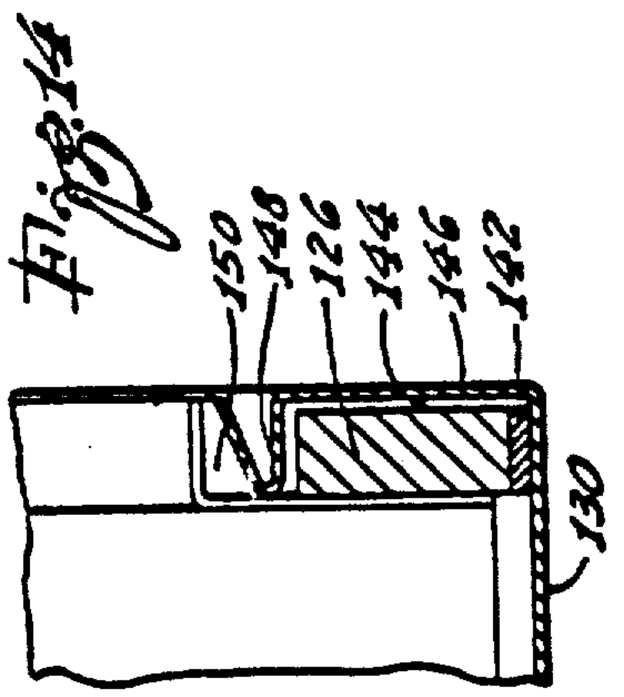


Fig. 14

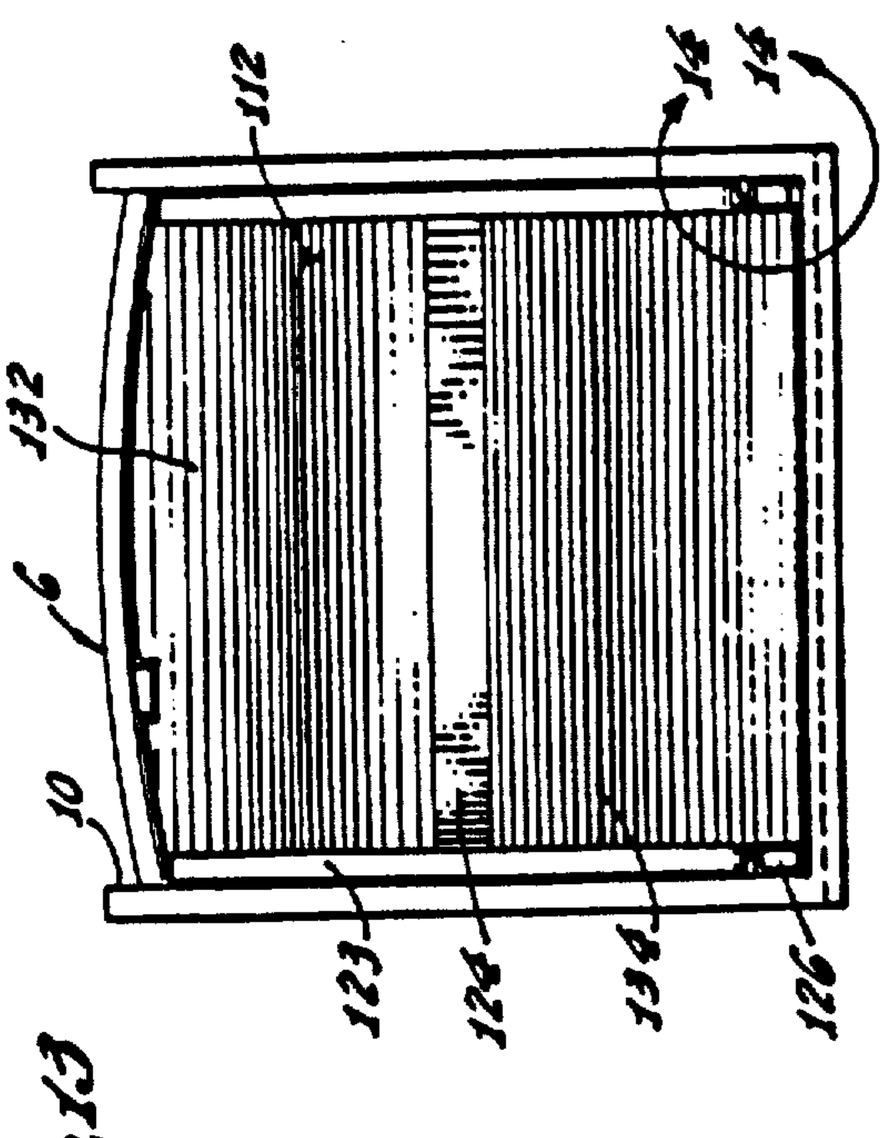
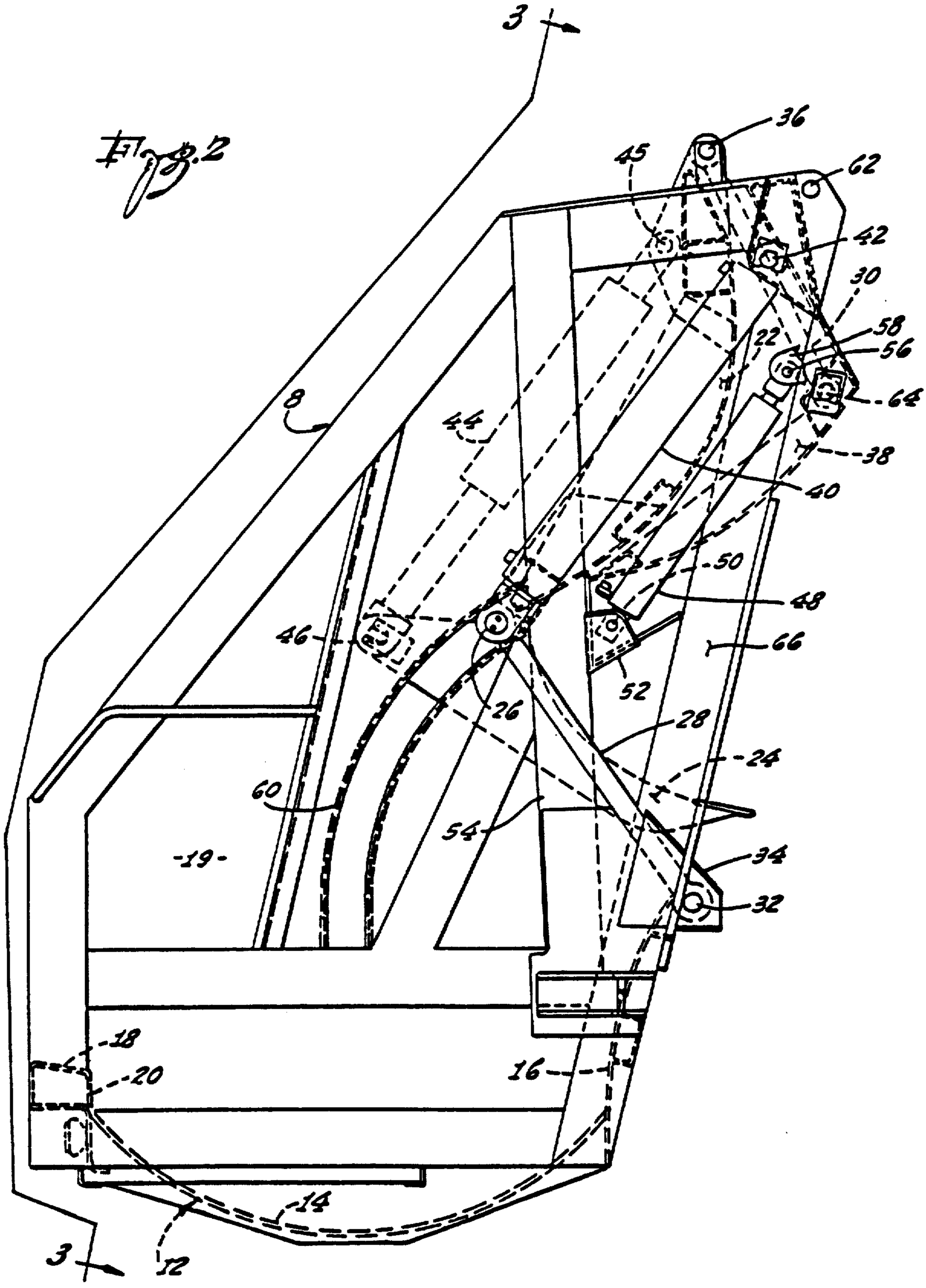


Fig. 13

Fig. 2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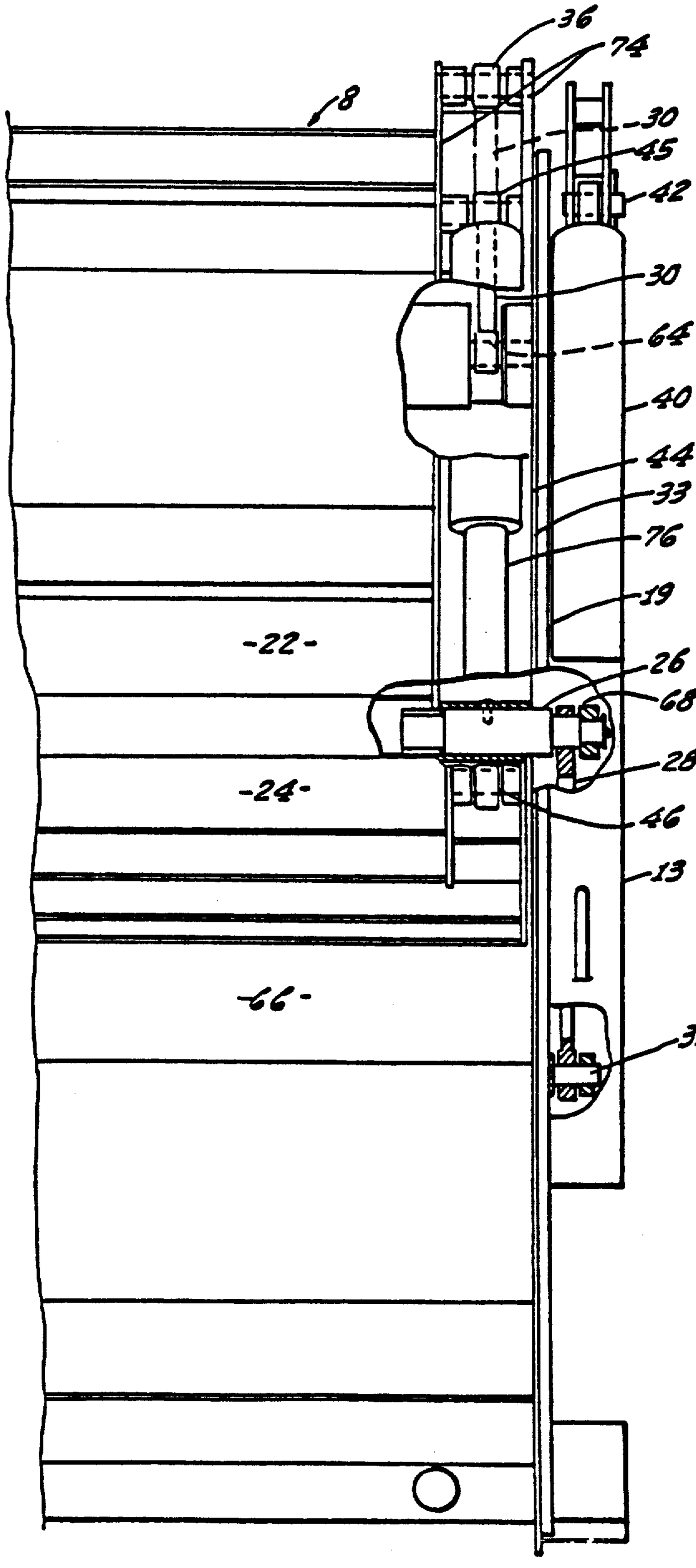

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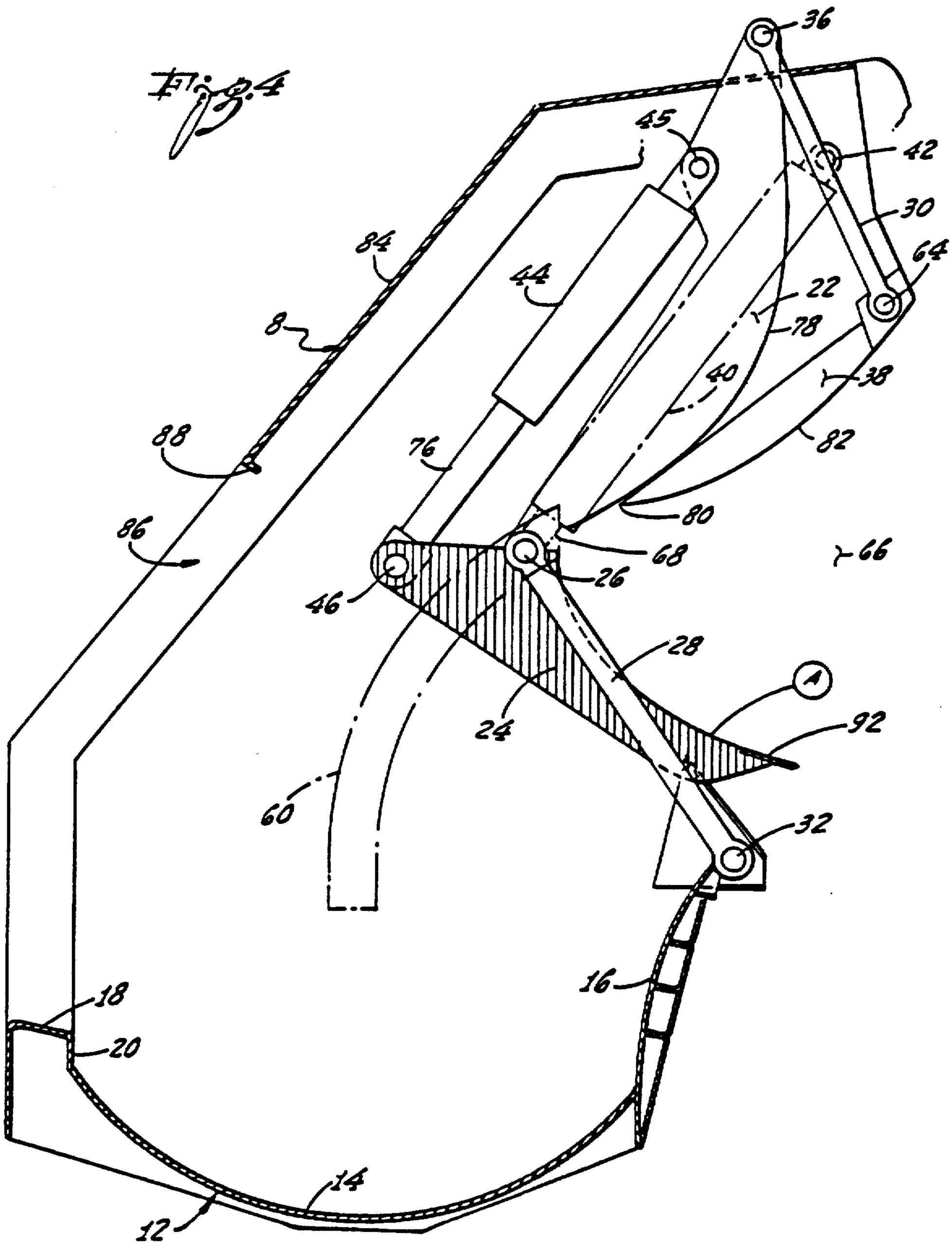
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Fig. 5

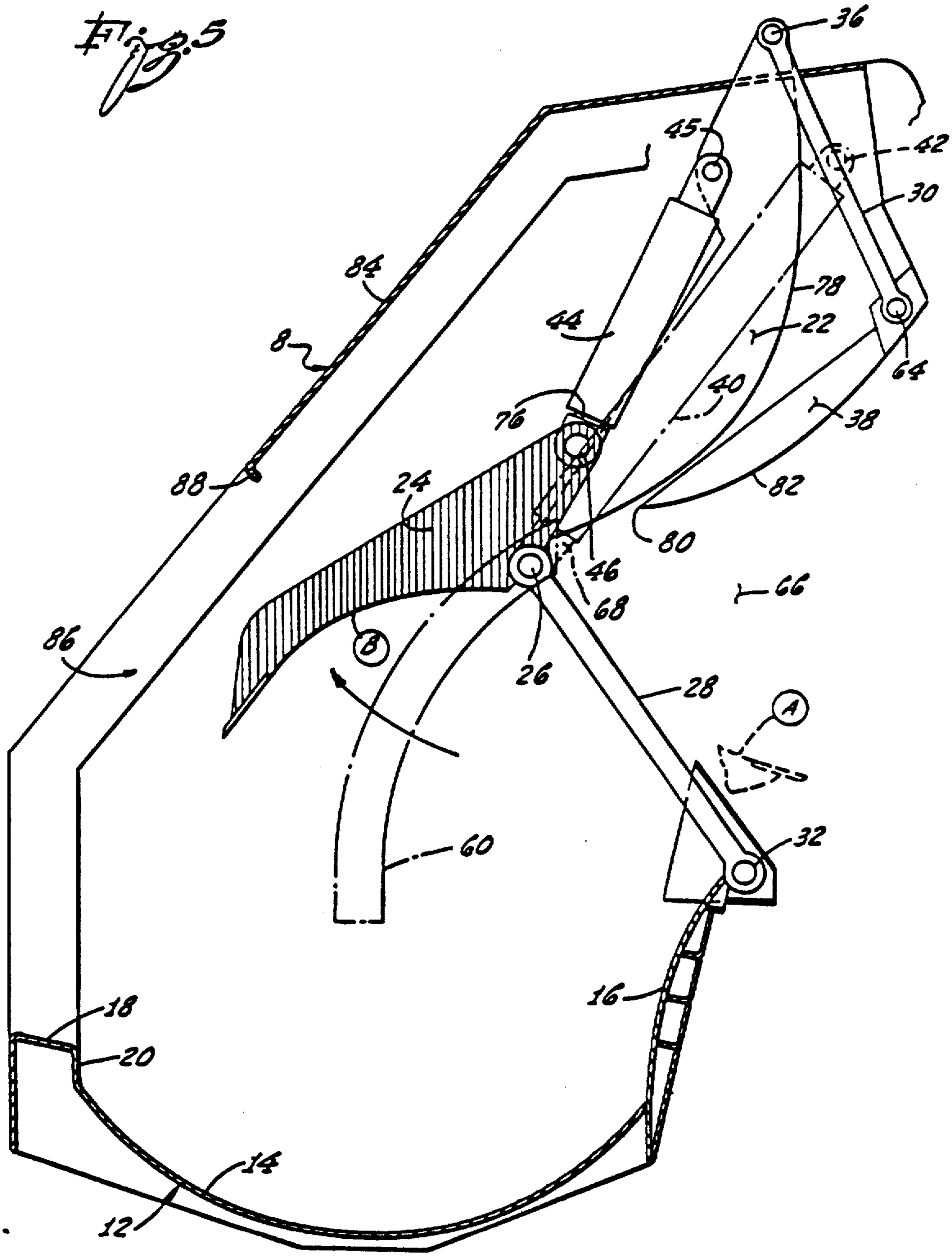
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Fig. 6

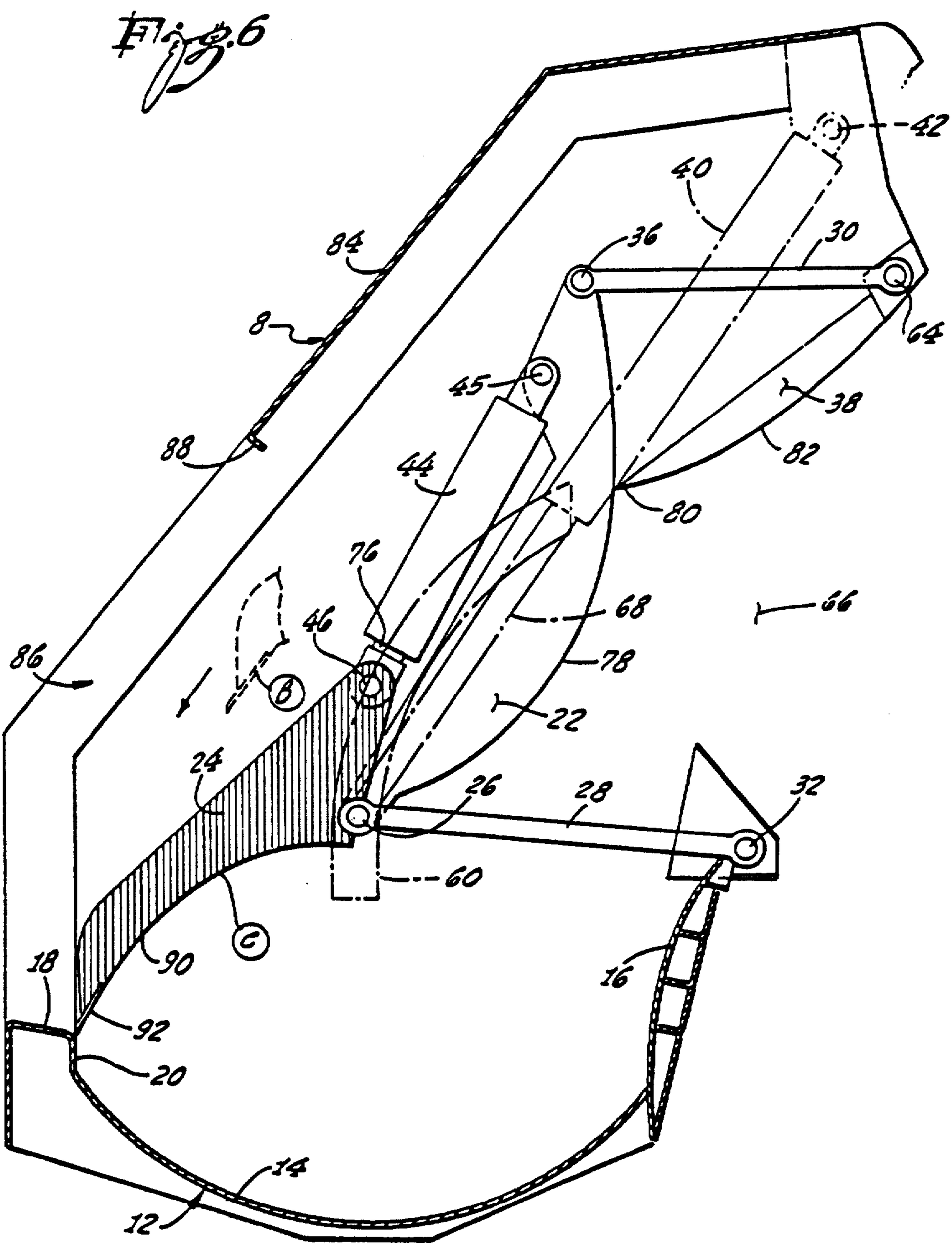
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Fig. 7

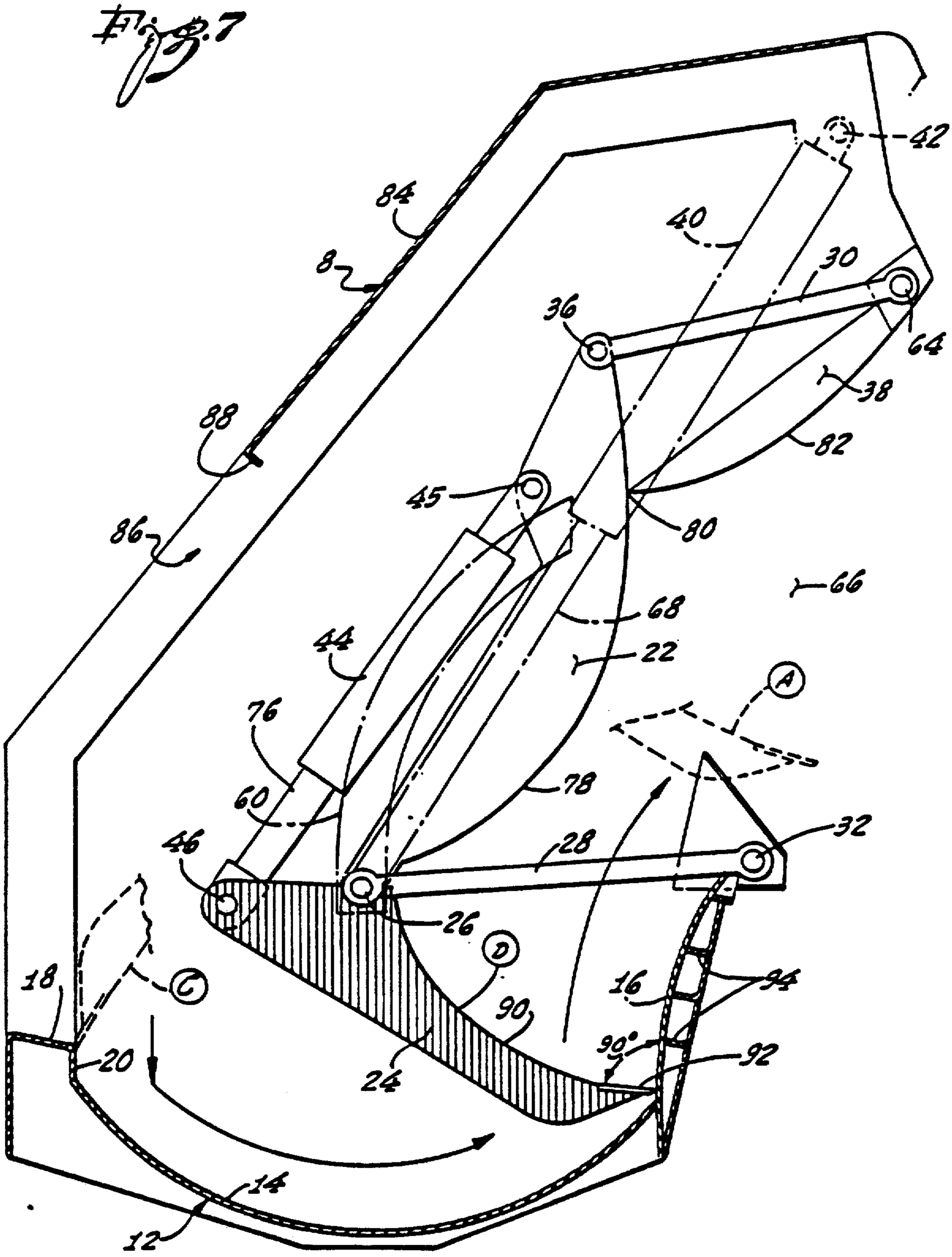
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Fig. 8

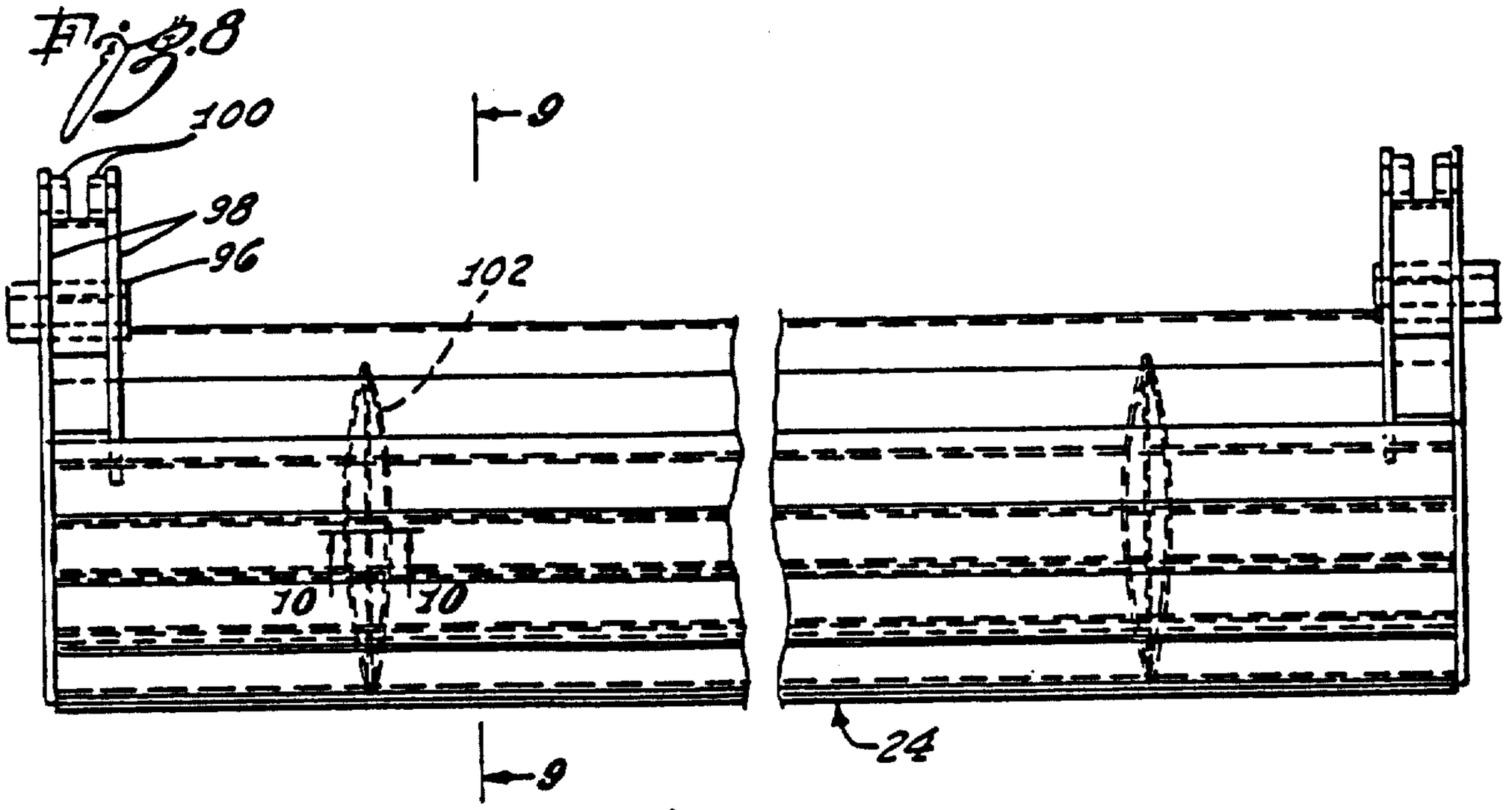


Fig. 9

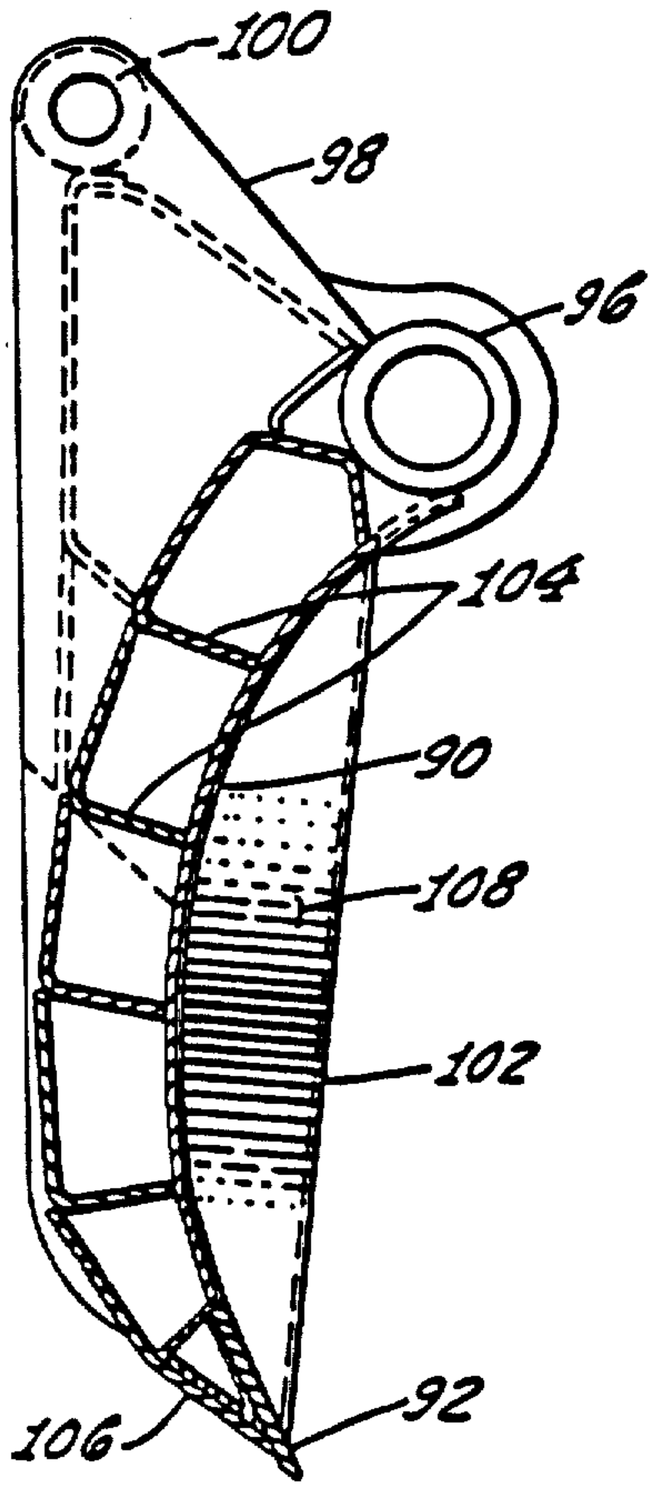
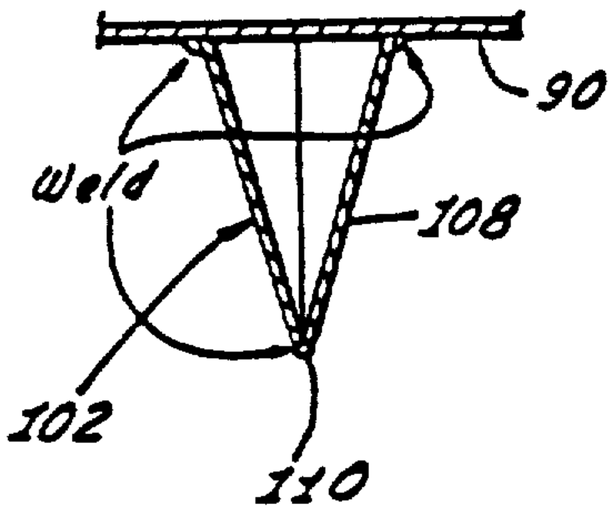


Fig. 10



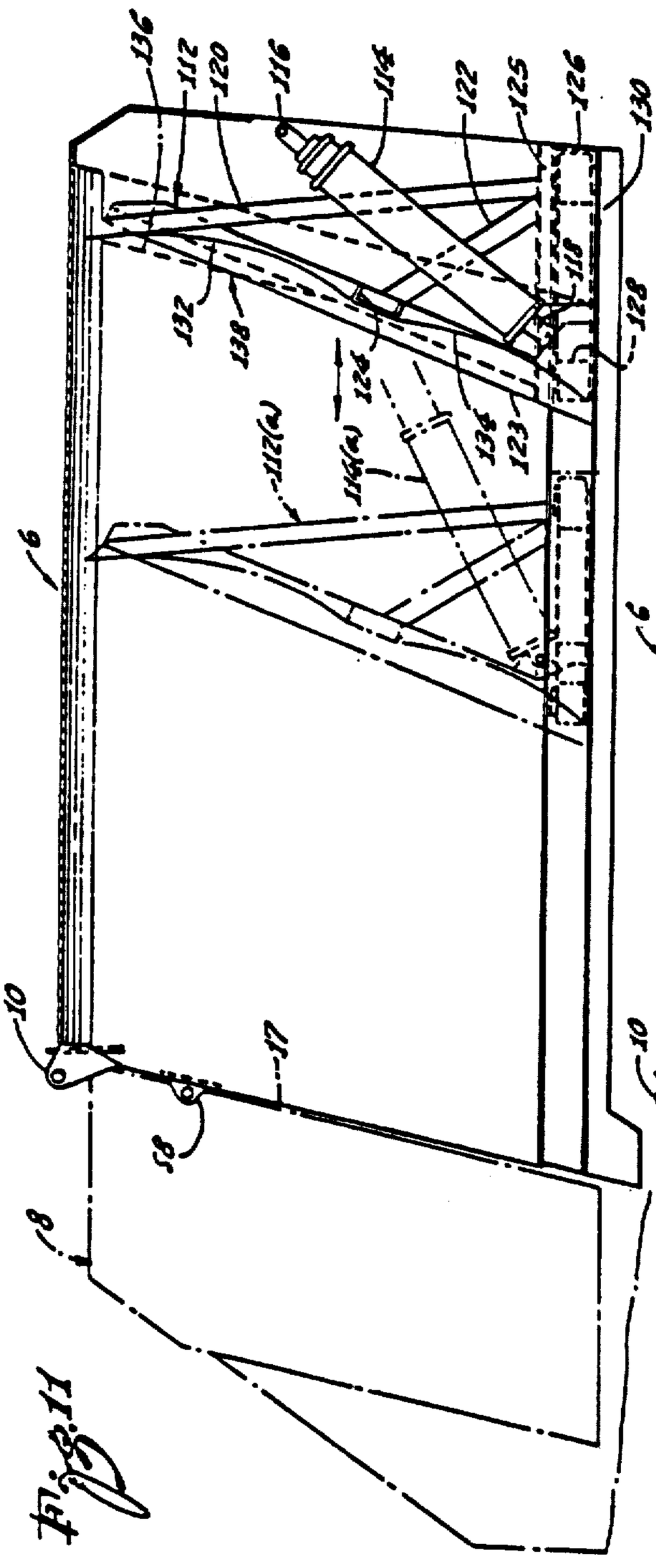

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Fig. 11

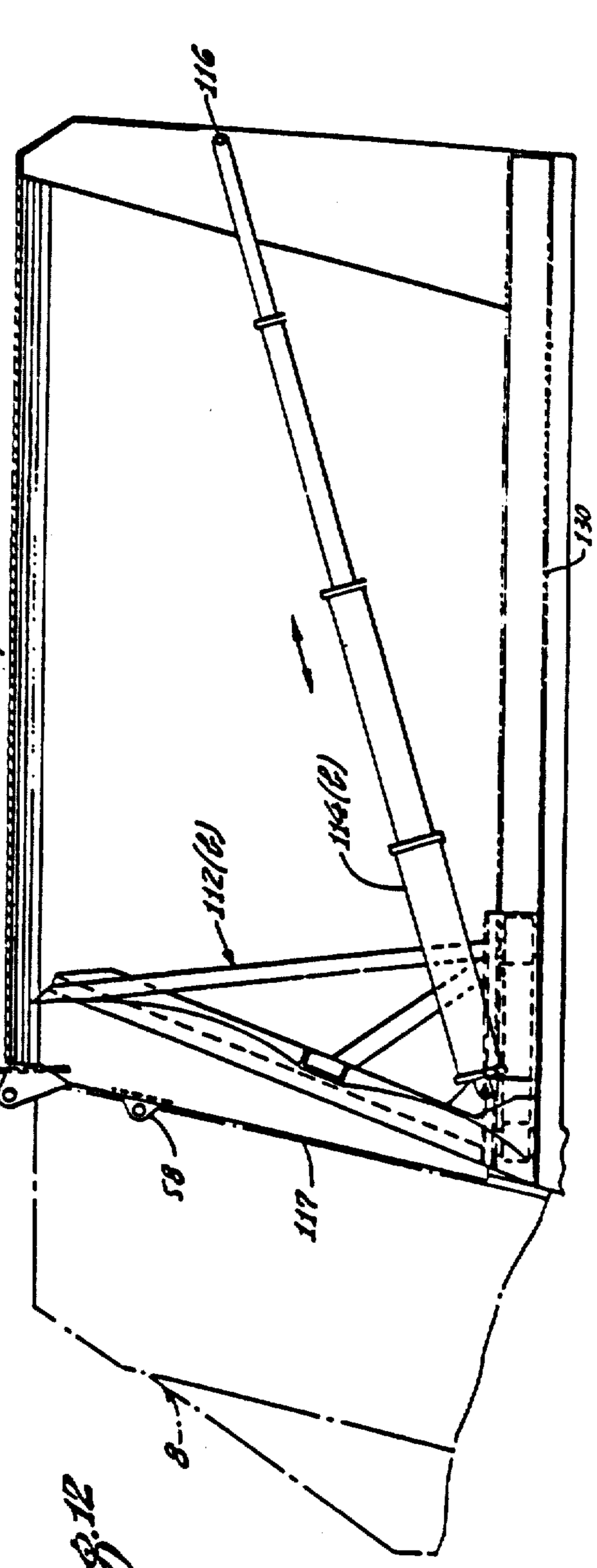
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Fig. 12

Fig. 15

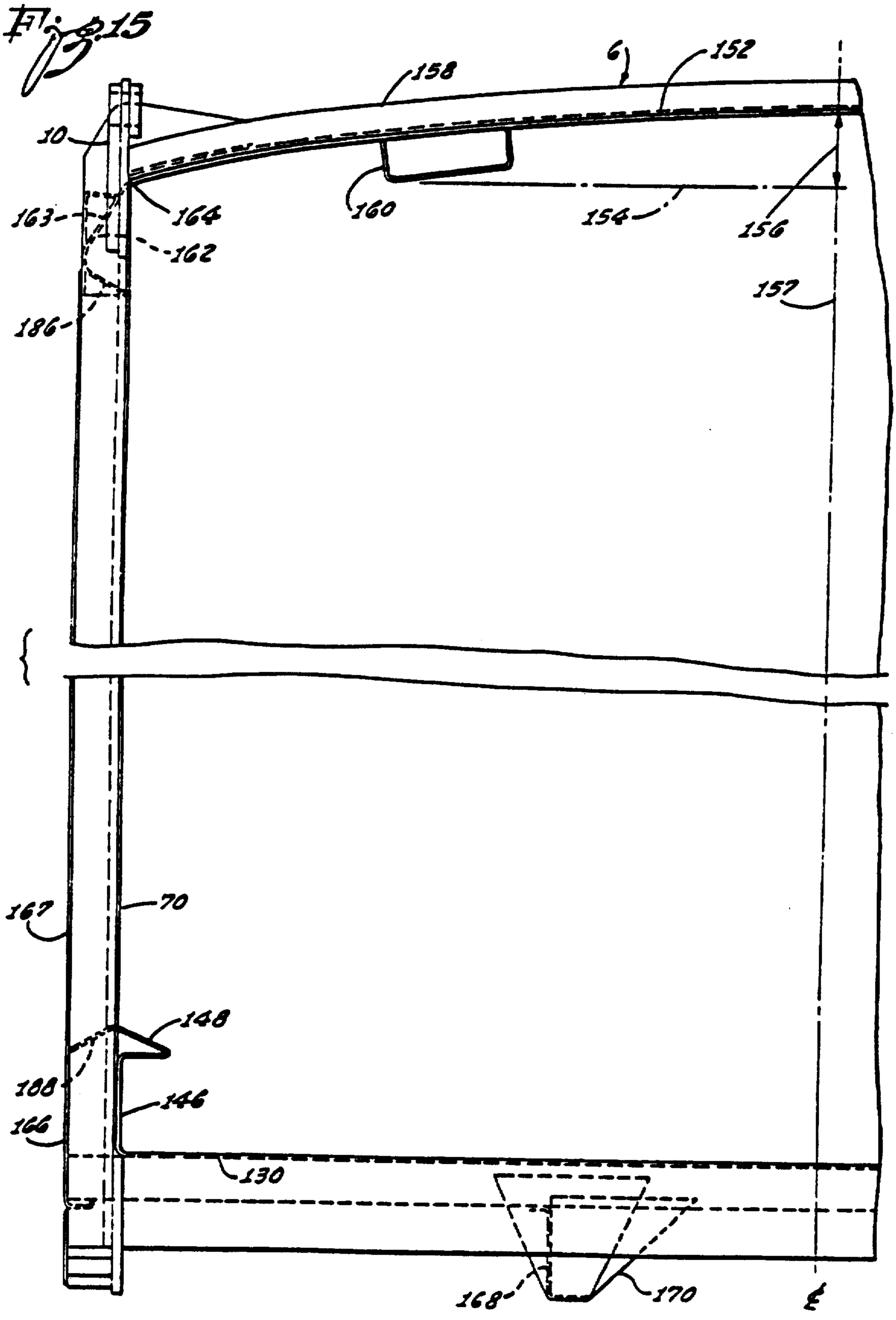
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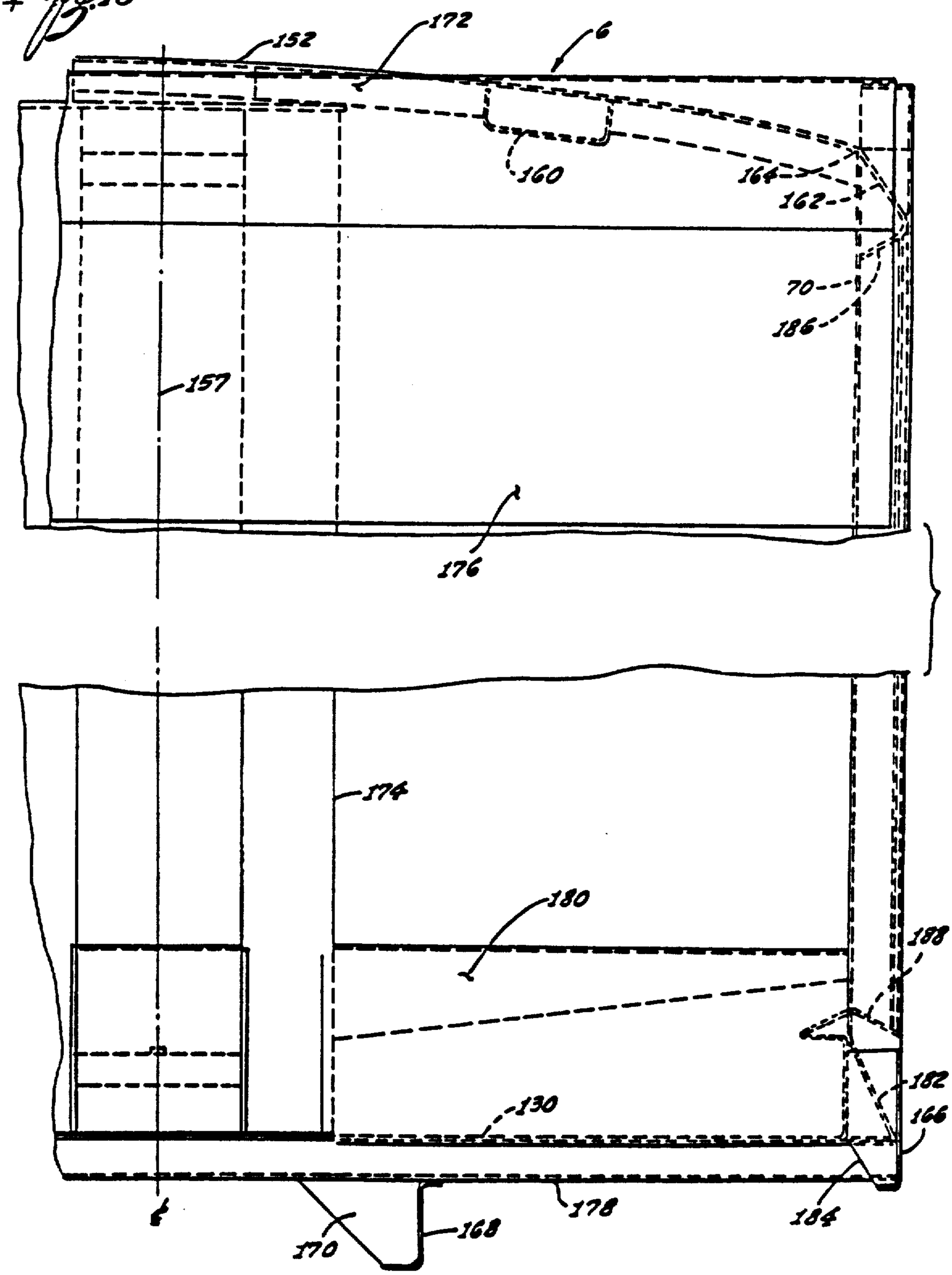
Fig. 16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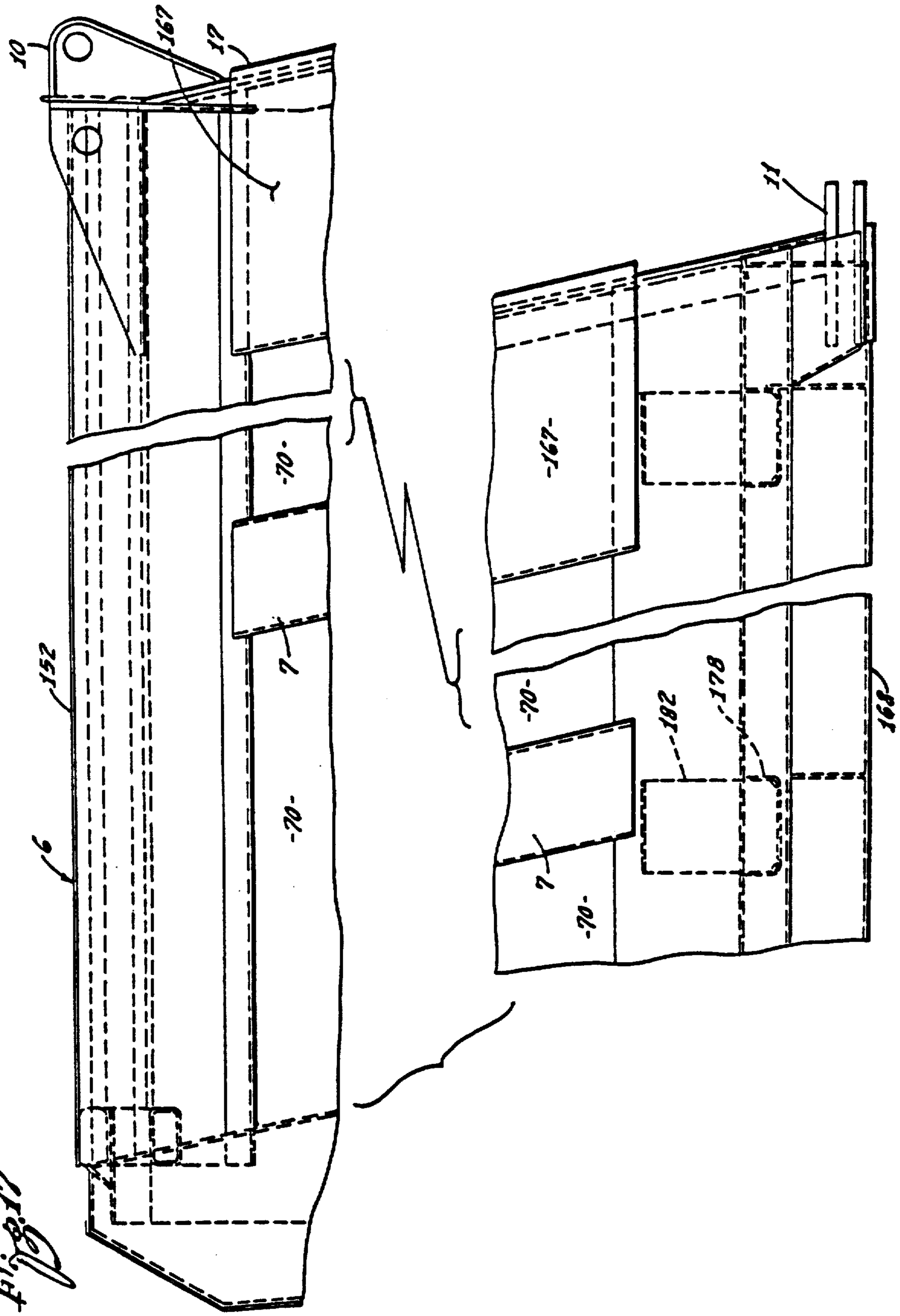

Fig. 17

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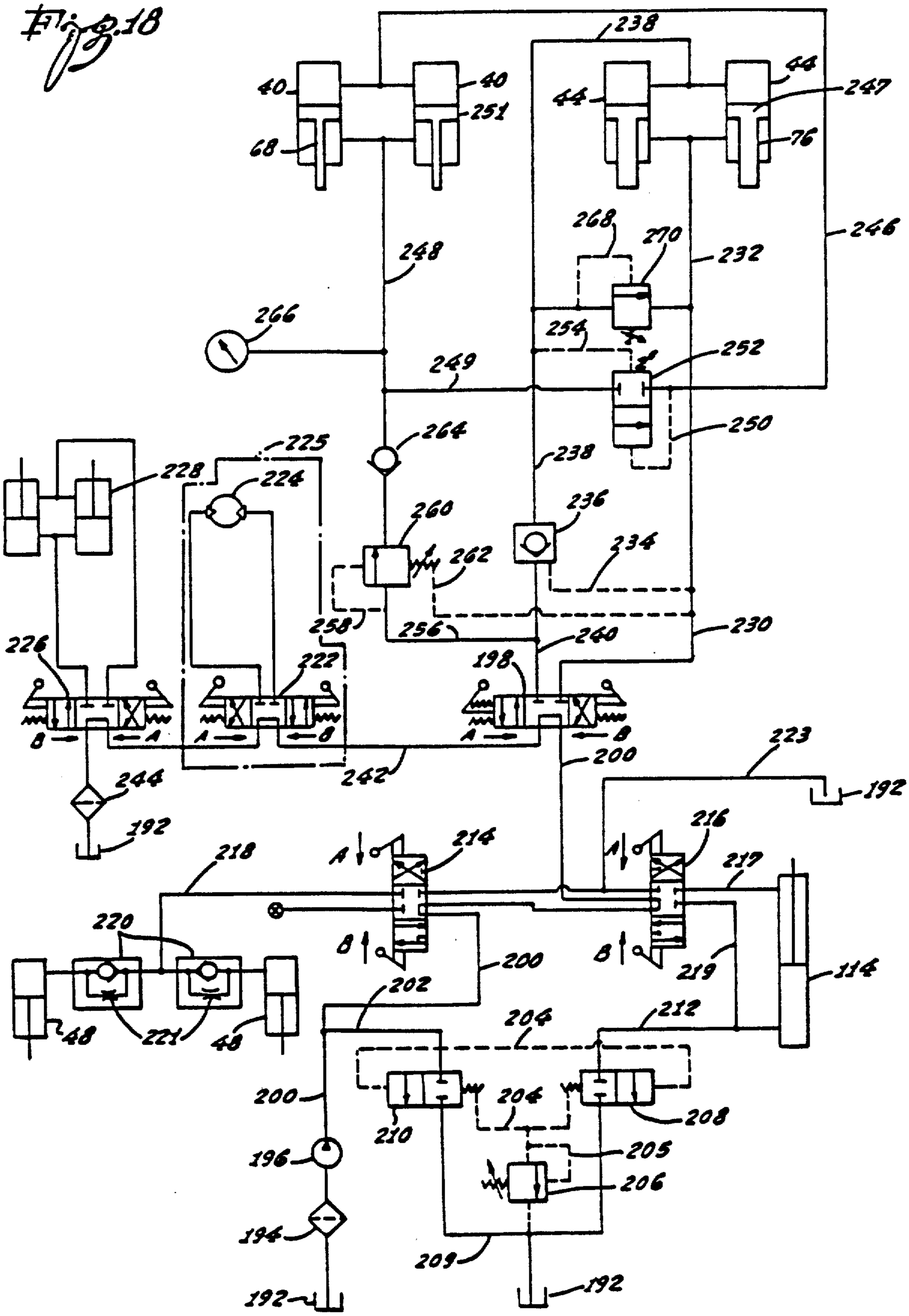
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Fig. 20

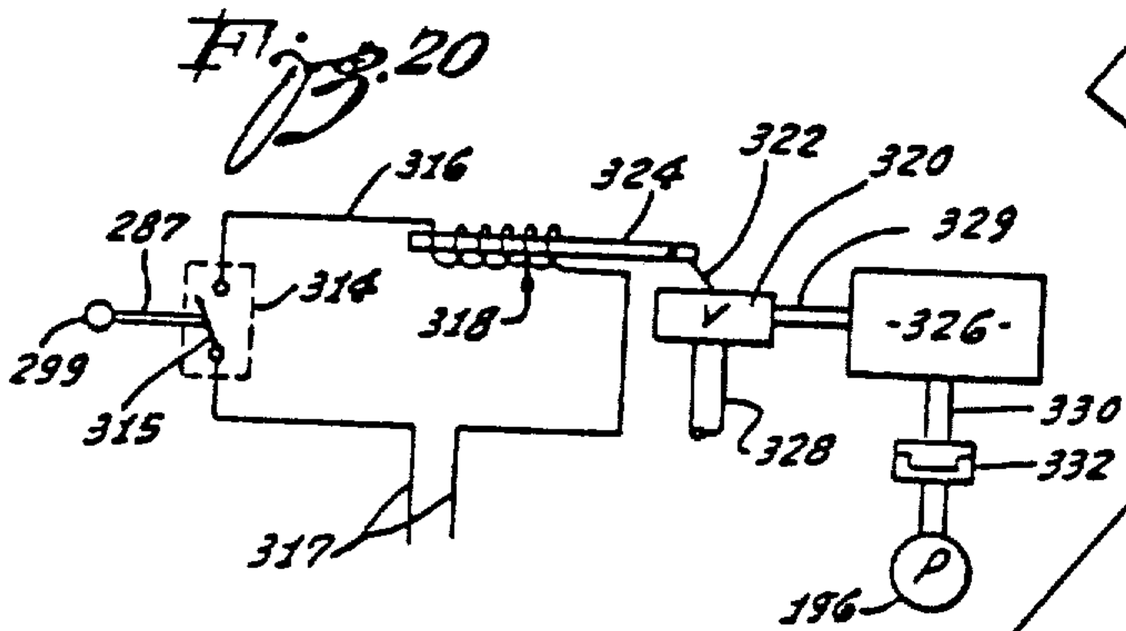
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Fig. 19

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REFUSE COLLECTION APPARATUS

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

BACKGROUND OF THE INVENTION

In collecting refuse, the refuse is generally picked up at individual locations, such as homes, and loaded into a storage body mounted on a truck. When the storage body becomes full, the truck must make a trip to a dumping point to unload the refuse. Depending upon the location of the dumping point, the time required for dumping can be quite substantial. This time is lost time since the refuse collection apparatus performs merely as a truck during its trip to and from the dumping site.

To reduce lost time spent in transporting refuse to the dumping site, modern refuse collection equipment functions by packing the refuse under high pressures within a storage body. The capacity of the refuse collection apparatus is, thereby, increased, and it is able to function by collecting refuse for a longer period of time before having to make a trip to the dump.

In refuse collection equipment presently in use, the storge body is mounted on a truck frame and mounted behind the storage body is a tailgate structure. The tailgate includes a loading hopper and packing means for removing the refuse from the hopper and packing it under high pressure within the storage body. It is common practice to mount a movable ejection panel within the storage body. During the packing operation, refuse is packed against the ejection panel which moves forwardly within the storage body as the packing operation progresses. When the storage body is completely full, the ejection panel has moved all the way forward to a position adjacent the front of the storage body. During the dumping operation, the tailgate structure is pivoted upwardly with respect to the storage body and the refuse is ejected by moving the ejection panel rearwardly to push the refuse out of the storage body.

Present refuse collection apparatus is rather large and unwieldy as a result of several factors. First, the tailgate structure which contains the packing mechanism is relatively long, and extends outward a considerable distance from the back of the storage body. The length of the tailgate structure is dictated, to a large extent, by the shape of the loading hopper defined in the lower portion of the tailgate. Present loading hoppers have a generally uniformly curved bottom which slopes gradually downward from a loading lip at the rear of the hopper to a low point and then gradually upward to an inclined passage which leads into the storge body. A panel is rotated through the hopper with the lower edge of the panel following along the curvature of the hopper bottom. Due to the curved configuration of the hopper bottom to accommodate rotation of the panel, the hopper is relatively long and shallow. Thus, the tailgate structure must also be relatively long which produces a tailgate whose center of mass is positioned a considerable distance rearward of the tailgate supporting structure.

A further factor contributing to a large end unwieldly refuse collection equipment is the movement of the packing means within the tailgate structure. Many refuse collectors which use pivotally interconnected upper and lower panels for packing (see U.S. Pat. No. 3,143,230), employ an upper panel which is reciprocated in a straight-line movement between an upper and forward position and a lower and rearward position. To provide a high horizontal force component to the upper panel, the straight-line path must have a slope which provides substantial horizontal movement to the panel. This, in turn, requires that the tailgate structure be relatively long.

In present refuse collection equipment, the storage body is made from relatively heavy structural members to accommodate the high internal pressures imposed on the body. The high weight of the structural members further contributes to making the refuse collection equipment unwieldly. Added weight in the refuse storage body requires additional weight in the structural members for the truck frame which also increases the weight of the vehicle. As the length and weight of the vehicle are increased, it becomes increasingly more difficult to maneuver in congested areas in picking up refuse.

As stated, modern refuse collection equipment functions by packing refuse under high pressures within a storage body mounted on the frame of a truck. In present equipment, little or no packing is accomplished within the loading hopper. The refuse is merely swept from the hopper by rotation of a panel and packing does not occur until the refuse is moved into the storage body. To accomplish more uniform packing, it would be desirable if some of the packing could take place within the loading hopper.

During the packing operation, the refuse is moved into a storage body and compacted against an ejection panel. As the refuse is compacted, it may be moved in an upward direction against the top of the refuse storage body and impose large stresses on the top of the body. To accommodate these stresses, the top of the refuse body will have to be heavily reinforced and, therefore, heavy.

As the packing continues, the ejection panel moves forwardly within the storage body. The movement of the ejection panel is generally controlled by a telescopic hydraulic cylinder in which the effective hydraulic area within the cylinder varies with its degree of extension. As the ejection panel moves forwardly, the refuse within the body also moves as new refuse is packed into the body. The friction between the refuse within the body and the side walls of the body varies depending on the amount of refuse in the body. Due to the various factors which affect movement of the ejection panel and refuse within the body, it is difficult to obtain uniform compaction of the refuse throughout the storage body. Refuse in one region of the storage body may be very densely compacted while refuse in another region may be less densely compacted. It would be desirable to obtain compaction throughout the body at relatively high and uniform compaction pressures at or near the maximum pressures generated by the packing means since this would permit packing more refuse into a storage body of a given volume.

SUMMARY OF THE INVENTION

In accord with the present invention, I have provided a refuse collector which is capable of using a relatively short and deep loading hopper that is positioned rearwardly of and adjacent to an opening into a storage body. In utilizing such a hopper, an upper panel having a lower panel pivotally connected therewith is moved

in a rearwardly and downwardly convexly curved path between an upward and forward position and a downward and rearward position. The path of movement provided the upper panel has a slope which changes from substantially vertical to substantially horizontal as the panel moves from a rearward lowered position to a forward raised position. This provides a high horizontal force component to the panel during the packing cycle without the use of a long tailgate structure.

The upper extremity of the opening into the storage body may be provided by a fixed panel having an upwardly curved lower surface. During upward movement of the packing panels, refuse is packed against the upwardly curved lower surface of the fixed panel. This provides a forward direction of movement to the refuse which assists its movement into the storage body and against the ejection panel. Further, by providing a forward direction of movement to the refuse, the refuse has less tendency to exert high pressures on the top of the refuse body.

In an embodiment of my invention which utilizes an upper and a lower packing panel which are pivotally interrelated for movement within a tailgate structure, the upper panel preferably has a curved forward surface in close proximity to a rearward surface of a fixed panel defining the upper extremity of the opening into the storage body. During relative movement between the upper panel and the fixed panel, the rearward surface of the fixed panel removes refuse from the curved forward surface of the upper panel.

In providing a rearwardly and downwardly convexly curved path for an upper panel, the panel is preferably tilted as it undergoes movement from a forward raised position to a rearward lowered position and vice versa. As the panel moves downwardly and rearwardly, the lower portion of the panel is tilted rearwardly while the upper portion of the panel is tilted forwardly. The lower panel is pivotally connected to the upper panel at a point adjacent its lower edge. Thus, as the lower portion of the panel is tilted rearwardly, the pivotal points for the lower panel are moved rearwardly to properly position the lower panel for movement with respect to the hopper. As the upper panel moves forwardly and upwardly, the tilting of the lower portion of the upper panel in a forward direction provides a forward movement to the refuse. This assists in moving the refuse through an opening into the storage body and in compacting the refuse against an ejection panel.

In accord with another aspect of my invention, a refuse collection apparatus is provided in which a packing panel having a curved furward packing surface is moved through a hopper. As the packing panel moves through the hopper, the refuse has a greater tendency to roll upwardly onto the surface of the panel due to its curved configuration. The refuse is, thus, more readily removed from the hopper by the panel.

The packing panel may have one or more upstanding ribs positioned on its curved forward surface. The ribs provide a reduced area for application of high localized pressures to refuse contacted by the rib or ribs as the panel moves through the hopper. If more than one rib is employed, the ribs are positioned in spaced relationship and preferably are positioned vertically with respect to the hopper bottom as the packing panel moves through the hopper. Each of the ribs has sloping side walls which are joined together to form a breaking surface. The sloping side walls of adjacent ribs define a packing region which is bounded by the adjacent side walls and

the forward curved surface of the packing panel. Refuse which moves between adjacent ribs into contact with the forward curved surface of the panel is thereby compacted through compression between the side walls of the adjacent ribs.

Preferably, the loading hopper has a vertically inclined forward packing surface. Thus, as the packing panel moves through the hopper, refuse is compacted between the curved packing surface of the panel and the upwardly inclined forward packing surface of the hopper. If the packing panel is rotated to provide movement through the hopper and then lifted to remove refuse from the hopper, the curved packing surface of the panel preferably makes an angle of at least about 90° with the forward packing surface. This reduces the tendency for refuse to jam between the surface of the packing panel and the forward packing surface of the hopper during upward movement of the packing panel.

In another aspect of my invention, the loading hopper is provided with a straight rearward wall portion positioned between a loading lip and the hopper bottom. A packing panel is then provided which has a narrowed lower edge. The narrowed lower edge of the panel is then moved in contiguous relation to the straight rearward wall portion of the hopper as the panel moves into the hopper. Refuse which overhangs the loading lip of the hopper is, thereby, subjected to breaking forces by the narrowed lower edge of the packing panel during its movement into the hopper.

In view of the various aspects of my invention, I am able to provide a refuse collection apparatus having a relatively short and deep hopper which is quite different than hoppers employed in previous refuse collection equipment. Further, I am now able to provide a refuse collection apparatus in which the refuse is broken up and packed to a considerable degree within the loading hopper itself.

As a corollary to my overall invention, I have provided a unique packing panel for use in a refuse collection apparatus in which the panel has a curved surface that is adapted to contact refuse contained in a hopper during movement of the panel through the hopper. The curvature of the panel surface, as it moves through the hopper assists in removing refuse from the hopper which rolls upwardly onto the panel along the curved surface. Also, the packing panel of my invention may provide one or more upstanding ribs on the curved surface of the panel to provide a reduced area for applicaton of high localized pressure to refuse which is contacted by the rib. When a plurality of ribs is employed which are positioned in spaced relation to each other, the side walls of adjacent ribs define a packing region which is bounded by the side walls and the curved surface of the packing panel. The packing panel may also have a narrowed edge which is adapted to provide high breaking pressures to refuse contacted by the edge.

A further corollary to my overall invention involves a unique refuse hopper which is particularly suitable for use in conjunction with the overall apparatus of my invention. The hopper has a lip over which refuse is dumped, a curved bottom portion and a straight wall portion between the lip and the curved bottom portion. Also provided in the hopper is an upwardly inclined structurally reinforced packing surface which is positioned opposite the straight wall portion. Side walls interconnect the bottom with the packing surface and the straight wall portion.

As described, refuse compactors presently in use include a storage body having a movable ejection panel within the body and packing means for compacting refuse within the body against the ejection panel. As refuse is compacted against the ejection panel, there is an incremental movement of the panel in a direction away from the packing means as the body is progressively filled with refuse. In accord with a further aspect of my invention, I have provided a unique means for hydraulically interrelating the movement of the ejection panel and the packing means to provide better compaction of the refuse. A first hydraulic means which controls the movement of the ejection panel is hydraulically interrelated with a second hydraulic means which controls the movement of the packing means. A sump means is provided for receiving hydraulic fluid from both of the first and second hydraulic means and a control means regulates the flow of hydraulic fluid from the first and second hydraulic means to the sump means.

The control means is set to operate at a predetermined pressure of hydraulic fluid in the second hydraulic means which controls movement of the packing means to momentarily dump hydraulic fluid from both the first and second hydraulic means to the sump means. Dumping of fluid ceases when the pressure of the hydraulic fluid in the second hydraulic means is reduced to a fixed level below the predetermined pressure. The predetermined pressure within the second hydraulic means which actuates the control means is generally set at or near the maximum operating pressure of the packing means. As a result, the refuse is packed at or near the maximum packing pressures obtainable throughout the entire loading operation. The incremental movement of the ejection panel away from the packing means during the packing operation is controlled entirely by the predetermined high pressure level within the hydraulic means which controls the movement of the packing means. Thus, the movement of the ejection panel is independent of such variables as the friction of refuse against the walls of the storage container or the effective hydraulic pressure surface within the telescopic cylinder which will vary with its degree of extension.

A further aspect of my invention concerns a hydraulic circuit for operation of an upper packing panel that is movably mounted within a tailgate structure for up-and-down movement with respect to a loading hopper and a lower packing panel mounted for forward and rearward rotation with respect to the hopper. A first hydraulic means is operably connected to the upper packer panel to provide up-and-down movement of the panel while a second hydraulic means is operably connected to the lower packer panel to provide forward and rearward rotation of the lower panel. The second hydraulic means provides a relatively quick rotation of the lower panel in a rearward directiion with relatively low rotational force exerted on the panel and a relatively slow rotation of the lower panel in a forward direction with relatively high rotational force exerted on the panel.

A first feed means is provided to feed hydraulic fluid to the second hydraulic means to rotate the lower panel in a rearward direction and to hold the panel in a rearward position. A second feed means is provided to feed hydraulic fluid to the first hydraulic means while withdrawing hydraulic fluid from the first hydraulic means and combining the withdrawn fluid with the feed fluid to establish a regenerative loop to the first hydraulic means. The use of a regenerative loop provides relatively quick downward movement of the upper panel after which the upper panel is held in a lowered position. A third feed means is provided to feed hydraulic fluid to the second hydraulic means to rotate the lower panel in a forward direction and to hold the lower panel in a forward position. Lastly, a fourth feed means is provided to feed hydraulic fluid at a relatively high pressure to the first hydraulic means to move the upper packing panel in an upward direction to move refuse from the hopper and through an opening into a storage body.

A further aspect of the invention includes the provision of a unique storage body for containing refuse under pressure. The body includes a reinforced bottom, a pair of parallel reinforced side walls, and a top. The top has a uniformly curved configuration and curves upwardly from its juncture with the side walls. The high point in the curvature of the top lies midway between the side walls and the high point has a preselected chordal height. The preselected chordal height of the high point of the top curvature provides a top in which the metal is primarily in tension in resisting the forces exerted on the top by the side walls due to the pressure of refuse within the storage body. Preferably, reinforcing members positioned along the side walls at the line of junction between the side walls and the top have a shape which reduces the abruptness in the changes of the surface at the juncture between the side walls and the top to reduce the stress concentration at the juncture.

In the storage body of the present invention the bottom portion of the storage body is preferably bent upwardly at either side to form side fold portions which are joined to the side walls to form a watertight dam between the bottom and the side walls. If an ejector panel is positioned within the storage body, the side fold portions are preferably bent adjacent their upper ends to form guideways which extend into corresponding grooveways on the sides of the ejector panel.

In the movement of an ejection panel within a storage body in accord with the invention, a hard metal slide plate is preferably attached to the structure supporting the ejection panel in sliding engagement with the metal forming the bottom of the storge body. The bottom of the storage body is formed of a softer metal than the slide plate. Hard refuse materials become imbedded in the metal of the floor in the region of contact of the floor with the slide plate during usage of the apparatus. The hard imbedded refuse materials form a slippery surface on which the slide plate moves.

An ejector panel having particular suitability in the overall apparatus of the present invention has a packing surface formed from a plurality of acruate segments. A brace member is positioned between pairs of arcuate segments and the chordal height of each of the segments is selected to permit the segments to be in tension in resisting packing pressure imposed by refuse. The length of arc of the arcuate segments is selected to reduce the end forces transmitted from the arcuate segments to the brace members which support them.

In accord with my invention, a storage body is utilized for holding refuse under pressure with the storage body having an opening through which refuse is packed. A plurality of parallel side support members are positioned along the side walls of the storage body to resist the side loading exerted by the pressure of refuse within the body. The pressures exerted by the refuse are higher adjacent the opening into the body. Thus, the

side support members are spaced closer together in the region adjacent to the opening of the storage body and are moved further apart in the areas of the side wall which are positioned further away from the opening.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings which are illustrative of an embodiment of my invention:

FIG. **1** is a side elevational view of a truck chassis supporting a storage body with a tailgate structure positioned rearwardly of the storage body;

FIG. **2** is a side elevational view of the tailgate structure with the protective cover removed which shields certain of the movable structural elements;

FIG. **3** is a partial end view of the tailgate structure, as seen from the left side along lines **3—3** in FIG. **2**, with portions broken away or in section to illustrate specific details;

FIG. **4** is a partial side sectional view of the tailgate structure illustrating the upper and lower packing panels in a raised position prior to initiation of the packing cycle;

FIG. **5** is a partial side sectional view, similar to FIG. **4**, showing the rotation of the lower packing panel in a rearward direction with respect to the upper packing panel in the first step of the packing cycle;

FIG. **6** is a partial side sectional view, similar to FIG. **5**, illustrating the next movement in the packing cycle in which the upper packing panel is moved from a forward and upward position to a lowered and rearward position;

FIG. **7** is a partial side sectional view, similar to FIG. **6**, illustrating the next movement in the packing cycle in which the lower packing panel hyas moved forwardly through the loading hopper while the upper packing panel has been held in a lowered position;

FIG. **8** is a front elevational view of a lower packing panel;

FIG. **9** is a sectional view through the packing panel of FIG. **8** along the lines **9—9**;

FIG. **10** is a sectional view through a rib portion of the packing panel of FIG. **8** along the lines **10—10**;

FIG. **11** is a side elevational view of a storage body, partly in section, to illustrate movement of the ejection panel within the storage body;

FIG. **12** is a partial section side elevational view, similar to FIG. **11**, illustrating the movement of the ejection panel within the storage body;

FIG. **13** is a rear elevational view of a refuse storage body with the tailgate section removed to show the ejection panel during unloading of the storage body;

FIG. **14** is a detailed sectional view of the structure indicated by the arrow **14—14** in FIG. **13** illustrating the structure for guiding and slidably positioning the ejection panel within the storage body;

FIG. **15** is a partial end elevation of the storage body as viewed from the tailgate end with the tailgate removed;

FIG. **16** is a partial end elevation of the storage body as viewed from the end adjacent the cab;

FIG. **17** is a partial side elevational view of the storage body;

FIG. **18** is a schematic drawing illustrating the hydraulic circuitry employed in actuation of the packing panels, the ejector panel, and auxiliary equipment, and

FIG. **19** is a partial side elevational view of the tailgate illustrating the control linkage used in automatically cycling the packing panel through a packing cycle, and

FIG. **20** is a schematic drawing illustrating the electrical circuit for controlling the power input from the truck engine to the pump during the packing cycle.

DETAILED DESCRIPTION

FIG. **1** illustrates a refuse collection apparatus in combination with a wheeled vehicle with the overall combination referred to as a truck **2**. The truck **2** includes a cab **4**, a frame **5** which supports a storage body **6**, and a tailgate **8**. The tailgate **8** is connected to the storage body **6** through a pair of hinges **10** with a lock **11**. On releasing the lock **11**, the tailgate **8** may be pivoted upwardly with respect to the body **6** about the hinges **10**.

A cover plate **13** is mounted on either side of the tailgate structure to cover certain of the mechanism which is positioned exteriorly of its side walls. The cover plates **13** are connected to the tailgate through hinges **15** and may be swung away from the tailgate by rotation about the hinges. The storage body **6** includes a plurality of parallel spaced side braces **7** which are spaced more closely together in the area adjacent to the connection of the body to the tailgate. Moving from the left to right in FIG. **1**, the side braces **7** are positioned increasingly further apart. The rear edge of the body **6** forms a slanting surface **17** which joins a correspondingly slanted surface on the tailgate **8**. The side supports **7** are each parallel to the slanting surface **17**.

FIG. **2** is a side elevational view of the tailgate **8** with the cover plate **13** removed. As shown, a hopper **12** is defined in the lower portion of the tailgate **8**. The hopper **12** has a curved bottom **14**, a vertically inclined forward packing surface **16**, a loading lip **18** and a straight rearward wall portion **20** interconnecting the loading lip with the curved bottom **14**. In the use of the terms "forward" and "rearward", forward refers to a direction toward the cab **4** while rearward refers to a direction toward the tailgate **8**.

Positioned between the side walls **19** of the tailgate **8** are an upper packing panel **22** and a lower packing panel **24**. A pair of lower stub shafts **26** carried at the lower extremity of the upper panel **22** pivotally support the lower packing panel **24** for rotational movement with respect to the upper panel **22**. A pair of lower links **28** are each pivotally connected to a stub shaft **26** at one end while their other ends are pivotally connected to pivots **32** on either side of the tailgate structure supported by pivot brackets **34**. The upper packing panel **22** is also supported by a pair of upper links **30** which are each pivotally connected at one end to an upper stub shaft **36** carried on the upper panel **22**. The other ends of the upper links **30** are connected to pivots **64** supported by the tailgate structure.

A fixed panel **38** is positioned transversely across the tailgate **8** and defines the upper extremity of an opening **66** leading from the tailgate **8** into the storage body **6** when the tailgate and the storage body are connected together. The lower extremity of the opening **66** is defined by the upper end of the packing surface **16** within hopper **12**.

The motive power for the upper packing panel **22** is provided by a pair of hydraulic cylinders **40** which are mounted on either side of the tailgate **8** exteriorly of the side walls. The hydraulic cylinders **40** are each connected at their upper ends to pivots **42** supported by the tailgate **8**. The lower ends of the hydraulic cylinders are

pivotally connected to extensions of the lower stub shafts **26** which extend through curved slots **60** in the side walls **19**.

A pair of hydraulic cylinders **44** are mounted inwardly of the side walls **19** to provide the motive power for the lower packing panel **24**. The upper portions of the cylinders **44** are connected to pivots **45** carried by the upper packing panel **22** while the lower portions of the cylinders **44** are connected to pivots **46** carried by the lower packing panel **24**.

A pair of hydraulic cylinders **48** mounted exteriorly of side walls **19** provides the motive power for raising and lowering the tailgate **8** with respect to the refuse body **6**. The forward ends of the cylinders **48** are connected to pivots **56** carried by pivot brace members **58** attached to the refuse body **6**. The rearward ends of the cylinders **48** are connected to pivots **50** supported by pivot brackets **52** carried by structural members **54** of the tailgate **8**. As illustrated, a portion of the upper panel **22** and portions of the upper links **30** extend through openings (not shown) in the upper surface of the tailgate **8** when the upper panel **22** is positioned as in FIG. **2**.

A pair of pivot openings **62** in the tailgate **8** are engaged by a pin (not shown) in providing hinges **10** (FIG. **1**) between the tailgate **8** and the storage body **6**. On extension of the hydraulic cylinders **48**, the structure is pivoted upwardly about the axis of the pivot opening **62** with respect to the storage body **6**. when the hydraulic cylinders **48** are contracted, the tailgate **8** pivots downwardly about the axis of the pivot openings **62** into engagement with the rearward surface **17** of the storage body **6** as shown in FIG. **1**.

FIG. **3**, which is a partial end view of the tailgate **8**, illustrates the relative positions of the upper links **30**, the lower links **28**, and the hydraulic cylinders **40** and **44**. The stub shaft **26** extends through the side wall **19** and connected to its outer end are a lower link **28** and a piston rod **68** extending from hydraulic cylinder **40**. The cover plate **13** shields the hydraulic cylinder **40** and lower link **28** to prevent contact with these elements during cycling of the packing means.

The upper link **30** is pivotally connected to upper stub shaft **36** which is held between support braces **74** extending from the upper panel **22**. The hydraulic cylinder **44** is pivotally connected to a pivot shaft **45** which is also held between support braces **74**. A piston rod **76** extending from hydraulic cylinder **44** is connected at its lower end to the pivot **46** carried by the lower panel **24**. The upper links **30** and hydraulic cylinders **44** are positioned inwardly from the side wall **19** while the hydraulic cylinders **40** and lower links **28** are positioned outwardly of side wall **19**.

As illustrated in FIG. **3**, the upper links **30**, lower links **28** and the hydraulic cylinders **40** and **44** are each mounted to provide for some lateral movement with respect to their pivotal mountings. This permits the links **30** and **28** and cylinders **40** and **44** to shift laterally under the influence of unbalanced loading on the upper panel **22** or lower panel **24**. The bearing surfaces on the supporting pivotal mountings are woven Teflon fabric bonded with an adhesive to the pivot support shaft which engages the eye connection of the link or hydraulic cylinder. During usage, the Teflon fabric flows into any holes in the pivot support shaft to give a uniform bearing surface. Also, the Teflon provides a low coefficient of friction to permit lateral movement between the eye connection of the link or hydraulic piston and the pivotal support shaft to provide a lateral floating action of the upper panel **22** and lower panel **24** relative to the tailgate **8**. Alternatively, the woven Teflon fabric is bonded with an adhesive to the inner surface of a steel bushing which is pressed into the eye connection of the links or the rod ends of the hydraulic cylinders. The inner surface of the bushing then engages the pivot support shaft with the Teflon providing a low coefficient of friction between the bushing and the shaft.

A gap **33** is provided between the sides of the upper and lower panels **22** and **24**, and the inner surfaces of the tailgate side walls **19**. The side walls **19** are constructed of steel sheets which are both strong and hard such as 165,000 psi sheets having a Brinnell hardness of 360 to 400. The extreme hardness of side walls **19** provides a durable bearing surface against which the relatively large side areas of the upper and lower panels **22** and **24** may rub during lateral movement of the panels to provide a floating action in movement of the panels to relieve unbalanced refuse loadings.

The movement of the upper packing panel **22** and the lower packing panel **24** during cycling is illustrated in FIGS. **4–7** which are each partial side sectional views of the tailgate **8**. The lower panel **24** has been shaded in these Figures to better illustrate its movement. FIG. **4** illustrates the beginning of a packing cycle with the upper panel **22** in a raised forward position and the lower packing panel **24** rotated forwardly with respect to the upper panel **22**. In this position, refuse is held within the storage body **6** by the lower packing panel **24** which extends into the opening **66**. To hold the panels in the position shown in FIG. **4**, hydraulic cylinders **44** are extended while hydraulic cylinders **40** are contracted.

The upper packing panel **22** has a curved forward surface **78** while the fixed panel **38** has a lower edge surface **80** which is in close proximity to the surface **78**. The fixed panel **38** has a curved upwardly extending lower surface **82**. As the upper panel **22** is raised with the [lowere] *lower* panel **24** held in the position shown in FIG. **4**, refuse is packed against the curved lower surface **82**. Due to the curvature of surface **82**, the refuse is given a forward direction of movement. Thus, the curvature of the lower surface **82** is an important factor in insuring even packing of the refuse within the storage body **6**.

A rear opening **86** in the tailgate **8** permits refuse to be dumped into the hopper **12** over the lip **18**. The tailgate **8** has a rear wall **84** which terminates at an inwardly bent portion **88**. The upper extremity of the opening **86** is defined by the bent portion **88** while the lower extremity is defined by the lip **18**.

As shown in FIG. **5**, during the first movement of the packing cycle the lower packing panel **24** is rotated rearwardly as shown by the arrow from position A to position B. During this movement, the lower stub shafts **26** on which the lower panel **24** is pivotally mounted are held in an upward position by the upper panel **22**. Thus, as the lower panel **24** rotates rearwardly, it passes well above refuse contained in the hopper **12**. Since the lower panel **24** does not encounter resistance during its rearward rotation to position B, this movement is relatively quick.

Following rotation of the lower packing panel to position B, the upper packing panel **22** is moved downwardly in a downward and rearward convexly curved path, as illustrated in FIG. **6**. As the upper panel **22** moves downwardly and rearwardly, the hydraulic cyl-

inders **40** are extended. When the lower packing panel **24** moves to position C the panel **24** enters the hopper **12**. The packing panel **24** has a curved packing surface **90** whose lower end terminates in a narrowed edge **92**. Due to the configuration of the lower panel **24** and the movement imparted to it by the movement of the upper packing panel **22**, the edge **92** enters the hopper **12** in a vertical movement during which the edge **92** moves along the straight rearward surface **20** of the hopper **12**.

The movement of the edge **92** as it enters the hopper **12** is an important consideration in the overall function of the apparatus. During the loading of refuse through the opening **86** into the hopper **12**, refuse will frequently overhang the loading lip **18**. Due to the relative movement between the edge **92** and the loading lip **18** as the lower panel **24** enters the hopper, refuse which overhangs the lower lip **12** will encounter the reduced area presented by the edge **92** and be exposed to high pressures which will tend to shear the refuse and break it.

As shown in FIG. **6**, the lower links **28** are longer than the upper links **30**. Thus, as the upper panel **22** moves downwardly and rearwardly, the lower portion of the upper panel **22** is tilted rearwardly. When this occurs, the stub shafts **26** are likewisely moved rearwardly due to the longer lengths of the links **28**. This results in moving the pivot points for the lower panel **24** in a rearward direction to properly position the lower panel **24** with respect to the hopper **12**. During the downward movement of the upper panel **22**, only slight resistance is encountered. Thus, the downward movement of the upper panel **22** is a relatively quick movement. As shown in FIG. **6**, the lower edge surface **80** of the fixed panel **38** is maintained in contiguous relation to the curved forward surface **78** of the upper panel **22** during relative movement between the upper panel **22** and the fixed panel **38**.

The next movement in the packing cycle is illustrated in FIG. **7** which shows the movement of the lower packing panel **24** within the hopper **12**. As illustrated, the lower panel **24** in moving from position C to position D, first moves downwardly into the hopper along the straight rearward wall position **20** of the hopper **12**. After reaching the juncture between the straight wall portion **20** and the curved bottom **14**, the lower packing panel **24** is then pivoted forwardly about the stub shafts **26**. As the panel **24** pivots forwardly through the hopper **12**, the lower edge **92** of the panel **24** moves in close proximity to the curved bottom **14**. During the movement of the lower panel **24** through the hopper **12**, refuse within the hopper is packed between the curved packing surface **90** and the vertically inclined packing surface **16**. Due to the large pressures imposed on the packing surface **16**, it is reinforced by internal bracing members **94**.

The packing which occurs within the hopper **12** between the curved packing surface **90** and the vertically inclined packing surface **16** is quite important to the overall functioning of my apparatus. By obtaining a considerable degree of packing within the hopper **12** itself as the lower packing panel **24** moves through the hopper, the overall packing efficiency of the apparatus is greatly improved. As the lower packing panel **24** moves through the hopper, the curved packing surface **90** provides another important function. Due to the curved configuration of the surface **90**, the refuse within the hopper **12** has a greater tendency to move upwardly along the surface **90**. Thus, the refuse, in addition to being packed within the hopper **12**, is rolled upwardly

along the surface **90** which assists the removal of the refuse from the hopper **12** by the lower panel **24**. The rolling action of the refuse as it moves upwardly on panel **24** also applies an abrasive action to the refuse which tends to break it up into smaller pieces.

When the lower packing panel **24** reaches position D as shown in FIG. **7**, the angle between the curved packing surface **90** and the vertically inclined packing surface **16** is preferably 90° or greater. This tends to prevent refuse from jamming between the curved packing surface **90** and the vertically inclined packing surface **16** during the next movement in the packing cycle. During the movement of the lower packing panel through the hopper **12**, considerable resistance may be encountered. Thus, this movement is a relatively slow one with a high rotational force being exerted on the lower packing panel **24** by the hydraulic cylinders **44**.

The next movement in the packing cycle is also illustrated in FIG. **7** by the arrow lesading from the solid line position of the lower packing panel **24** in position D to the position of the lower packing panel outlined in phantom as position A. When the lower packing panel **24** reaches position A, the position of the upper packing panel **22** and the lower packing panel **24** is as shown in FIG. **4**.

During the movement of the lower packing panel **24** from position D to position A, the lower panel **24** is held in a fixed position by extension of the hydraulic cylinders **44**. With the lower packing panel **24** thus held, the upper packing panel **22** is moved forwardly and upwardly by contraction of the hydraulic cylinders **40**. During this portion of the packing cycle, high resistance is encountered in the upward movement of the upper packing panel **22**. The movement is, therefore, relatively slow with a high upward force being exerted through the hydraulic cylinders **40**. As the lower packing panel **24** is lifted upwardly by the movement of the upper packing panel **22**, the edge **92** of the lower panel **24** follows along the curvature of the vertically inclined packing surface **16**. Thus, during this upward movement, additional packing takes place against the surface **16**.

The lower edge surface **80** follows in close proximity the curved forward surface **78** during relative movement between the upper packing panel **22** and the fixed panel **38**. As a result, refuse is continuously removed from the surface **78** by the lower edge surface **80** during relative movement between the upper panel **22** and the fixed panel **38**.

As the upper packing panel **22** is moved upwardly, refuse supported on the curved packing surface **90** and the curved forward surface **78** is forced against the curved lower surface **82** of the fixed panel **38**. As the refuse is packed against lower surface **82**, it is given a forward movement due to the curvature of the surface **82**. This assists in moving the refuse through the opening **66** into the refuse body **6**.

Further, the path of upward movement of the upper packing panel **22** provides a horizontal force component to the panel which increases as the panel moves upwardly. The lower panel links **28** are longer than the upper links **30**. During upward movement of the panel **22**, this produces a forward tilting of the lower portion of the upper panel **22**. The forward tilting provides an additional forward movement to the refuse and assists in its movement through the opening **66** into the storage body **6**.

When the upper packing panel **22** and the lower packing panel **24** reach the extent of their upper movement to occupy the positions shown in FIG. **4**, the packing cycle is complete. In this position, the lower packing panel **24** effectively closes the opening **66** into the storage body **6** and prevents refuse from rolling out of the storage body and back into the hopper **12**. Also, during the upward movement of the upper panel **22** to the position shown in FIG. **4**, the narrowed edge **92** of the panel **24** is moved into the opening **66** and into contact with the refuse therein. This applies a breaking and wedging force to the refuse through contact between the narrowed edge **92** and the refuse which helps to eliminate fall-out of the refuse through the opening during the packing cycle. The hopper interior including the surfaces **14** and **16** are made from strong, hard steel such as 165,000 psi steel sheets having a Brinnell hardness of 360–400.

Turning to FIG. **8**, there is shown an elevational view of the lower packing panel **24** as it would be viewed from the rear if positioned within the tailgate **8**. The panel **24** includes a pair of stub sleeves **96** which are engaged by the lower stub shafts **26** in rotatably supporting the lower panel **24** with respect to the upper panel **22**. Support plates **98** which project upwardly from the panel **24** each support an apertured boss **100**. The space between adjacent bosses **100** receives the lower end of the piston rod **76** and a pin passing through the openings in the bosses **100** provides the pivot **45** between piston rod **76** and the lower panel **24**.

As shown in FIG. **8**, a plurality of ribs **102** project from the curved packing surface **90** of the panel **24**. Turning to FIG. **9**, which is a sectional view along the lines **9—9** of FIG. **8**, the curved packing surface **90** is supported by a plurality of internal bracing members **104**. The bracing members **104** are positioned substantially normal to the curved surface **90** to provide the surface **90** with the structural rigidity required to withstand the high pressures imposed during the packing operation. The edge **92** is formed of a thickened piece of metal to withstand the high stresses imposed when the lower panel **24** enters the hopper **12**. To provide additional rigidity for the edge **92**, a thickened edge support member **106** is positioned on the back side of the panel **24** in contact with the side surface of the edge member **92**.

A sectional view through one of the ribs **102** is shown in FIG. **10**, which is taken along the lines **10—10** of FIG. **8**. As illustrated, the rib **102** is composed of two side walls **108**. The side walls **108** are joined together along their outer extremities to form a breaking surface **110**. From the breaking surface **110**, the side walls **108** are sloped outwardly to join the curved surface **90**.

In usage, as the panel **24** moves through the hopper **12**, the reduced area presented by the breaking surface **110** provides an area of increased pressure when the surface **110** encounters refuse. The sloping side walls **108** provides packing regions between adjacent ribs **102**. As shown in FIG. **8**, the ribs **102** are parallel to each other and are positioned vertically with respect to the edge **92** of the panel **24**. Due to the slope of the side walls **108**, the distance between the surfaces of adjacent ribs **102** decreases within the distance from the surface **110** to the curved surface **90**. Thus, as refuse moves between the side walls **108** of adjacent ribs **102** into contact with the curved surface **90**, it is compacted due to the convergence of the adjacent side walls **108**. The ribs **102** break up the refuse through application of high localized forces to the refuse and the breaking and compacting action of the ribs **102** serves to hold the refuse on the side walls **108** and the surface **110** since it then has less tendency to spring back to its original shape.

FIGS. **11** and **12** are each partially sectionaed elevational views of the storage body **6** indicating the position of an ejection panel **112** during various phases of the overall packing operation. As shown to the right in FIG. **11**, the ejection panel **112** is connected through a pivot **118** to a telescopic ejection cylinder **114** that is pivotally connected to its forward end to a fixed pivot **116**. The ejection panel **112** includes a pair of vertically positioned supports **120** which are connected to horizontal supports **125** at their bottoms and to side supports **123** at their tops. A cross brace **124** interconnects the side supports **123** at their midpoints. Slide blocks **126** and **128** are connected to the outer surfaces of each of the horizontal support members **125**. The slide blocks **126** and **128** move along the bottom **130** of the storage body **6** in a manner which will be described subsequently

A pair of arcuate panels **132** and **134** are fixedly held between the support members **123** and **124** and provide a pair of surfaces against which refuse is packed during filling of the storage body **6**. The curvature of each of the arcuate panels **132** and **134** is controlled so that the thin metal forming the panels will resist in tension the stresses imposed on the panels by the refuse which is packed against them. With reference to the upper arcuate panel **132**, the chord of the panel is shown at **136**. The point of greatest distance from the chord **136** is at the midpoint of panel **132** and this distance is the chordal height **138** of the panel. The lower arcuate panel **134** has the same chordal height since the two panels **132** and **134** are the same.

The chordal height of each of the panels **132** and **134** is chosen so that the panels will resist in tension the forces imposed on them by refuse which is packed against the panels **132** and **134** during loading of the storage body **6**. In addition, the length of arc of each of the panels **132** and **134** is chosen so that reduced end forces are transferred to the supporting members by the arcuate panels **132** and **134**. If, for example, only a single arcuate panel was employed which had a length of arc approximately twice that of each of the individual panels **132** and **134**, the support members for the panel would have to be made considerably larger to resist the higher end forces transmitted from the panel to the support members. Thus, it is a considerable advantage to utilize a plurality of separate arcuate panels in forming the ejection panel **112**.

During loading of the storage body **6**, the ejection panel **112** moves forwardly from a position adjacent the rearward edge **17** of the storage body to a position adjacent the forward end of the storage body. The position of the ejection panel **112** in its forward position is shown in solid line drawing in FIG. **11** and the position of the ejection panel **112** in an intermediate position is shown at **112**(a) in which the ejection cylinder is shown as partially expanded at **114**(a).

The position of the ejection panel **112** in its rearward position is shown at **112**(b) in FIG. **12**. As shown, the ejection cylinder **114** is then completely extended to the position illustrated at **114**(b). With the ejection panel **112** in the position shown in FIG. **12**, the storage body **6** is essentially empty.

The ejection panel occupies the position shown at **112**(b) during the initial stages of the overall packing

operation. As the packing pregresses, the ejection panel **112** moves forwardly in short incremental movements until it reaches the position shown in solid line drawing in FIG. **11** when the storage body is completely full. In loading the storage body **6**, the tailgate **8** is pivoted upwardly about the hinge **10** between the tailgate **8** and the storage body **6**, as described previously. The ejection cylinder **114** is then expanded to the position shown at **114**(b) and the ejection panel **112** moves to position **112**(b) to push the refuse from the storage body **6**.

Turning to FIG. **13**, which is a view of the rear of the storage body with the tailgate removed, the ejection panel **112** is shown in its rearward position adjacent the opening into the storage body **6**. As shown, the supports **123** are in close proximity to the side walls on either side of the storage body and the ejection panel **112** moves on the slide blocks along the floor of the storage body **6**.

FIG. **14** is a detailed view taken along the arrows **14—14** in FIG. **13**. As shown, the slide block **126** is supported on a slide plate **142** which engages the floor **130**. Slide plates **142** positioned between each of the slide blocks **126** and **128** and the floor **130** are made of a hard metal which is harder than the metal of the floor **130**. In usage, hard refuse materials within the storage body **6** become imbedded in the floor **130** in the areas over which the slide plates **142** move during movement of the ejection panel **112**. As refuse materials become imbedded in the floor **130**, a slippery surface is formed in these areas which facilitates the sliding movement of the slide blocks **142**.

The floor **130** is bent up at either side to form side fold portions **146** which engage and are joined to the side walls of the storage body **6** in a manner to be described subsequently. Gaps **144** between the edge of the blocks **126** and the inner surfaces of the side fold portions **146** permits some movement of the blocks **126** from side to side to prevent binding of the blocks as they slide relative to the bottom **130**. The side fold portions **146** are bent inwardly adjacent their upper ends to form guideways **148**. The guideways **148** slide in grooves **150** in the sides of the ejection panel **112** and bear against the upper surface of block **126** to guide the movement of the ejection panel **112** and to prevent its tipping within the storage body **6**.

In FIG. **15**, which is an end elevational view of the storage body **6** as viewed from the rear, the storage body **6** includes a uniformly curved top **152** supported by a top support brace **158**. The top **152** is joined to side walls **70** which are, in turn, joined to the bottom **130**. The upper point on the curved top **152** is at the center line **157** of the body **6**. The distance at the upper point, as measured from the chord **154** of the top **152** is the chordal height **156**. The curvature of the top **152**, as determined by the chordal height **156**, is chosen so that the thin metal forming the top **152** resists in tension the side forces imposed on the top **152** by the side walls **70** during maximum loading of the storage body **6**. This permits the use of thin material in forming the top **152** which does not require a reinforcing rib structure, which reduces the overall weight of the storage body **6**.

The top **152** is connected to the side walls **70** along either side at a juncture line **164**. A conduit channel **160** which runs longitudinally along the storage body **6** is affixed to the under surface of the top **152**. The conduit channel **160** carries hydraulic lines and shields them from the extreme pressures within the storage body **6**.

Angle braces **162** are positioned along either side of the storage body **6** to provide strength along the juncture lines **164**. The angle braces **162** have a configuration which reduces the sharp change in contour at the juncture lines **164** between the top **152** and the side walls **70**. As shown, the upper leg **163** of the angle brace **162** slopes rather gradually with respect to the contour of the top **152** where it intersects the side walls **70**. This reduces the stress concentration along the juncture lines **164**. The top **152** and side walls **70** are constructed of relatively strong steel sheets such as 50,000 psi sheet material.

Turning to the lower portion of FIG. **15**, the bottom **130** is bent upwardly at either side to form side fold portions **146** which are bent adjacent their upper edge to form guideways **148**. The side fold portions **146** are fixedly connected to the side walls **70** to form a watertight interior dam between the side walls **70** and the bottom **130**.

Fenders **166** extend down either side of the refuse body to provide structural support in the region adjacent the connection between the side walls **70** and the bottom **130**. The fenders **166** have upper legs **188** which are bent inwardly to join the outer surfaces of the side walls **70**. Side braces **167** are positioned vertically along either side of the refuse body **6** to provide structural rigidity. The side braces **167** are cut at an angle at their bottom ends to fit against the sloping top fender leg **188** and are cut at an angle at their top ends to fit against a sloping bottom angle leg **186**. A floor support brace **168** runs longitudinally beneath the storage body **6** on either side of the center line **157**. The floor support braces **168** are joined to gusset plates **170** which are positioned at intervals along the length of the braces **168** in a manner to be described.

In FIG. **16**, which is an end view of the storage body **6** as seen from the front, the top **152** is supported at its forward end by a support member **172** which runs between the side walls **70**. The support member **172** is broken on either side of the conduit channel **160** and a pair of vertical supports **174** extend between the bottom **130** and the top support member **172** to provide vertical rigidity. An end plate **176** partially covers the ejection cylinder **114** and the ejection panel **112** and provides additional cross stability for the storage body **6**. An additional end plate **180** is positioned between the side wall **70** and the vertical supports **174** and interconnects the side walls **70**, the vertical supports **174**, and the bottom **130**.

A plurality of cross channel members **178** are positioned transversely to the longitudinal axis of the storage body **6** between the floor support braces **168** and the floor **130**. The gusset plates **170** are positioned on the floor support braces **168** to support the cross channels **178** where they cross over the floor support braces **168**.

Support braces **182** are positioned diagonally between the inner surface of the fenders **166** and the side walls **70** at preselected locations along the sides of the storage body as will be described. Closure plates **184** are connected to the fender ends.

Turning to FIG. **17**, which is a partial side elevational view of the storage body **6** and the supporting frame, the rear edge **17** of the storage body **6** is slanted outwardly from its top to its bottom. The side brace members **167** positioned adjacent the rear edge **17** are slanted at the same angle as the rear edge **17**. Moving forwardly along the side of the storage body **6**, a plurality of side braces **7** (see FIG. **1**) are positioned along the side walls **70** of the storage body **6**. Each of the side brace members **7** is also slanted at the same angle as the rear edge

17 with the distance between the side braces 7 being progressively increased in moving from the rear edge 17 toward the front of the storage body 6. Cross channels 178 are positioned transversely at the location of each side brace 7 and also at the location of the side braces 167 adjacent the rear of the storage body 6. Each of the cross channels 178 supports the bottom 130 of the storage body 6 and the cross channels 178 are in turn, supported by the floor support members 168 running longitudinally of the storage body 6.

In supporting the cross channels 178 (see FIG. 16), gusset plates 170 are tied to the floor support brace 168 at the locations where the cross channels 178 pass over the supports 168. Support plates 182 fit within the cross channels 178 and are positioned diagonally to tie into the side walls 70. The support plates 182 provide additional support for the side braces 7 and the side braces 167. The side braces 7 are connected at their upper ends to the angle braces 162 which run along either side of the storage body 6 adjacent the juncture 164 between the top 152 and the side wall 70. The bottom ends of the side braces 7 are connected to the fenders 166 which run along the side walls 70 adjacent the connection between the side walls 70 and the bottom 130. The upper ends of the side braces 7 are cut at an angle to join the bottom leg 186 of the angle brace 162 while the bottom ends of the side braces 7 are cut at an angle to join the top leg 188 of the fender 166. FIGS. 15 and 16 illustrate the position of the angle braces 162 and the fenders 166 which tie into the side braces 7. By positioning the side braces 7 at an angle, such as 13° from the vertical, the braces 7 support a larger area of the side walls 70 against side loading. The storage body 6 is both strong and yet relatively light as compared with storage bodies employed in previous refuse collection apparatus. This permits a reduction in the overall weight of the present apparatus with the result that is is easier to use, for example, on the streets of residential neighborhoods.

The hydraulic circuitry which I employ in operation of my apparatus is illustrated schematically in FIG. 18. Hydraulic fluid is drawn from a sump 192 through a strainer 194 by a pump 196. A number of sumps 192 are shown for purposes of convenience in illustration. However, it should be understood that the sump 192 is generally a single container which supplies oil for the operation of the hydraulic circuitry and also receives oil which is returned from the hydraulic circuitry.

Leading from the pump 196 is an input line 200 which is joined to a branch line 202 inward from the pump 196. The branch line 202 leads to a valve 210. The ejection cylinder 114 is connected by a line 212 to a valve 208 and both valves 208 and 210 lead to the sump 192. In operation, the valves 208 and 210 are controlled by a relief valve 206. The relief valve functions in response to the pressure in pilot lines 204 which pass through the valves 208 and 210 to the relief valve 206. When the pressure in the pilot lines 204, which is the pressure in the input line 200, reaches a predetermined value, the relief valve 206 is opened by the pressure acting through a control line 205. This causes the valves 208 and 210 to open and hydraulic fluid in line 200 then passes through line 202 and valve 210 to a line 209 to the sump 192. At the same time, hydraulic fluid from the ejection cylinder 114 passes through line 212 and valve 208 to line 209 and the sump 192.

Preferably, the pressure which actuates the relief valve 206 is set at or very close to the maximum operating pressure for the hydraulic system. When the pressure then drops to a fixed lower pressure, the relief valve 206 automatically closes. As hydraulic fluid is withdrawn from the ejection cylinder 114 to the sump 192, the hydraulic cylinder 114 shortens an incremental distance to cause an incremental movement of the ejection panel 112. The movement of the ejection panel 112 is illustrated in FIGS. 11 and 12 showing the incremental forward movement of panel 112 as the storage body 6 is progressively packed with refuse under high pressure.

The setting of the relief valve 206 to open at a pressure which is at or near the maximum operating pressure of the hydraulic system insures that the system operates constantly at pressures which are close to the maximum operating pressure. When this pressure is exceeded during packing, the pressure drops momentarily as hydraulic fluid is withdrawn from both the ejection cylinder 114 and the main input line 200. However, since the relief valve 206 is not open for a long period of time, the pressure in the hydraulic system does not drop very far from its maximum operating pressure as the packing operation proceeds. Thus, each packing cycle is conducted under a high and relatively constant packing pressure near the maximum system pressure in uniformly compacting refuse within the storage body 6.

The main input line 200, after leaving the pump 196, passes to a main control valve 198. To begin the packing operation, as illustrated earlier with regard to FIGS. 4–7, the main control valve 198 is moved from its neutral position shown in FIG. 18 in the direction of the arrow denoted A. When this occurs, hydraulic fluid is then fed through lines 230 and 232 to the undersides of a pair of pistons 247 in hydraulic cylinders 44. Piston rods 76 attached to the undersides of pistons 247 are relatively large in diameter to provide a small area on the undersides of pistons 247 which is contacted by hydraulic fluid. This provides a quick upward movement of the pistons 247 to produce a quick rearward rotation of the lower packing panel 24 to the position shown in FIG. 5.

A pilot line 234 leads to a pilot operated check valve 236. The check valve 236 is set to open at a relatively low pressure in line 230 to permit the flow of fluid in cylinders 44 through a line 238 and valve 236 to a line 240. Hydraulic fluid is, thus, withdrawn from the upper sides of pistons 247 and fed through valve 198, line 242, a strainer 244, to the sump 192.

After contraction of the hydraulic cylinders 44 with the valve 198 remaining in the direction of the arrow A, hydraulic fluid is fed through a line 246 to the upper sides of the pistons 251 within hydraulic cylinders 40. As hydraulic fluid is fed to cylinders 40 through line 246, fluid is withdrawn from the undersides of the pistons 251 through line 248. This fluid passes through a line 249 to a valve 252. The valve 252, which is normally in a closed position, is opened by the pressure in a pilot line 250 which reflects the pressure in the line 246. Pilot fluid passing through valve 252 exits from the valve through a return line 254. Valve 252 is set to open at a higher pressure than the valve 236. Thus, valve 252 will not normally be open during the contraction of the hydraulic cylinders 44.

The hydraulic fluid passing from line 249 through valve 252 joins the fluid being fed to the hydraulic cylinders 40 through line 246. Thus, there is established a regenerative loop to cylinders 40 which includes lines 248 and 249, valve 252 and line 246. By establishing a regenertive loop for the hydraulic cylinders 40, the

effective area on the upper surfaces of pistons **251** acted upon by hydraulic fluid is equal to the diameter of the piston rods **68** attached to the undersides of the pistons **251**. Since this area is relatively small, the extension of the cylinders **40** and the downward movement of the piston rods **68** is relatively quick to provide a quick downward movement of the upper packing panel **22** as illustrated in FIG. **6**.

After extension of the hydraulic cylinders **40**, the valve **198** is moved to its opposite position in the direction of the arrow B. Hydraulic fluid entering through the valve **198** is then fed through line **240**, check valve **236** and line **238** to the upper sides of the pistons **247**. Since the entire upper surface of the pistons is being pressurized, the movement of the pistons **247** is relatively slow. As the pistons **247** move downwardly with considerable force, hydraulic fluid is withdrawn from the undersides of the pistons **247** through lines **232** and **230** and passes through the valve **198** and line **242** to the sump **192**. During downward movement of the piston **247**, the lower packing panel **24** is rotated forwardly through the hopper **12** as illustrated in FIG. **7**. The resistance to movement of the lower packing panel **24** may be relatively high as it passes through the hopper **12** to compact refuse between its curved packing surface **90** and the vertically inclined forward packing surface **16** of the hopper. Thus, the movement of the panel **24** is relatively slow and a high rotational force is exerted on the panel **24** by the extension of the hydraulic cylinders **44**.

After the cylinders **44** have been extended and with the valve **198** held in the direction of the arrow B, hydraulic fluid is then fed from line **240** into a line **256**. The flow of hydraulic fluid through line **256** is impeded by a valve **260** which is normally in a closed position. When the pressure of fluid in line **256** builds up to a predetermined high level that is slightly less than the pressure which opens the relief valve **206**, the pressure is transmitted through a pilot line **258** to open the valve **260**. The pilot fluid flowing through valve **260** is withdrawn through a pilot return line **262**.

On opening of the valve **260**, hydraulic fluid under relatively high pressure is fed through a check valve **264** and line **248** to the underside of pistons **251**. This causes the hydraulic cylinders **40** to contract. During contraction, hydraulic fluid is withdrawn from the upper sides of the pistons **251** through line **246** and passes through line **230** and valve **198** to the sump **192**. The contraction of the cylinders **40** is a relatively slow movement during which great force is applied to the upper packing panel **22** in its upward movement as illustrated in FIG. **7**.

During upward movement of the upper panel **22** and contraction of the hydraulic cylinders **40**, the lower packing panel **24** is held in the position illustrated in FIG. **7** by the extension of the hydraulic cylinders **44**. Since the valves controlling the flow of fluid from cylinders **44** through line **238** are closed during this period, the pressure can build up within the hydraulic cylinders **44** due to the forces exerted by refuse against the curved packing surface **90** of the lower panel **24**. These forces are transmitted to the hydraulic fluid in the cylinders **44** through the piston rods **76** connected to the lower panel **24**. To prevent rupture of the hydraulic cylinders **44** as a result of these static pressures, a pilot operated relief valve **270** is provided which operates through the pressure in a pilot line **268** that transmits the pressures within the hydraulic cylinders **44**. The relief valve **270** may be set to open, for example, at a pressure of 2,500–3,000 psi, or any other suitable pressure, depending upon the design of the hydraulic cylinders **44**. On opening of the relief valve **270**, hydraulic fluid passes through the valve to reduce the pressures in the cylinders **44**. This fluid is carried through line **230** and valve **198** to the sump **192**.

An auxiliary gauge **266** may be connected to line **248** to indicate the pressure in the hydraulic cylinders **40** during their contraction in raising the upper packing panel **22**. By noting these pressures, the efficiency of the packing operation can be determined.

After contraction of the hydraulic cylinders **40** to raise the panel **22** to its upper position, the valve **198** is returned to its neutral position as shown in FIG. **18**. When this occurs, one packing cycle has been completed.

As shown in FIG. **18**, various auxiliary equipment may be actuated by the hydraulic pressures generated by the pump **196**. During actuation of the auxiliary hydraulic equipment, the valve **198** is in its neutral position. A valve **214** is utilized to operate the hydraulic cylinders **48** for raising and lowering of the tailgate **8** with respect to the storage body **6**. When the valve **214** is moved from its neutral position in the direction of the arrow A, hydraulic fluid is fed through line **218** and valves **220** to the upper sides of the cylinders. This causes raising of the tailgate **8**. During lowering of the tailgate, the valve **214** is moved to its opposite side in the direction of the arrow B. Hydraulic fluid then flows around the valves **220** through constricted bypasses **221** and is transmitted to the sump **192** through a line **223**. After lowering of the tailgate **8**, the valve **214** is returned to its neutral position.

A valve **216** is used to either expand or contract the ejection cylinder **114**. When the valve **216** is moved in the direction of the arrow A, the hydraulic cylinder is contracted by feeding hydraulic fluid through a line **217** while withdrawing fluid to the sump **192** through a line **219**. When the valve **216** is moved in the direction of arrow B, the cylinder **114** is expanded by feeding fluid through line **219** and withdrawing fluid to sump **192** through line **217**.

A valve **222** is used to operate a winch **224**. By moving valve **222** in the direction of arrow B, the winch is rotated in one direction, for example, to lift heavy containers to dump their contents into the hopper **12**. By moving the valve **222** in the direction of the arrow A, the winch **224** may be rotated in the opposite direction, eg., to lower the container after its contents have been dumped.

A pair of auxiliary hydraulic cylinders **228** may be operated by movement of a valve **226**. On movement of the valve **226** in the direction of the arrow A, the hydraulic cylinders **228** may be expanded while on movement of the valve in the direction B, the cylinders **228** may be contracted. Auxiliary hydraylic cylinders such as **228** may be utilized for example, to operate a fork lift device positioned at the rear of the tailgate **8** to lift heavy containers. As indicated at **225**, the winch **224** and valve **222** may be supplied as a unit which is plumbed into the overall hydraulic circuit by connecting valve **222** into line **242**.

In the movement of the upper panel **22** and the lower panel **24** through a complete packing cycle, as described in FIGS. **4–7** and **18**, it is necessary to move the valve **198** in the direction of arrow A to begin the cycle. The valve **198** remains in this position during the first half of

the cycle when the lower panel **24** is rotated rearwardly and the upper panel **22** is moved downwardly and rearwardly. For the next half of the packing cycle, it is necessary to move the valve **198** in the direction of the arrow B in FIG. **18**. The valve **198** remains in this position as the lower packing panel **24** is moved through the hopper **12** and the upper packing panel **22** is raised to its upward position. When the upper packing panel **22** reaches its upward position, it is then necessary to return the valve **198** to its neutral position to terminate the packing cycle.

It is desirable that the necessary movements of the valve **198** during the packing cycle be carried out automatically. This may be accomplished by the mechanism shown in FIG. **19** which is a view of an outer side of the tailgate with the cover plate **13** removed. To begin the packing cycle, a handle **272** is pulled outwardly away from the side wall **19** and then pushed forwardly over a stop **273**. The handle **272** is pivotally mounted at **274** and, thereby, imparts a counterclockwise movement to an arm **276** connected to the handle. The arm **276** is pivotally connected at **280** to a rod **278** and imparts a downward movement to the rod. With downward movement of the rod **278**, a force is transmitted at right angles through a joint **286** connected to a bell crank or other suitable mechanism, not shown, to move the valve **198** in the direction of the arrow A. This begins the packing cycle, as previously described.

As rod **278** moves downwardly, a force is transmitted through an arm **282** that it pivotally connected to the rod **278** at **284**. The arm **282** is pivotally mounted at **284** in line with a second arm **288**. Movement of the arm **282** in a counterclockwise direction causes a corresponding counterclockwise movement of the arm **288** which, acting through a spring **292**, causes counterclockwise rotation of an arm **294** about a pivotal mounting **296**. As the arm **294** moves, a rod **298** pivotally connected to arm **294** at **295** is moved upwardly. The lower end of rod **298** is pivotally connected at **300** to an arm **302** which is pivotally mounted at **304**. Thus, as the arm **298** is pulled upwardly, the arm **304** is rotated upwardly. Counterclockwise rotation of the arm **282** on downward movement of the rod **278** also causes counterclockwise rotation of an arm **290** which relieves the tension in a spring **310**. This permits counterclockwise rotation of an arm **306** which is pivotally mounted on a support **308**.

At the beginning of the packing cycle, the upper packing panel **22** is in a raised position as shown in FIG. **4** and a stub shaft **26** extends through a slot or opening **60** in a side wall **19** of the tailgate **8**. With the upper panel **22** in a raised position, the stub shaft **26** is positioned near the top of the slot **60**. The stub shaft **26** is shown in this position in FIG. **19**.

After beginning the packing cycle by moving the arm **272** forward and moving the valve **198** in the direction of arrow A, the upper panel **22** is lowered which causes the stub shaft **26** to move downwardly within the slot **60** and to strike the arm **302**, causing it rotate in a counterclockwise direction. On rotation of the arm **302**, the rod **298** is pulled downwardly. This places the spring **292** in tension, causes arm **282** to rotate in a clockwise direction, and causes an upward movement of rod **278**. The upward movement of rod **278** is transmitted at right angles through a bell crank or other suitable means to the valve **198**, thereby causing it to move in the direction of the arrow B for the last half of the packing cycle.

During the last half of the packing cycle, the upper packing panel **22** is moved upwardly which causes the stub shaft **26** to again move upwardly in the slot **60**. When the upward movement of the panel **22** is essentially complete, the stub shaft **26** strikes the arm **306** and causes it to rotate in a counterclockwise direction. As arm **306** rotates, it acts through the spring **310**, arm **290** and arm **282** to cause a downward movement of the rod **278**. The downward movement of rod **278** causes the valve **198** to return to its neutral position. The position of the rod **278** and handle **272** with valve **198** in a neutral position is as shown in FIG. **19**.

An adjusting screw **312** may be used to vary the tension in the spring **310**. Also, if desired, adjusting means may be utilized with the other spring **292** to adjust its tension.

An actuator **283** positioned on the rod **278** selectively engages a switch arm **287** during movement of the rod **278**. The actuator **283** includes enlarged ends **285** and **293** separated by a valley **291** and a roller **299** is mounted on the end of the arm **287**. When the valve **198** is in its neutral position, the roller **299** lies in the valley **291** and the switch is open. As the rod **278** moves downwardly to shift valve **198** in the direction of the arrow A, the roller **299** moves into contact with the enlarged end **285** to move switch arm **287** and close the switch. With the switch closed, an electrical signal is sent through conventional circuitry to a solenoid on the truck engine which increases the fuel to the engine to provide additional power for operation of the pump **196** that is driven by the truck engine.

At the end of the first half of the packing cycle, the rod **278** is moved upwardly to move valve **198** in the direction of the arrow B. As this occurs, the roller **299** moves into contact with enlarged end **293** which maintains the switch in a closed position to provide additional fuel to the truck engine during the last half of the packing cycle. When the rod **278** is again moved downwardly at the end of the packing cycle to return valve **198** to its neutral position, the roller **299** moves into contact with the valley **291** to open the switch and to cut off the supply of additional fuel to the truck engine. A mounting plate **305**, which supports a portion of the actuating linkage, is affixed to the side of the tailgate **8** to properly position the actuating linkage on the tailgate **8**. As described, the various functions of the packing mechanism for my apparatus are controllable by movement of a single rod **278**. This provides a greater ease of control than in previous refuse loading equipment which required the movement of several handles in cycling of the packing mechanism.

The manner in which the power to the pump **196** may be varied during the packing cycle is illustrated in FIG. **20**. Movement of the switch arm **287** and roller **299** by the position of rod **278**, as described previously, controls the opening and closing of a switch **314**. When the roller **299** engages the enlargements **285** or **293**, the arm **287** moves a throw **315** of switch **314** to a closed position and when the roller **299** engages the valley **291** (see FIG. **19**), the throw **315** is in an open position as shown in FIG. **20**. With the throw **315** in a closed position, electricity from input lines **317** flows through switch **314** and through a conductor **316** to a solenoid **318** having a push rod **324**. Passage of current through the coil of solenoid **318** causes the push rod **324** to move a valve lever **322** which controls a valve **320**. The valve **320** regulates the flow of fuel from a fuel input line **328** into a valve output line **329** to an engine **326**. The engine

s operatively connected through a drive **330** to the pump **196** and clutch means **332** may be provided for disengaging or engaging the drive **330** to transmit power from engine **326** to the pump **196**. With clutch means **332** engaged, movement of valve lever **322** by push rod **324** increases the supply of fuel to the engine **126** which causes an increase in the power supplied to pump **196**. Thus, when the valve **198** (FIG. **18**) is in the position of either arrow A or arrow B during the packing cycle, the roller **299** is in engagement with enlargements **285** or **293** and switch **314** is closed to supply additional fuel to engine **326**. This provides additional power to pump **196** to provide power for operation of the packing mechanism.

The presence of a bulky piece of refuse within the hopper **12** may, under some circumstances, cause the packing mechanism to jam during a packing cycle. Jams do not occur often; however, to protect the packing mechanism, it is necessary that the apparatus be equipped to handle jams.

If a jam occurs when the lower packing panel **24** has been rotated rearwardly and the upper panel **22** is moving downwardly and rearwardly, the jam can be alleviated by pulling the handle **272** rearwardly and thereby moving the valve **198** to position B. When this is done, the lower panel **24** beings its forward rotation through contraction of the hydraulic cylinders **44** to eliminate the jam. When the handle **272** is pulled rearwardly the rod **278** moves downwardly from its position shown in FIG. **19** which expands the spring **292** and places it in tension without rotation of the arm **302**. Thus, when the jam has been cleared and the handle **272** is released, the spring **292** pulls the arm **288** downwardly which pushes rod **278** upwardly and returns valve **198** in the direction of the arrow A. The upper panel **22** then proceeds to again move downwardly with the lower panel in a partially rotated forward position. When the upper panel **22** reaches its lowered position, the stub shaft **26** engages arm **302** to rotate it in a counterclockwise direction and to thereby move rod **278** upwardly and to move valve **198** in the direction of arrow B. With valve **198** in the direction of arrow B, the lower panel **24** completes its forward rotation and the upper panel **22** then moves forwardly and upwardly during the last half of the packing cycle.

In clearing a jam which occurs during downward movement of the upper panel **22**, the handle **272** may be moved back and forth, as desired, in moving valve **198** in the direction of arrow B, then in the direction of arrow A, etc. until the jam is cleared.

This will result in switching from the first half of the packing cycle to the second half of the packing cycle and back again, etc. in moving the upper panel **22** and lower panel **24** to clear the jam.

A further situation where jams can occur is during the forward rotation of the lower panel **24** in moving through the hopper **12** when the valve **198** is shifted in the direction of arrow B. With reference to FIG. **18**, if the lower panel **24** encounters an obstruction, this causes a pressure buildup in lines **240**, **238** and **256**. When the pressure in line **256** builds up to a sufficient extent to open the valve **260**, the hydraulic cylinders **40** begin to contract which raises the upper panel **22**. When panel **22** has raised to a sufficient extent for the lower panel **24** to pass over the object causing the jam, the pressure in line **238** then causes the cylinders **44** to complete their expansion and the lower panel **24** to complete its forward rotation. As the pressure in line **240** is thus transmitted to cylinders **44**, there is a drop in the pressure in line **256** which causes valve **260** to close and the movement of cylinders **40** to cease. When the cylinders **44** have completed their expansion, pressure is then transmitted through line **256** and valve **260** to complete the contraction of cylinders **40** and the raising of the upper packing panel **22**.

If desired, the valve **198** can be moved in the direction of arrow A in relieving a jam occurring during forward rotation of the lower panel **24**. This would cause rearward rotation of the lower panel **24** with the lower panel **24** then rotating forwardly when the valve **198** is again moved in the direction of arrow B. Normally, as explained above, it is not necessary to move the valve **198** in relieving a jam which occurs during forward rotation of panel **24**. Relief of the jam normally occurs through raising of the panel **22** which occurs automatically due to pressure buildup in line **256**.

In a third situation where jams can occur, the upper panel **22** is moving forwardly and upwardly during the last half of the packing cycle while the lower panel **24** is held in a forwardly-rotated position as shown in FIG. **7**. With the lower panel **24** thus held in a fixed position, the valve **236** (FIG. **18**) is closed and hydraulic fluid within cylinders **44** is trapped within the volume on the upper surfaces of the pistons **247**. The pressure of the hydraulic fluid within cylinders **44** during this situation is determined by the forces transmitted to the fluid by the piston rods **76** due to the pressure of refuse bearing against the lower panel **24**. To prevent the rupture of cylinders **44** when a jam occurs during raising of the upper panel **22**, the relief valve **270** is set to open at a predetermined pressure. This permits hydraulic fluid to drain through the relief valve **270** to the sump **192** which results in a partial rearward rotation of the lower panel **24**. The rearward rotation of panel **24** permits the panels **22** and **24** to be raised while clearing the object which is causing the jam.

As described, my apparatus provides a greatly improved means of packing refuse. The terms "convex" or "convexly" used in describing the movement of the upper panel **22** are not used in a precise geometrical sense Rather the terms are used to describe the slope of the path of movement which becomes more horizontal during raising of the panel. This provides a high horizontal force component to the panel toward the end of the packing cycle when the packing resistance is highest without the use of a relatively long tailgate structure. The movement of the upper and lower panels **22** and **24** provided by the upper and lower links **30** and **28** permits a lateral floating action to alleviate the affects of unbalanced loading on the panels. This is a considerable improvement over previous refuse loading equipment in which movement of the panels along a fixed, inflexible path was largely controlled by the shape of grooved or slotted guideways in the tailgate structure that received rollers carried by the panels with the rollers following along the guideways duirng movement of the panels.

I claim:

1. In a refuse collector including a storage body[,] and a tailgate structure providing a [relatively short] loading hopper having a bottom surface continuous through an arc symmetrical about a substantially vertical radius with the hopper positioned rearwardly of and adjacent to an opening into said storage body;

apparatus for moving refuse from said hopper into said body comprising:

an upper panel extending across the width of said hopper and movably mounted above and longitudinally of said hopper for movement as a unit in the longitudinal and vertical directions relative to said hopper;

mounting means operatively coupled to said tailgate structure and said upper panel in a particular relationship for providing a movement of the upper panel as a unit in a rearwardly and downwardly convexly curved path from an upward and forward position to a lowered and rearward position;

a lower panel having an upper edge pivotally connected to the lower edge of said upper panel;

pivotal mounting means operatively coupled to the lower panel for providing a rotary motion of the lower panel about the pivotal connection between the lower and upper panels as a fulcrum through a continuous arc symmetrical about a substantially vertical radius; and

means to actuate said upper and lower panels in the sequence of rotating said lower panel rearwardly, through the continuous arc symmetrical about the substantially vertical radius, with said upper panel positioned in the upward and forward position, moving said upper panel as a unit in a rearwardly and downwardly convexly curved path to the lowered and rearward position, rotating said lower panel forwardly, through the continuous arc symmetrical about the substantially vertical radius, with respect to said upper panel with the lower edge of said lower panel in close proximity to the bottom curved surface of said hopper *in a scooping movement forwardly of the vertical radius* and with the upper panel in the lowered and rearward position, and moving said upper panel in a forwardly and upwardly curved path to move refuse through said opening into said truck body.

2. The apparatus of claim 1 including

a fixed panel defining the upper extremity of said opening, the fixed panel being attached to the tailgate structure;

said fixed panel having an upwardly curved lower surface and being disposed relative to said lower panel to impart a forward direction of movement to refuse moved upwardly against said lower surface during the movement of said lower panel in a forwardly and upwardly curved path with the upper panel.

3. The apparatus of claim 1 wherein

said mounting means for the upper panel is attached to the tailgate structure and to the upper panel in a relationship to provide tilting of the lower portion of said upper panel in a rearward direction as said panel is moved downwardly and rearwardly relative to the storage body and to provide a tilting of the lower portion of said upper panel in a forward direction as said panel is moved upwardly and forwardly,

whereby the tilting of the lower portion of said upper panel in a forward direction provides a forward movement to refuse moving through said opening during the upward movement of said panel.

[4. In a refuse collector including

a storage body and a tailgate structure providing a loading hopper positioned rearwardly of and adjacent to an opening into said storage body, the hopper having a bottom surface continuous through an arc symmetrical about a substantially vertical axis;

apparatus for moving refuse from said hopper into said body comprising:

an upper panel mounted in said tailgate for forward and rearward movement as a unit relative to the storage body in a curved path relative to the tailgate structure;

first means operatively coupled to the upper panel and the tailgate structure for producing a controlled movement of the upper panel as a unit forwardly and upwardly or rearwardly and downwardly in the curved path relative to the tailgate structure;

a packing panel swingably mounted on the lower portion of said upper panel;

pivotal means operatively coupled to the packing panel and the tailgate structure for producing a swinging motion of the packing panel relative to the upper panel through the continuous arc defined by the bottom surface of the hopper;

said packing panel having a curved forward surface which contacts refuse in said hopper when said packing panel is swung forwardly with respect to said upper panel and a lower edge which moves in close proximity to the curved bottom surface of said hopper when said packing panel is swung forwardly with respect to said hopper to remove refuse from the curved bottom surface of said hopper; and

means operatively coupled to said first and pivotal means for producing in sequence a rearward swinging of the packing panel, through the continuous arc symmetrical with the substantially vertical axis, with the upper panel retained stationary, a downward and rearward movement of the upper panel, a forward swinging of the packing panel, through the continuous arc symmetrical with the substantially vertical axis, with the upper panel retained stationary and an upward and forward movement of the upper panel;

whereby refuse within said hopper rolls upwardly onto the curved forward surface of said packing panel as said panel is swung forwardly through said hopper.]

[5. The apparatus of claim 4 including

an upstanding rib on the curved forward surface of said packing panel;

said rib providing a reduced area for application of high localized pressures to refuse contacted by said rib as the packing panel swings forwardly through said hopper; and

said first means including links pivotable relative to the hopper and operatively coupled at one end to the hopper and operatively coupled at the other end to the upper panel.]

6. In a refuse collector including a storage body and a tailgate structure positioned rearwardly of and adjacent to an opening into said storage body,

apparatus comprising:

a hopper defined by the lower portion of said tailgate structure;

said hopper having a curved bottom surface and a forward packing surface extending substantially vertically from the curved bottom surface;

an upper packing panel mounted in said tailgate structure for movement between a forward raised position and a rearward lowered position;

a lower packing panel swingably mounted on a lower portion of said upper panel;

said lower packing panel having a lower edge which moves in close proximity to said bottom when said packing panel is swung forwardly;

means operatively coupled to the tailgate structure and to the upper packing panel for producing a movement of the upper packing panel between the forward raised position and the rearward lowered position and a *swinging* movement of the lower packing panel *relative to the upper panel* in close proximity to the vertically inclined forward packing surface for compression of the refuse during such *swinging* movement of the lower packing panel;

means operatively coupled to the lower packing panel and the tailgate structure for producing [a] *such* swinging movement of the lower packing panel relative to the upper packing panel and the hopper; and

means to move said upper packing panel and said lower packing panel in the sequence of swinging said lower packing panel rearwardly while said upper packing panel is in a raised position, moving said upper packing panel to a lowered and rearward position, swinging said lower packing panel forwardly to pack refuse in said hopper against said forward packing surface, and moving said upper packing panel to a raised and forward position with said lower edge of said lower packing panel in contiguous relation to said forward packing surface of said hopper.

7. The apparatus of claim 6 including

a rearward lip on said hopper, said lip defining the bottom of an opening into said hopper;

a rearward wall portion in said hopper between said lip and said curved bottom surface and extending substantially vertically from the curved bottom surface of said hopper to the rearward lip[;] and

guide means included in the [first mounting] *moving* means *for the upper panel* for controlling the movement of said upper packing panel between its raised and lowered positions through a path to provide for the movement of the lower packing panel [through a path to provide for the movement of the lower packing panel] in close proximity to the rearward wall portion and the forward wall portion of the hopper.

8. The apparatus of claim 7 including

a narrowed lower edge on said lower packing panel; and

said [guide] means *for moving the upper panel* being constructed and disposed to provide for the movement of said narrowed lower edge of said lower packing panel in close proximity to said rearward wall portion during *the* movement of said upper panel to a lowered position,

whereby refuse overhanging said lip is subjected to breaking force by said narrowed lower edge during the downward movement of said upper packing panel, and

the [guide] means *for moving the upper panel* including links connected at one end to the hopper and at an opposite end to the upper packing panel.

9. The apparatus of claim 6 wherein

said forward packing surface is curved upwardly and progressively forwardly from a vertical position adjacent to the curved bottom surface to terminate

at its upper extremity at the opening into said storage body and the first mounting means are constructed to provide for an upward movement of the upper packing panel with the lower panel in close proximity to the upwardly and forwardly curved configuration of the forward packing surface.

10. In a refuse collector including

a storage body having an opening at its rear end and further including a tailgate structure positioned rearwardly of and adjacent to the opening into said storage body;

apparatus including:

a hopper defined by the lower portion of said tailgate structure;

said hopper including a bottom curved surface defining a continuous arc of a circle with opposite ends of the arc at substantially the same vertical level and further including a forward packing surface extending upwardly from said bottom curved surface and having a vertical direction adjacent the bottom curved surface and having an upwardly and forwardly curved direction at progressive positions removed from the bottom curved surface;

packing means movably mounted in said tailgate structure including an upper packing panel and a lower packing panel pivotally mounted to the lower portion of the upper packing panel;

first means operatively coupled to the upper packing panel for moving said upper packing panel upwardly and forwardly in contiguous relationship to said forward packing surface;

a fixed panel defining the upper portion of said opening;

said fixed panel having an upwardly directed lower surface to pack refuse during the upward movement of the packing panel and to direct said packed refuse into said storage body through the opening in said storage body;

pivotal means operatively coupled to said lower packing panel to swing said lower packing panel *relative to the upper packing panel in a scooping movement* through said hopper in contiguous relationship to said bottom continuous arcuate surface to pack refuse against said forward packing surface, and

means to provide substantially for the operation of said pivotal means and then said first means.

[11. In a refuse collector,

a storage body having an opening at its rear end,

a loading hopper positioned rearwardly of and adjacent to the opening in said body and having a vertically disposed forward wall adjacent to the opening in the storage body,

an upper packing panel mounted above and longitudinally of said hopper for upward and downward movement with respect to said hopper,

a lower packing panel pivotally connected near its upper end to the upper packing panel at a position near the lower end of the upper packing panel for forward and rearward rotation with respect to said hopper and for upward and downward movement with the upper packing panel;

first mounting means including a first hydraulic means operably connected to said upper packing panel and to said storage body to provide upward and downward movement of said upper and lower panels and to provide movement of said lower packing panel along the vertically disposed for-

ward wall of the hopper during the upward movement of the upper and lower panels;

second mounting means including a second hydraulic means operably connected to said storage body and said lower packing panel at a position removed from the connection between the upper and lower panels to provide forward and rearward rotations of said lower panel;

said second hydraulic means being constructed to provide a relatively quick rotation of said lower panel in a rearward direction with a relatively low rotational force exerted on said panel and a relatively slow rotation of said lower panel in a forward direction with a relatively high rotational force exerted on said panel;

means including a first feed means to feed hydraulic fluid to said second hydraulic means to rotate said lower panel in a rearward direction and to hold said panel in a rearward position;

means including a second feed means to feed hydraulic fluid to said first hydraulic means while withdrawing hydraulic fluid from said first hydraulic means and combining the withdrawn fluid with the fluid feed to provide a regenerative loop to said first hydraulic means to thereby cause a relatively quick downward movement of said upper panel and to hold said upper panel in a lowered position;

means including a third feed means to feed hydraulic fluid to said second hydraulic means to rotate said lower panel in a forward direction and to hold said lower panel in a forward position, and

means including a fourth feed means to feed hydraulic fluid at a relatively high pressure to said first hydraulic means to move said upper packing panel in an upward direction to move refuse through said opening into said body.]

[12. The apparatus of claim 11 wherein

said second hydraulic means comprises a hydraulic cylinder, a piston slidable within said cylinder and a large diameter piston rod affixed to the underside of said piston and pivotally connected at its outer end to said lower packing panel, with hydraulic fluid being fed to the underside of said piston when said lower panel is rotated rearwardly and to the upper side of said piston when said lower panel is rotated forwardly.]

[13. The apparatus of claim 11 wherein

said first hydraulic means comprises a hydraulic cylinder, a piston slidable within said cylinder, and a piston rod affixed to the underside of said piston and pivotally connected at its outer end to said upper packing panel, with hydraulic fluid being fed to the upper side of said piston in combination with fluid withdrawn from the lower side of said cyilnder to provide a regenerative feed loop to said cylinder during the downward movement of said upper packing panel.]

[14. The apparatus of claim 10 including a safety valve interconnecting said third feed means and said first feed means;

a sump;

said first feed means connected with said sump when said fourth feed means is operative to feed hydraulic fluid to move said upper packing panel in an upward direction; and

said safety valve set to open in response to a predetermined pressure in said third feed means to dump fluid from said third feed means to said sump through said first feed means.]

[15. The apparatus of claim 11 wherein

said fourth feed means includes a valve set to open at a predetermined high pressure;

said valve blocking the flow of hydraulic fluid to said first hydraulic means at pressures below said predetermined high pressure and permitting the flow of hydraulic fluid to said first hydraulic means through said fourth feed means at pressures equal to or higher than said predetermined high pressure.]

[16. The apparatus of claim 11 including

the hopper having a vertically disposed rear wall and the first and second mounting means and the upper and lower packing panels being constructed to provide movement of the lower packing panel along the vertically disposed rear wall of the hopper during the downward movement of the upper and lower panels;

a sump;

a valve interconnecting said first, second, third and fourth feed means in the sequence of connecting said third feed means to said sump when said first feed means is connected to a pressure source and the valve interconnecting said second and fourth feed means to form a regenerative loop to said first hydraulic means with said second hydraulic means connected to a pressure source to feed fluid to said first hydraulic means while fluid is being withdrawn from said first hydraulic means and combined with the feed fluid in said second hydraulic means

and the valve connecting said third feed means to a pressure source when said first feed means is connected to said sump, and

the valve connecting said fourth feed means to a pressure source when said second feed means is connected to said sump.]

[17. In a refuse collector,

a storage body for storing the refuse;

hopper means for holding the refuse, the hopper means having an interior rear wall and an interior front wall defining the bottom of an opening through which refuse is moved into the hopper means, the interior rear wall of the hopper means extending downwardly in a substantially vertical direction from the position defining the bottom of the opening in the hopper means and the interior front wall of the hopper means extending upwardly in a substantially vertical direction from the position defining the bottom of the opening in the hopper means to provide a surface for compression of the refuse against the surface and the hopper means having an opening at the forward end for transferring refuse from the hopper means into the storage body,

packer panel means movable downwardly along the rear wall of the hopper means in contiguous relationship to the rear wall from the bottom of the opening to shear any refuse overhanging the rear wall and to move into the hopper refuse deposited into the hopper and movable forwardly against the hopper means to compress the refuse against the forward wall of the hopper means and movable upwardly along the front wall of the hopper means in a substantially vertical direction to move the

refuse into the storage body through the opening in the hopper means,

reinforcing means disposed on the packer panel means at the end of the packer panel means for facilitating the shearing of the refuse overhanging the rear wall, and

control means operatively coupled to the packer panel means for producing the downward movement of the packer panel means along the rear wall of the hopper means with a force to facilitate the shearing of the refuse overhanging the rear wall of the hopper and for producing the forward movement of the packer panel means against the front wall of the hopper means with a force to compress the refuse and for producing the upward movement of the packer panel means along the front wall of the hopper means with a force to facilitate the movement of the refuse into the storage body through the opening in the hopper means.]

[18. In a refuse collector as set forth in claim 17,

a tailgate defined in part by the hopper means and extending above the front walls in the hopper means, the storage body being positioned forwardly of the hopper means with the tailgate being pivotable relative to the storage body, and

means operatively coupled to the tailgate for pivoting the tailgate relative to the storage body.]

[19. In a refuse collector as set forth in claim 17,

means disposed at the tip of the packer panel means for reinforcing the tip of the packer panel means,

the hopper having an opening at its forward end to receive refuse inserted into the hopper, and

the control means being operative to move the packer panel means past the opening in the rear wall of the hopper to provide for the shearing of the refuse by the tip of the packer panel means and the insertion of the sheared refuse into the hopper.]

20. In a refuse collector,

a storage body having an opening at its rear end,

a tailgate structure providing a refuse hopper having [a relatively short length and] a curved bottom surface defining a continuous arc symmetrical about a substantially vertical radius and having essentially a vertical wall defining the forward end of the refuse hopper to provide for a compression of refuse against the essentially vertical wall defining the forward end of the hopper, the hopper being positioned rearwardly of and adjacent to the opening into the storage body; and

apparatus for moving refuse from the hopper into the body, the apparatus comprising;

an upper panel movably mounted on the tailgate structure above the hopper for movement as a unit relative to the hopper;

first mounting means operatively coupled to the tailgate structure and the upper panel in a particular relationship for providing an upward or downward movement of the upper panel as a unit between limit positions and for providing a movement of the upper panel as a unit in a vertical direction in the first portion of the upward movement;

a lower panel having an upper edge pivotally connected to the upper panel at a position near the lower edge of the upper panel;

second mounting means operatively coupled to the lower panel for providing a rotary motion of the lower panel about the pivotal connection between the upper and lower panels as a fulcrum and along

the continuous arcuate bottom surface of the refuse hopper; and

means to actuate the lower and upper panels in a sequence of rotating the lower panel rearwardly, through the continuous arc symmetrical about the substantially vertical radius, with the upper panel positioned in the upward position, moving the upper panel as a unit downwardly to the limit position, rotating the lower panel forwardly with respect to the upper panel, through the continuous arc symmetrical about the substantially vertical radius, with the lower edge of the lower panel in close proximity to the curved bottom surface of the hopper to provide a compression *on slidable bearing means* of the refuse against the vertical wall defining the forward end of the hopper and with the upper panel in the bottom limit position and moving the upper panel upwardly to the limit position.

21. In a refuse collector as set forth in claim 20, the first mounting means being operatively coupled to the tailgate structure and the upper panel for imparting a forward component to the upward movement of the upper panel in the last portion of such motion.

22. In a refuse collector as set forth in claim 20, the hopper having a loading lip at its rear end and having a rear wall extending downwardly from the loading lip in essentially a vertical direction and the upper panel and the first mounting means providing a movement of the upper panel as a unit in a vertical direction in the last portion of the downward movement and the lower panel being disposed for the lower panel to scrape along the rear vertical wall during the movement of the upper panel to the lower limit position to shear any refuse overhanging the loading lip.

23. In a refuse collector,

a storage body having an opening at its rear end,

a tailgate structure providing a [relatively short] loading hopper having an arcuate bottom surface and a forward surface with the hopper positioned rearwardly of and adjacent to the opening into the storage body and with the arcuate bottom surface being disposed below the opening into the storage body and with the arcuate bottom surface being continuous and being symmetrical about a substantially vertical radius at an approximately median position along the length of the hopper and with the forward surface being disposed to compress the refuse during movement of the refuse against the forward surface, and

apparatus for moving refuse from the hopper into the storage body, the apparatus comprising:

an upper packer panel;

a lower packer panel;

first means operatively coupled to the tailgate structure and to the upper packer panel for mounting the upper packer panel for rotary movement of the lower packer panel in forward and reverse directions through the continuous arc symmetrical about the substantially vertical radius and for upward movement of the upper and lower packer panels to a first limit position with progressively increasing forward components in at least the last portion of the upward movement and for downward movement to a second limit position with progressively decreasing rearward components in at least the first portion of the downward movement,

second means operatively coupled to the upper and lower packer panels for mounting the lower packer panel for rotary movements in forward and rearward directions through the continuous arc symmetrical about the substantially vertical radius,

third means operatively coupled to the upper and lower packer panels and to the first and second means and to the tailgate structure for producing in a sequence a rotary movement of the lower packer panel in the rearward direction through the continuous arc symmetrical about the substantially vertical radius, a movement of the upper and lower packer panels in the downward direction, a rotary movement of the lower packer panel in the forward direction through the continuous arc symmetrical about the substantially vertical radius *in a scooping movement* to compress the refuse against the forward surface of the hopper and a movement of the upper and lower packer panels in the upward direction, and

fourth means mounted on the tailgate structure and disposed in fixed position in the opening in the tailgate structure at the upper end of the opening and disposed relative to the lower packer panel during the upper movement of the lower packer panel to impart a forward movement through the opening to the refuse being packed by the lower packer panel.

[**24**. In a refuse collector as set forth in claim **23**, the packer panel having at its forward surface a concave curvature to facilitate a rolling of the refuse as the lower panel is moved upwardly.]

25. In a refuse collector as set forth in claim **23**, the [third] *fourth* means including a fixed panel tilted forwardly and upwardly and having a convex curvature to facilitate the movement of the refuse forwardly into the storage body through the opening during the upward movement of the lower panel.

26. In a refuse collector as set forth in claim **25**, the packer panel having at its forward surface a concave curvature to facilitate a rolling of the refuse as the lower panel is moved upwardly.

27. In a refuse collector,

a storage body having an opening at its rear end;

a tailgate structure providing a refuse hopper having a bottom surface defining a continuous arc symmetrical about a substantially vertical radius through a position constituting approximately the center position along the length of the hopper and having essentially a first wall defining the forward end of the refuse [packer] *collector* and shaped to provide for a compression of the refuse against the first wall and a second vertical wall defining the rear end of the refuse packer and a [lid] *lip* defining an opening in the refuse packer at the rear wall of the refuse packer, the hopper being positioned rearwardly of and adjacent to the opening into the storage body; and

apparatus for moving refuse from the hopper into the body, the apparatus comprising:

an upper panel movably mounted on the tailgate structure above the hopper for movement as a unit relative to the hopper;

first mounting means operatively coupled to the tailgate structure and the upper panel in a particular relationship for providing an upward or downward movement of the upper panel as a unit between [limited] *limit* positions and for providing a movement of the upper panel as a unit in a vertical direction in the terminal portion of the downward movement;

a lower panel pivotally connected near its upper end to the upper panel at a position near the lower end of the upper panel for arcuate movement relative to the upper packing panel;

second mounting means operatively coupled to the lower panel for providing a rotary motion of the lower panel about the pivotal connection between the upper and lower panels as a fulcrum through the continuous arc corresponding to the arcuate bottom surface of the refuse hopper and in contiguous relationship to the arcuate bottom surface of the refuse hopper; and

means to actuate the lower and upper panels in a sequence of rotating the lower panel rearwardly, through the continuous arc symmetrical about the substantially vertical radius, with the upper panel positioned in the upward position, moving the upper panel as a unit downwardly to the limit position, rotating the lower panel forwardly, through the continuous arc symmetrical about the substantially vertical radius, with respect to the upper panel with the lower edge of the lower panel in close proximity to the curved bottom surface of the hopper *in a scooping movement to provide such compression of the refuse against the first wall* and with the upper panel in the bottom limit position and moving the upper panel upwardly to the limit position.

28. In a refuse collector as set forth in claim **27**, wherein the actuating means includes first hydraulic means operatively coupled to the [tailgate structure] *upper panel* at one end and to the [upper] *lower* panel at an opposite end and second hydraulic means operatively coupled to the tailgate structure at one end and at an opposite end to the lower panel at a position removed from the pivotal connection between the upper and lower panels.

29. In a refuse collector as set forth in claim **27**, the forward wall of the hopper being essentially vertical and the lower panel being provided with a [relatively great] length from the pivotal connection with the upper panel to provide the lower panel with substantially a horizontal motion during the forward rotary motion of the lower panel to provide a packing of the refuse against the forward vertical wall during such movement.

30. The apparatus of claim **29** wherein the first mounting means include at least a first link connected at opposite ends to the upper ends of the tailgate structure and the upper packing panel and at least a second link connected at opposite ends to the lower ends of the tailgate structure and the upper packing panel.

31. The apparatus of claim **29** wherein the second link is longer than the first link to facilitate the movement of the lower panel along the forward wall of the hopper during the upward movement of the upper panel and wherein the upper packing panel is disposed to be swingable laterally relative to the hopper.

[**32**. In a refuse collector including a storage body, and a tailgate structure providing a relatively short loading hopper having a curved bottom surface with the hopper positioned rearwardly of and adjacent to an opening into said storage body;

apparatus for moving refuse from said hopper into said body comprising:

an upper panel movably mounted above and longitudinally of said hopper;

pivotal mounting means for said upper panel providing a rearwardly and downwardly convexly curved path for said panel in moving from an upward and forward position to a lowered and rearward position;

a lower panel having an upper edge pivotally connected to the lower edge of said upper panel, and

means to actuate said upper and lower panels in the sequence of rotating said lower panel rearwardly with respect to said upper panel positioned in an upward and forward position, moving said upper panel in a rearwardly and downwardly convexly curved path, rotating said lower panel forwardly with respect to said upper panel with the lower edge of said lower panel in close proximity to the bottom curved surface of said hopper, and moving said upper panel in a forwardly and upwardly curved path, to move refuse through said opening into said truck body.

a fixed panel defining the upper extremity of said opening;

said fixed panel having an upwardly curved lower surface to impart a forward direction of movement to refuse moved upwardly against said lower surface during the movement of said lower panel in a forwardly and upwardly curved path with the upper panel;

said upper panel having a curved forward surface;

said fixed panel having a rearward surface in close proximity to said curved forward surface, and

the curvature of said forward surface and the location of said rearward surface maintaining a close proximity between said forward surface and said rearward surface as said upper panel is moved in a downwardly and rearwardly convexly curved path and in an upwardly and forwardly curved path with respect to said hopper, whereby the rearward surface of said fixed panel removes refuse from said curved forward surface during relative movement between said upper panel and said fixed panel.]

33. In a refuse collector including a storage body, and a tailgate structure providing a [relatively short] loading hopper having a curved bottom surface with the hopper positioned rearwardly of and adjacent to an opening into said storage body;

apparatus for moving refuse from said hopper into said body comprising:

an upper panel movably mounted above and longitudinally of said hopper;

pivotal mounting means *without any torsion members* for said upper panel, *said pivotal means* providing a rearwardly and downwardly convexly curved path for said panel in moving from an upward and forward position to a lowered and rearward position;

a lower panel having an upper edge pivotally connected to the lower edge of said upper panel, and

means to actuate said upper and lower panels in the sequence of rotating said lower panel rearwardly with respect to said upper panel positioned in an upward and forward position, moving said upper panel in a rearwardly and downwardly convexly curved path, rotating said lower panel forwardly with respect to said upper panel with the lower edge of said lower panel *in a scooping movement* in close proximity to the bottom curved surface of said hopper, and moving said upper panel in a forwardly and upwardly curved path, to move refuse through said opening into said truck body,

said pivotal mounting means comprising a top link pivotally mounted at one end to said upper panel adjacent [its] *the* upper edge *of the upper panel* and pivotally mounted at its other end to said tailgate structure, and

a bottom link pivotally mounted at one end to said upper panel adjacent its lower edge and pivotally mounted at its other end to said tailgate structure.

34. The apparatus of claim **33** wherein said bottom link is longer than said top link.

35. The apparatus of claim **33** including

a pair of top links pivotally mounted on opposite sides of said upper panel;

a pair of stub shafts mounted on opposite sides of said upper panel, and

each of said stub shafts pivotally supporting a top link.

36. The apparatus of claim **33** including

a pair of bottom links pivotally mounted on opposite sides of said upper panel;

a pair of stubs shafts mounted on opposite sides of said upper panel, and

each of said stub shafts pivotally supporting one side of an upper edge of said lower panel and a bottom link.

37. The apparatus of claim **33** including

a pair of top links pivotally mounted on opposite sides of said upper panel;

a pair of upper stub shafts mounted on opposite sides of said upper panel;

each of said upper said stub shafts pivotally supporting a top link;

a pair of bottom links pivotally mounted on opposite sides of said upper panel;

a pair of lower stub shafts mounted on opposite sides of said upper panel, and

each of said lower stub shafts pivotally supporting one side of an upper edge of said lower panel and a bottom link.

[**38**. In a refuse collector including

a storage body and a tailgate structure positioned rearwardly of and adjacent to an opening into said storage body,

apparatus comprising:

a hopper defined by the lower portion of said tailgate structure;

said hopper having an arcuate curved bottom surface and a forward packing surface initially extending vertically upwardly and then curving upwardly and forwardly from the bottom surface;

an upper packing panel mounted in said tailgate for movement between a forward raised position and a rearward lowered position;

a lower packing panel swingably mounted on a lower portion of said upper panel;

said lower packing panel having a lower edge which moves in close proximity to said bottom when said packing panel is swung forwardly;

means to move said upper packing panel and said lower packing panel in the sequence of swinging said lower packing panel rearwardly while said upper packing panel is in a raised position, moving said upper packing panel to a lowered position, swinging said lower packing panel forwardly to pack refuse in said hopper against said forward packing surface, and moving said upper packing

panel to a raised position with said lower edge of said lower packing panel in contiguous relation to said forward packing surface,

said lower packing panel having a curved forward surface which surface makes an angle of at least 90° with said forward packing surface when the lower edge of said lower packing panel is in contiguous relation to said forward packing surface,

whereby refuse resting on the curved surface of said lower packing panel has less tendency to jam between said lower packing panel and said forward packing surface during upward movement of said upper packing panel to a raised position.]

39. In a refuse collector including

a storage body and a tailgate structure positioned rearwardly of and adjacent to an opening into said storage body;

apparatus comprising:

a hopper defined by the lower portion of said tailgate structure *and having side walls*;

said hopper having a vertically inclined forward packing surface;

an upper packing panel movably mounted in said tailgate;

means for moving said upper panel in a rearwardly and downwardly convexly curved path from an upward and forward position to a lowered and rearward position;

a lower packing panel movably mounted on a lower portion of said upper panel;

a fixed panel defining the upper portion of said opening;

said fixed panel having an upwardly directed lower surface;

means to move said lower packing panel *relative to the upper panel* through said hopper to pack refuse against said forward packing surface *by means of a scooping movement*, and

means to then raise said upper packing panel to an upward position to pack refuse against said fixed panel,

the moving means for the upper and lower packing panels being constructed, without the inclusion of any torsion members, to provide for a displacement of the upper and lower packing panels against the side walls of the hopper with unbalanced loads of refuse on the lower packing panel,

said upper packing panel having a curved forward surface;

said fixed panel having a rearward surface in close proximity to said curved forward surface, and the path of movement provided *to* said upper packing panel maintaining the rearward surface of said fixed panel in close proximity to the curved forward surface of said upper panel during movement of said upper packing panel.

[40. In a refuse collector,

a storage body,

hopper means for storing the refuse, the hopper means having a rear wall, a forward wall spaced from the rear wall and a bottom wall extending between the rear wall and the forward wall,

fixed panel means disposed relative to the hopper means to define an opening through which the refuse is moved into the storage body,

packing panel means disposed and movable relative to the hopper means and the fixed panel means from an initial position for providing a packing of the refuse in horizontal and vertical directions and a movement of the refuse through the opening defined by the packer panel means and the hopper means,

a handle movable between first and second positions, and

control means operatively coupled to the packer panel means and responsive to the movement of the handle to the second position to obtain a movement of the packer panel means from the initial position relative to the hopper means and the fixed panel means to produce a packing of the refuse in the horizontal and vertical directions and a movement of the refuse through the opening defined by the packer panel means and the hopper means, the control means being responsive to the movement of the handle to the first position to return the packer panel means to the initial position,

the handle being movable from the second position to the first position prior to the complete movement of the packer panel means in providing the horizontal and vertical packing,

the control means being responsive to the movement of the handle from the second position to the first position to move the packer panel means in a direction for clearing an obstacle in the hopper means for the initiation of a new cycle of movement of the packer panel means,

the packer panel means being disposed relative to the hopper means for lateral movement relative to the hopper means to prevent the packer panel means for being jammed by unbalanced loads of refuse in the hopper means,

the refuse collector being disposed on a truck body and the truck body including an engine having a throttle to control the operation of the engine and the engine supplying power to the control means in the refuse collector in accordance with the operation of the throttle, and

means responsive to the movement of the handle to the second position to obtain an operation of the throttle in a direction for increasing the power from the engine.]

41. In a refuse collector,

a storage body having an opening,

a tailgate structure positioned rearwardly of and adjacent to the opening in the storage body,

hopper means for storing the refuse, the hopper means having *side walls*, a rear wall, a forward wall spaced from the rear wall and a bottom wall extending between the rear wall and the forward wall,

fixed panel means disposed relative to the hopper means and the storage body to define with the forward wall of the hopper means the opening in the storage body through which the refuse is moved,

packer panel means defining the opening with the fixed panel means and disposed and movable relative to the hopper means and the fixed panel means in a cycle involving rearward, downward, forward and upward movements of the packer panel means for providing a movement of the refuse through the opening defined by the packer panel means and the fixed panel means,

a plurality of linkage means supporting the packer panel means relative to the hopper means and the tailgate structure at a first pair of upper and for-

ward positions in the tailgate structure and a second pair of lower and forward positions in the tailgate structure, *without the inclusion of any torsion members, and being constructed to provide* for *a* lateral movement *of the packer panel means* relative to the hopper means and to the upper and lower pairs of positions in the tailgate structure during the rearward, downward, forward and upward movement of the packer panel means *by lateral bearing means* in the cycle to prevent, *by a movement of the packer panel means against the side walls of the hopper means,* the packer panel means from being jammed by unbalanced loads of refuse in the hopper means, and

means operatively coupled to the packer panel means for providing a movement of the packer panel means in the cycle involving the rearward, downward, forward and upward movements of the packer panel means.

42. In a refuse collector as set forth in claim **41**,

the linkage means in the plurality including a first pair of links attached at one end to the upper positions in the tailgate structure and at the other end to the packer panel means to provide for lateral movement relative to the hopper means and the tailgate structure further including a second pair of links attached at one end to the lower positions in the tailgate structure and at the other end to the packer panel means to provide for lateral movement relative to the hopper means and the tailgate structure.

43. In a refuse collector as set forth in claim **42**,

the packer panel means including an upper panel and a lower panel and the lower panel being pivotally connected to the upper panel at a position near the lower end of the upper panel and the upper end of the lower panel and the links including first links attached at one end to the tailgate structure at an upper position in the tailgate structure and attached at the other end to the packer panel means at an upper position on the packer panel means and second links attached at one end to the tailgate structure at a lower position in the tailgate structure and attached at the other end to the packer panel means at a lower position on the packer panel means.

44. In a refuse collector as set forth in claim **43**,

the lower links being longer than the upper links and the support means being constructed and disposed to provide the packer panel means with a vertical movement at one terminal portion of the upward and downward movement of the packer panel means and the forward and rear walls of the [packer panel] *hopper* means having a vertical disposition and the packer panel means being disposed along the forward and rear walls of the hopper means during the upward and downward movements of the packer panel means.

45. In a refuse collector,

a storage body having an opening at its rear end,

a tailgate structure positioned rearwardly of and adjacent to the opening in the storage body,

hopper means having a pair of spaced side walls and forward and rear portions spaced from each other, [the hopper means being formed from a metal having a high strength,]

a pair of pivot pins each disposed in the hopper means adjacent an individual one of the side walls and having only a limited length and disposed for movement rearwardly and downwardly along the

side walls of the hopper means and for movement forwardly and upwardly along the side walls of the hopper means,

packer panel means including upper and lower packing panels coupled to each other by the pivot pins and connected to the tailgate structure at one end and mounted at the other end on the pivot pins for pivotal movement of the lower packing panel about a fulcrum defined by the pivot pins and for rearward and downward movement of the upper and lower packing panels with the pivot pins along the walls of the hopper means and for upward and forward movement of the upper and lower panels with the pivot pins along the walls of the hopper means and for lateral movement relative to the side walls of the hopper means during such rearward and downward movement and during such forward and upward movement, and

control means operatively coupled to the packer panel means for producing controlled movements of the packer panel means relative to the side walls of the hopper means in the rearward and downward movement of the upper and lower packing panels and the pivot pins, in the pivotal movement forwardly of the lower packing panel, in the forward and upward movement of the upper and lower packing panels and the pivot pins and in the pivotal movement rearwardly of the lower packing panel in a cycle for providing a movement of refuse into the hopper, a packing of refuse in the hopper and *a* discharge of the packed refuse into the storage body through the opening in the storage body,

the pair of pivot pins and the packer panel means being disposed relative to the side walls of the hopper means, *without the inclusion of any torsion members,* to provide for a lateral movement of the packer panel means and the pivot pins [relative to] *against* the side walls of the hopper means *with unbalanced loads of refuse on the packer panel means* during the packing cycle to prevent the packer panel means from being jammed by unbalanced loads of refuse in the hopper means,

the hopper means being formed from a metal having a high strength to withstand wear by the lateral movement of the packer panel means against the side walls of the hopper means as a result of unbalanced loads of the refuse on the packer panel means.

46. In a refuse collector as set forth in claim **45**,

means operatively coupled to the control means for obtaining a lateral movement of the packer panel means by the control means during the rearward and downward movement of the packer panel means and the upward and forward movement of the packer panel means to clear any refuse constituting an obstacle in the storage means to the controlled movement of the packer panel means relative to the hopper means and means responsive to the movement of the packer panel means to a position clearing the obstacle for initiating a movement of the packing panel means to complete the packing cycle.

47. In a refuse collector as set forth in claim **46**,

linkage means supporting the packer panel means and the pivot pins at one end and attached to the tailgate structure at the other end at upper and lower positions on the tailgate structure for providing a movement of the packer panel means in a curved path having a vertical disposition at one terminal

portion during the rearward and downward movement of the packer panel means and the upward and forward movement of the packer panel means,

the hopper means forward and rear walls with vertical dispositions corresponding to the vertical disposition in the curved path of movement of the packer panel means at the terminal portions of the rearward and downward movement and the upward and forward movement of the packer panel means.

48. In a refuse collector as set forth in claim **47**,

the linkage means including first linkage means attached at one end to the tailgate structure at the upper positions in the tailgate structure and attached at the other end to the packer panel means at upper positions in the packer panel means and including second linkage means attached at one end to the tailgate structure at the lower positions in the tailgate structure and attached at the other end to the packer panel means at lower positions in the packer panel means, the lower linkage means being longer than the upper linkage means.

49. In a refuse collector,

a storage body having an opening at its rear end,

a tailgate structure positioned rearwardly of and adjacent to the opening in the tailgate structure,

hopper means having a hollow interior for storing the refuse, the interior of the hopper means being defined by forward and rear walls of vertical disposition and a bottom arcuate and continuous wall defined by a large radius for the arc and extending continuously on the arcuate basis between the forward and rear walls,

fixed panel means disposed relative to the hopper means and the storage body for defining the opening in the storage body through which the refuse is moved,

lower packing panel means movable on a cyclical basis from an initial position relative to the hopper means and the fixed panel means to pack the refuse in the hopper means, the cyclical movement of the lower packer means including a downward movement of the lower packer panel means close to the rear wall of the hopper means in a terminal portion of the downward movement of the packer panel means to facilitate the disposition of the refuse in the hopper means, an arcuate and continuous movement of the packer panel means forwardly along the bottom wall of the hopper means *in a scooping movement* from the rear wall to the forward wall of the hopper means to obtain a horizontal packing and a compression of the refuse in the hopper means against the vertical forward wall of the hopper means and an upward movement of the packer panel means close to the forward wall of the hopper means in a terminal portion of the upward movement of the packer panel means to obtain a vertical packing of the refuse in the hopper means against the fixed panel means and a movement of the packed refuse into the storage body,

upper packer panel means [operatively] *swingably* coupled to the lower packer panel means for providing a movement of the lower packing means with the upper packer panel means initially in the downward direction and subsequently in the upward direction and for providing for a movement of the lower packer panel means in the arcuate and

continuous movement along the bottom wall of the hopper means,

first support means operatively coupled to the upper packer panel means and the tailgate structure for providing for the movement of the upper and lower packer panel means initially in the downward direction and subsequently in the upward direction,

second support means operatively coupled to the upper and lower packer means for providing for the movement of the lower packer panel means in the arcuate and continuous movement along the bottom wall of the hopper means, and

control means operatively coupled to the support means to provide a movement of the upper and lower packer panel means on a cyclical basis to provide for the specified movements of the lower packer panel means.

50. In a refuse collector as set forth in claim **49**,

the first support means including linkages supported on the tailgate structure and the upper packer panel *means* to provide for lateral movement of the upper and lower packer panel means relative to the hopper means to prevent the upper and lower packer panel means from being jammed by unbalanced loads of refuse in the hopper means.

51. In a refuse collector as set forth in claim **49**,

the support means including linkages coupled to the tailgate structure and the packer panel means for lateral movement of the linkages and the packer means relative to the hopper means during such cyclical movement of the packer panel means to prevent the packer panel means from being jammed by unbalanced loads of refuse in the hopper means.

52. In a refuse collector as set forth in claim **49**,

a handle movable between first, second and third positions,

the control means being responsive to the movement of the handle to the second position to obtain the downward movement of the packer panel means and being responsive to the movement of the handle to the third position to obtain the forward and upward movement of the packer panel means.

53. In a refuse collector,

a storage body having an opening at its rear end,

hopper means for storing the refuse, the hopper means having a rear wall, having a forward wall spaced from the rear wall and disposed adjacent the opening in the storage body and having a bottom wall extending between the rear wall and the forward wall,

a tailgate structure,

fixed panel means supported by the tailgate structure for disposition adjacent the opening in the storage body,

packer panel means disposed and movable relative to the hopper means and the fixed panel means and the storage body and the tailgate structure from an initial position for providing a packing of the refuse in forward and upward directions and a movement of the refuse through the opening in the storage body during a packing of the refuse in the upward and forward direction,

a handle movable between first and second positions,

control means operatively coupled to the packer panel means and responsive to the movement of the handle to the second position to obtain a movement

of the packer panel means from the initial position relative to the hopper means and the fixed panel means to produce a packing of the refuse in the forward and upward directions and a movement of the refuse through the opening in the storage means, the control means being responsive to the movement of the handle to the first position to return the packer panel means to the initial position, and

first and second pairs of linkage means operatively coupled to the tailgate structure and to the packer panel means at spaced positions vertically and laterally on the tailgate structure, *without the inclusion of any torsion members*, for providing for *a* controlled movement of the packer panel means in the forward and upward directions and for *a* lateral movement of the packer panel means *on slidable bearing means* relative to the hopper means and the storage body and the tailgate structure *and against the hopper means* during such forward and upward movements of the packer panel means to prevent the packer panel means from being jammed by unbalanced loads of refuse in the hopper means during such forward and upward movements of the packer panel means.

54. In a refuse collector as set forth in claim **53**,

the handle being movable from the second position to the first position prior to the complete movement of the packer panel means in providing the forward and upward packing and upon the occurrence in the hopper means of an obstacle preventing the complete movement of the packer panel means,

the control means being responsive to the movement of the handle from the second position to the first position to move the packer panel means in a direction for clearing an obstacle in the hopper means for the initiation of a new cycle of movement of the packer panel means.

55. In a refuse collector as set forth in claim **54**,

the packer panel means being disposed relative to the hopper means for lateral movement relative to the hopper means to prevent the packer panel means from being jammed by unbalanced loads of refuse in the hopper means.

56. In a refuse collector as set forth in claim **53**,

the handle being movable from the second position to the first position prior to the complete movement of the packer panel means in providing the forward and upward packing and upon the occurrence in the hopper means of an obstacle preventing the complete movement of the packer panel means,

the control means being responsive to the movement of the handle from the second position to the first position to move the packer panel means in a direction for clearing an obstacle in the hopper means for the initiation of a new cycle of movement of the packer panel means.

57. In a refuse collector,

a storage body having an opening at its rear end,

a tailgate structure positioned rearwardly of and adjacent to the opening in the storage body.

hopper means for storing the refuse, the hopper means having forward and rear walls of vertical disposition and a bottom curved wall of essentially a horizontal disposition,

fixed panel means disposed relative to the hopper means and the storage body for defining the opening in the storage body through which the refuse is moved,

an upper panel,

a lower panel,

first means operatively connecting the upper and lower panels to provide a movement of the upper panel with the lower panel and to provide a rotary *scooping* movement of the lower panel relative to the upper panel,

first mounting means operatively connected to the upper panel and to the tailgate structure for providing an upward movement of the upper panel to a first limit position with progressively increasing forward components in at least the last portion of the upward movement and for providing a downward movement of the upper panel to a second limit position with progressively decreasing forward components in at least the first portion of the downward movement,

second mounting means operatively connected to the lower panel and to the tailgate structure for providing rotary movements of the lower panel in the forward and reverse directions,

the lower panel means being movable on a cyclical basis from an initial position relative to the hopper means and the fixed panel means to pack the refuse in the hopper means, the cyclical movement of the lower panel including a downward movement of the lower panel close to the rear wall of the hopper means in a terminal portion of the downward movement of the upper and lower panels to facilitate the disposition of the refuse in the hopper means, a forward rotary movement of the lower panel along the bottom wall of the hopper means from the rear wall toward the forward wall of the hopper means to obtain a horizontal packing of the refuse in the hopper means against the vertical forward wall of the hopper means and an upward *scooping* movement of the lower panel close to the forward wall of the hopper means in a terminal portion of the upward movement of the upper and lower panels to obtain a vertical packing of the refuse in the hopper means against the fixed panel means and a movement of the packed refuse into the storage body through the opening in the storage body, and

control means operable to actuate the first and second mounting means in a controlled sequence to obtain the movement of the lower panel on the cyclical basis.

58. In a refuse collector as set forth in claim **57**,

the first and second mounting means being constructed to provide for lateral shifts in the disposition of the upper and lower panels relative to the tailgate structure to prevent the upper and lower panels from being jammed by unbalanced loads of refuse in the hopper means.

59. In a refuse collector as set forth in claim **58**,

the first mounting means including first links attached at one end to the tailgate structure at an upper position on the tailgate structure and attached at the other end to the upper panel at an upper position on the upper panel and second links attached at one end to the tailgate structure at a lower position on the tailgate structure and attached at the other end to the upper panel at a lower position on the upper panel, the second links being longer than the first links.

60. In a refuse collector as set forth in claim 59,
the first means including pivot pins extending through the upper and lower panels at a lower position on the upper panel and an upper position on the lower panel and the second mounting means being operatively coupled to the lower panel at a position displaced from the pivot pins.

[61. In a refuse collector as set forth in claim 60,
the lower panel having a forward surface with a convexly curved configuration and the fixed panel means extending downwardly and rearwardly and having a convexly curved configuration at its forward surface.]

62. In a refuse collector as set forth in claim [61] *64*,
the upper panel having a convexly curved forward surface being disposed relative to the rear surface of the fixed panel means to provide a wiping of refuse from the forward surface of the upper panel by the fixed panel means during the upward movement of the upper panel.

63. In a refuse collector as set forth in claim 62,
the lower panel being provided with at least one reinforcing rib at [its] *a* forward surface and the rear wall in the hopper means defining the bottom of an opening in the hopper means for the insertion of refuse into the hopper means through the opening in the hopper means and the tip of the lower panel being provided with characteristics to shear refuse overhanging the opening in the hopper means during the downward movement of the lower panel along the rear wall of the hopper means.

64. In a refuse collector as set forth in claim 63,
the tailgate structure and the hopper means and the storage body being made from a high strength steel.

[65. In a refuse collector including
a storage body and a tailgate structure providing a loading hopper positioned rearwardly of and adjacent to an opening into said storage body, the hopper having a curved bottom surface;
apparatus for moving refuse from said hopper into said body comprising:
an upper panel mounted in said tailgate for forward and rearward movement as a unit relative to the storage body;
first means operatively coupled to the upper panel and the tailgate structure for producing a controlled movement of the upper panel as a unit forwardly and upwardly or rearwardly and downwardly relative to the tailgate structure;
a packing panel swingably mounted on the lower portion of said upper panel;
second means operatively coupled to the packing panel and the tailgate structure for producing a swinging motion of the packing panel relative to the upper panel;
said packing panel having a curved forward surface which contacts refuse in said hopper when said packing panel is swung forwardly with respect to said upper panel and a lower edge which moves in close proximity to the curved bottom surface of said hopper when said packing panel is swung forwardly with respect to said hopper to remove refuse from the curved bottom surface of said hopper;
means operatively coupled to said first and second means for producing in sequence a rearward swinging of the packing panel with the upper panel retained stationary, a downward and rearward movement of the upper panel, a forward swinging of the packing panel with the upper panel retained stationary and an upward and forward movement of the upper panel,
whereby refuse within said hopper rolls upwardly onto the curved forward surface of said packing panel as said panel is swung forwardly through said hopper,
an upstanding rib on the curved forward surface of said packing panel;
said rib providing a reduced area for application of high localized pressures to refuse contacted by said rib as the packing panel swings forwardly through said hopper;
said first means including links pivotable relative to the hopper and operatively coupled at one end to the hopper and operatively coupled at the other end to the upper panel;
a plurality of upstanding ribs;
said ribs being positioned in spaced relationship to each other along the transverse disposition of the packing panel and positioned vertically with respect to said hopper bottom as said packing panel is swung forwardly through said hopper; and
said links on said first means including a first link attached at one end to the tailgate structure at an upper position in the tailgate structure and attached at its other end to the upper panel at an upper position in the upper panel and including a second link attached at one end to the tailgate structure at a lower position in the tailgate structure and attached at its other end to the upper panel at a lower position in the upper panel.]

[66. The apparatus of claim 65 wherein
each of said ribs has sloping side walls joined together to form a breaking surface;
the side walls of adjacent ribs defining a packing region bounded by said side walls and the forward surface of said packing panel,
whereby refuse between adjacent ribs is compacted as it moves between said ribs into contact with said forward surface; and wherein
the second link in the first means is longer than the first link in the first means.]

67. In a refuse collector,
a storage body having an opening at its rear end,
a tailgate structure providing a refuse hopper having [a relatively short length and] a curved bottom surface and having essentially a vertical wall defining the forward end of the refuse hopper, the hopper being positioned rearwardly of and adjacent to the opening into the storage body; and
apparatus for moving refuse from the hopper into the body, the apparatus comprising:
an upper panel movably mounted on the tailgate structure above the hopper for movement as a unit relative to the hopper;
first mounting means operatively coupled to the tailgate structure and the upper panel in a particular relationship for providing an upward or downward movement of the upper panel as a unit between limit positions and for providing a movement of the upper panel as a unit in a vertical direction in the first portion of the upward movement;

a lower panel having an upper edge pivotally connected to the upper panel at a position near the lower edge of the upper panel;

second mounting means operatively coupled to the lower panel for providing a rotary motion of the lower panel about the pivotal connection between the upper and lower panels as a fulcrum;

means to actuate the lower and upper panels in a sequence of rotating the lower panel rearwardly with the upper panel positioned in the upward position, moving the upper panel as a unit downwardly to the limit position, rotating the lower panel forwardly, with respect to the upper panel, *to the vertical wall at the forward end of the hopper* with the lower edge of the lower panel in close proximity to the curved bottom surface of the hopper and with the upper panel *in a scooping movement* in the bottom limit position and moving the upper panel upwardly to the limit position; and

links included in the first mounting means and pivotally supporting the upper panel at upper and lower positions in the tailgate structure for guiding the upward and downward movements of the upper panel and for supporting the load on the upper panel during the upward movement of the upper panel.

68. In a refuse collector as set forth in claim **67**, the first mounting means including at least a first link pivotally supported at one end on the tailgate structure at an upper and forward position in the tailgate structure and connected at the other end to the upper panel at an upper position in the upper panel.

69. In a refuse collector as set forth in claim **68**, the first mounting means including at least a first link pivotally supported at one end on the tailgate structure at a lower and forward position in the tailgate structure and connected at the other end to the upper panel at a lower position in the upper panel.

70. In a refuse collector as set forth in claim **68**, the mounting means including at least a second link pivotally supported at one end on the tailgate structure at a lower end forward position on the tailgate structure and connected at the other end to the upper panel at a lower position in the panel,

the actuating means including a first hydraulic cylinder mounted at one end on the tailgate structure and attached at the other end to the upper panel at a position near the lower end of the upper panel and further including a second hydraulic cylinder mounted at one end on the [tailgate structure] *upper panel* and attached at the other end to the lower panel at a position removed from the fulcrum defining the pivotal movement of the lower panel.

71. In a refuse collector as set forth in claim **70**,

a fixed panel disposed adjacent the opening in the storage body at a position above the opening to provide a movement of the refuse into the storage body during the upward movement of the upper and lower panels,

the fixed panel being tilted upwardly and forwardly to facilitate the movement of the refuse into the storage body during the upward movement of the upper and lower panels,

the fixed panel being disposed and shaped relative to the upper panel to wipe refuse from the upper panel during the upward movement of the upper panel.

[**72**. In a refuse collector,

a storage body having an opening at its rear end,

a tailgate structure providing a refuse hopper having a relatively short length and a curved bottom surface and having essentially a vertical wall defining the forward end of the refuse hopper, the hopper being positioned rearwardly of and adjacent to the opening into the storage body; and

apparatus for moving refuse from the hopper into the body, the apparatus comprising;

an upper panel movably mounted on the tailgate structure above the hopper for movement as a unit relative to the hopper;

first mounting means operatively coupled to the tailgate structure and the upper panel in a particular relationship for providing an upward or downward movement of the upper panel as a unit between limit positions and for providing a movement of the upper panel as a unit in a vertical direction in the first portion of the upward movement;

a lower panel having an upper edge pivotally connected to the upper panel at a position near the lower edge of the upper panel;

second mounting means operatively coupled to the lower panel for providing a rotary motion of the lower panel about the pivotal connection between the upper and lower panels as a fulcrum;

means to actuate the lower and upper panels in a sequence of rotating the lower panel rearwardly with the upper panel positioned in the upward position, moving the upper panel as a unit downwardly to the limit position, rotating the lower panel forwardly with respect to the upper panel with the lower edge of the lower panel in close proximity to the curved bottom surface of the hopper and with the upper panel in the bottom limit position and moving the upper panel upwardly to the limit position;

the lower panel having a relatively great length from the pivotal connection between the upper and lower panels as a fulcrum to produce essentially a horizontal motion of the lower panel in the arc defined by the rotary motion of the lower panel to provide a pressing of the refuse by the lower panel against the forward wall of the hopper during the rotary motion of the lower panel in the forward direction, and

a fixed panel disposed in the tailgate structure adjacent the opening in the storage body and shpaed at its lower end to facilitate the movement of refuse through the opening in the storage body during the upward movement of the upper and lower panels.]

[**73**. In a refuse collector,

a storage body having an opening at its rear end;

a tailgate structure providing a refuse hopper having a curved bottom surface and having essentially a first wall defining the forward end of the refuse packer and a second vertical wall defining the rear end of the refuse packer and a lid defining an opening in the refuse packer at the rear wall of the refuse packer, the hopper being positioned rearwardly of and adjacent to the opening into the storage body; and

apparatus for moving refuse from the hopper into the body, the apparatus comprising:

an upper panel movably mounted on the tailgate structure above the hopper for movement as a unit relative to the hopper;

first mounting means operatively coupled to the tailgate structure and the upper panel in a particular relationship for providing an upward and downward movement of the upper panel as a unit between limit positions and for providing a movement of the upper panel as a unit in a vertical direction in the terminal portion of the downward movement;

a lower panel pivotally connected near its upper end to the upper panel at a position near the lower end of the upper panel;

second mounting means operatively coupled to the lower panel for providing a rotary motion of the lower panel about the pivotal connection between the upper and lower panels as a fulcrum;

means to actuate the lower and upper panels in a sequence of rotating the lower panel rearwardly with the upper panel positioned in the upward position, moving the upper panel as a unit downwardly to the limit position, rotating the lower panel forwardly with respect to the upper panel with the lower edge of the lower panel in close proximity to the curved bottom surface of the hopper and with the upper panel in the bottom limit position and moving the upper panel upwardly to the limit position; and

the first mounting means including at least a first link pivotally attached at one end to the tailgate structure at an upper position on the tailgate structure and attached at the other end to the upper panel at an upper position on the panel and further including at least a second link pivotally attached at one end to the tailgate structure at a lower position on the tailgate structure and attached at the other end to the upper panel at a lower position on the upper panel.]

[74. In a refuse collector as set forth in claim 73, the second link being longer than the first link and the outer edge of the lower panel being hardened and being disposed in contiguous relationship to the rear wall of the hopper during the downward movement of the upper panel and in contiguous relationship to the bottom wall of the hopper during the forward rotary movement of the lower panel.]

75. In a refuse collector,

a storage body having an opening at its rear end,

a tailgate structure positioned rearwardly of and adjacent to the opening in the tailgate structure,

hopper means for storing the refuse, the hopper means having forward and rear walls of vertical disposition and a bottom curved wall of essentially a horizontal disposition,

fixed panel means disposed relative to the hopper means and the storage body for defining the opening in the storage body through which the refuse is moved,

packer panel means movable on a cyclical basis from an initial position relative to the hopper means and the fixed panel means to pack the refuse in the hopper means, the cyclical movement of the packer means including a downward movement of the packer panel means close to the rear wall of the hopper means in a terminal portion of the downward movement of the packer panel means to facilitate the disposition of the refuse in the hopper

means, a forward movement of the packer panel means along the bottom wall of the hopper means from the rear wall [toward] to the forward wall of the hopper means *in a scooping movement* to obtain a horizontal packing of the refuse in the hopper means against the vertical forward wall of the hopper means and an upward movement of the packer panel means close to the forward wall of the hopper means in a terminal portion of the upward movement of the packer panel means to obtain *by such scooping movement* a vertical packing of the refuse in the hopper means against the fixed panel means and a movement of the packed refuse into the storage body through the opening in the storage body,

support means operatively coupled to the packing panel means and the tailgate structure for providing the movement of the packer panel means on the cyclical basis;

control means operatively coupled to the support means to provide the movement of the packer panel means on the cyclical basis; and

the support means including first links connected at upper position to the packer panel means and connected at the other end to the tailgate structure at an upper position on the tailgate structure and including second links connected to one end to the packer panel means at a lower position on the packer panel means and connected at the other end to the tailgate structure at a lower position on the tailgate structure, the lower links being longer than the upper links.

76. In a refuse collector as set forth in claim 75,

a truck body,

an engine in the truck body, the engine having a throttle to control the operation of the engine,

the engine being operatively coupled to the control means to supply power to the control means in the refuse collector in accordance with the operation of the throttle, and

means [responsive to the movement of the handle to the second position to obtain] *for obtaining* an operation of the throttle in a direction for increasing the power from the engine.

77. In a refuse collector as set forth in claim 75,

a handle movable between first, second and third positions,

the control means being responsive to the movement of the handle to the second position to obtain the downward movement of the packer panel means to the second position and being responsive to the movement of the handle to the third position to obtain the forward and upward movement of the packer panel means, the control means being responsive to the downward movement of the packer panel means to move the handle to the third position and being responsive to the forward and upward movements of the packer panel means to return the handle to the first position.

78. In a refuse collector as set forth in claim 20,

a fixed panel disposed adjacent the opening in the storage body at a position above the opening to facilitate the movement of the refuse into the storage body during the upward movement of the upper and lower panels.

[79. In a refuse collector as set forth in claim 40,

the control means being responsive to the movement of the handle from the second position to the first

position prior to the complete movement of the packer panel means in providing the horizontal and vertical packing for providing a completion of the cycle of movement of the packer panel means in directions to produce a packing of the refuse in the forward and upward directions.]

80. In a refuse collector as set forth in claim 41,

the packer panel means including upper and lower panels,

the means providing the movement of the packer panel means including:

a first pair of pivot pins having only a limited length,

first cylinder means having upper and lower ends and disposed at their upper ends on the pivot pins in the first pair for pivotal movement relative to the hopper means on a fulcrum defined by such pivot pins,

a pair of stub shafts having only a limited length,

the bottom ends of the first cylinder means, particular ones of the linkage means in the plurality, the upper panel and the lower panel being mounted on the pair of stub shafts for pivotal movement on a fulcrum defined by such stub shafts,

second cylinder means having upper and lower ends,

a second pair of pivot pins having only a limited length, the upper ends of the second cylinder means being disposed on the pivot pins in the second pair for pivotal movement of the second cylinder means relative to the hopper means on a fulcrum defined by such pivot pins, and

a third pair of pivot pins having only a limited length, the lower ends of the second cylinder means and the lower panel being mounted on the pivot pins in the third pair for pivotal movement of the second cylinder means relative to the hopper means on a fulcrum defined by such pivot pins,

the position of mounting of the lower panel on the pivot pins in the third pair being different from the position of mounting of the lower panel on the stub shafts in the pair,

the first pair of pivot pins, the pair of stub shafts, the second pair of pivot pins and the third pair of pivot pins being constructed to provide for a lateral movement of the packer panel means against the side walls of the hopper means with unbalanced loads of refuse on the packer panel means.

81. In a refuse collector as set forth in claim 80,

the particular linkage means in the plurality having a different length than the other linkage means in the plurality and having a non-parallel relationship to the other linkage means in the plurality,

a second pair of stub shafts having only a limited length,

the other linkage means in the plurality and the upper panel being mounted on the stub shafts in the second pair for pivotal movement relative to the hopper means on a fulcrum defined by the stub shafts in the second pair,

the stub shafts in the second pair being constructed to provide for the pivotal movement of the packer panel means against the side walls of the hopper means with unbalanced loads of refuse on the packer panels means,

the vertical distance between the stub shafts in the first pair and the stub shafts in the second pair comprising substantially the full height of the upper panel.

82. In a combination as set forth in claim 80,

the particular linkage means in the plurality being disposed on the pivot pins in the third pair for pivotal movement relative to the hopper means on a fulcrum defined by such pivot pins, and

a fourth pair of pivot pins having only a limited length, the other linkage means in the plurality being disposed on the pivot pins in the fourth pair for pivotal movement relative to the hopper means on a fulcrum defined by such pivot pins,

the fourth pair of pivot pins being constructed to provide for a lateral movement of the packer panel means against the side walls of the hopper means with unbalanced loads of the refuse on the packer panel means,

the upper and lower panels having substantially planar sides, the sides of the upper and lower panels being disposed in adjacent relationship to the side walls of the hopper means to provide for a rubbing between the sides of the upper and lower panels and the side walls of the hopper means during the lateral movement of the panels with unbalanced loads of refuse on the packer panel means for providing a floating action of the panels in removing unbalances in the loads of refuse on the packing panel means.

83. In a combination as set forth in claim 82,

first linkage means in the plurality being supported on one of the side walls in the hopper means and second linkage means in the plurality being supported on the other one of the side walls in the hopper means,

the upper and lower panels being disposed in the hopper means and being supported on the linkage means in the plurality to provide for an independent adjustment in the positioning of the first linkage means on the one side wall of the hopper means relative to the adjustment in the positioning of the second linkage means on the other side wall of the hopper means when the upper and lower panels are subjected to an unbalanced load.

84. In a combination as recited in claim 82,

a second pair of stub shafts having only a limited length,

the other linkage means in the plurality and the upper panel being mounted on the stub shafts in the second pair for pivotal movement relative to the hopper means on a fulcrum defined by the stub shafts in the second pair,

the upper and lower panels being disposed in the hopper means and being supported on the linkage means in the plurality without the inclusion of any torsion members between the opposite sides of the upper and lower panels,

each of the pivot pins in the first, second, third, and fourth pairs being disposed on the opposite side wall of the hopper means from the other pivot pin in each of the first, second, third and fourth pairs,

each of the stub shafts in the first and second pairs being disposed on the opposite side wall of the hopper means from the other stub shaft in each of the first and second pairs,

the upper and lower panels having substantially planar sides disposed in adjacent relationship to the side walls of the hopper means for rubbing against the side walls of the hopper means during lateral movement of the upper and lower panels with unbalanced loads of refuse on the panels to provide a floating action of the panels in removing unbalances in the loads of refuse on the panels,

the second pair of stub shafts being constructed to provide for a movement of the side walls of the upper and lower panels adjacent the side walls of the hopper means with unbalanced loads of refuse on the lower panels.

85. In a refuse collector as set forth in claim 45,
the control means including a pair of packing cylinders each having opposite ends and each supported at one end for pivotal movement relative to the hopper means and each mounted at the other end on an individual one of the pivot pins in the pair and each including a rod expansible and contractible within the associated packing cylinder to obtain controlled movements of the upper packing panel rearwardly and downwardly or upwardly and forwardly,
a second pair of pivot pins each having only a limited length,
the control means further including a pair of sweep cylinders each having opposite ends and each supported at one end for pivotal movement relative to the hopper means and each mounted at the opposite end on an individual one of the pins in the second pair and each including a rod expansible and contractible within the associated sweep cylinder to obtain a rotation of the lower panel relative to the upper panel forwardly or rearwardly in the hopper means,
the packer panel means including a first pair of links each having opposite ends and each mounted at one end to the tailgate structure and each mounted at the other end on an associated one of the pivot pins in the first pair, the upper and lower panels also being mounted on the pivot pins in the first pair,
a pair of stub shafts each having only a limited length, and
the packer panel means including a second pair of links each having opposite ends and each attached at one end to the tailgate structure and each mounted at the other end on an associated one of the stub shafts in the pair,
the first and second pairs of pivot pins and the pair of stub shafts being constructed to provide for a lateral movement of the upper and lower panels against the side walls of the hopper means with unbalanced loads of refuse on the lower panel.

86. In a refuse collector as set forth in claim 85,
the first pair of links being disposed in a non-parallel relationship to the second pair of links,
a third pair of pivot pins each having only a limited length and each supported by the tailgate structure,
each of the links in the first pair being mounted at one end on an associated one of the pivot pins in the third pair,
a fourth pair of pivot pins each having only a limited length and each supported by the tailgate structure,
each of the links in the second pair being mounted at one end on an associated one of the pivot pins in the fourth pair,
the third and fourth pair of pivot pins being constructed to provide for a lateral movement of the upper and lower panels against the side walls of the hopper means with unbalanced loads of refuse on the lower panel.

87. In a refuse collector as set forth in claim 86,
the upper packing panel having top and bottom ends and being disposed substantially vertically in the hopper means,
the upper packing panel being mounted on the first pair of pivot pins at the bottom end of the upper packing panel and being mounted on the stub shafts at the top end of the upper packing panel.

88. In a refuse collector as set forth in claim 86,
the upper packing panel having top and bottom ends and being disposed substantially vertically in the hopper means,
the upper packing panel being mounted on the first pair of pivot pins at the bottom end of the upper packing panel and being mounted on the stub shafts at the top end of the upper packing panel,
the links in the first pair being provided with a different length than the links in the second pair,
each of the pivot pins in the first, second, third and fourth pairs being disposed on the opposite side of the hopper means from the other one of the pivot pins in the first, second, third and fourth pairs,
each of the stub shafts in the pair being disposed on the opposite side of the hopper means from the other one of the stub shafts in the pair.

89. In a combination as set forth in claim 86,
the upper and lower panels having substantially planar sides and the side walls of the hopper means being constructed to provide a durable bearing surface against which the sides of the upper and lower panels may rub during lateral movement of the panels to provide a floating action in the movement of the panels for relieving any unbalanced loading of refuse in the hopper means.

90. In a combination as set forth in claim 88,
the upper panel, the lower panel, the links in the first pair and the packing cylinders being mounted on the pivot pins in the first pair, and the upper panel and the links in the second pair being mounted on the stub shafts, to provide for a different pivotal disposition of the individual ones of the links in the first and second pairs on one side of the hopper means relative to the pivotal disposition of the other ones of the links in the first and second pairs on the other side of the hopper means with unbalanced loads of refuse on the upper and lower panel.

91. In a combination as set forth in claim 46,
the packer means including first and second pairs of links pivotally connected to the tailgate structure, individual ones of the links in the first and second pairs being disposed adjacent one side wall of the hopper means and the other ones of the links in the first and second pairs being disposed adjacent the other side wall of the hopper means,
the control means including packing cylinders pivotally disposed relative to the tailgate structure and further including sweep cylinders pivotally disposed relative to the tailgate structure,
the upper and lower panels and the packing cylinders being pivotally coupled to the links in the first pair on a fulcrum defined by the pivot pins in the pair, and
the sweep cylinders being pivotally coupled to the lower panel,
the upper and lower panels being coupled to the links in the first pair, and the upper panel being coupled to the links in the second pair, to provide for an individual positioning of the links in the first and second pairs adjacent the one side wall of the hopper means relative to the positioning of the links in the first and second pairs adjacent the other side wall of the hopper means with unbalances in the load of the refuse in the hopper means on the upper and lower panels,
the upper and lower panels having substantially planar sides and the side walls of the hopper means being substantially planar and being constructed to provide a durable bearing surface against which the sides of the upper and lower panels may rub during lateral movement of the panels to provide a floating action of the panels for relieving any unbalances in the load of the refuse in the hopper means on the upper and lower panels.

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