United States Patent [19]

Blakeley et al.

[11] **3,773,197**

[45] **Nov. 20, 1973**

[54] **REFUSE CONTAINER LOADING AND TRANSPORT SYSTEM AND APPARATUSES THEREFOR**

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[73] Assignee: **Fabit Corporation,** Lubbock, Tex.

[22] Filed: **Nov. 20, 1972**

[21] Appl. No.: **308,157**

[52] **U.S. Cl.** **214/302,** 214/152, 214/731

[51] **Int. Cl.** **B65f 3/02**

[58] **Field of Search** 214/302, 730, 303, 214/152; 280/29, 47.17

[56] **References Cited**

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3,148,793 9/1964 Walter 214/149

Primary Examiner—Gerald M. Forlenza
Assistant Examiner—Lawrence J. Oresky
Attorney—Ely Silverman

[57] **ABSTRACT**

A system for one-man operation of side-loading elevating and emptying and return of refuse containers and transport of the contents thereof: A laterally extensible container engaging and loading mechanism is manipulated by an operator to engage and lift a container adapted for such manipulation.

3 Claims, 16 Drawing Figures

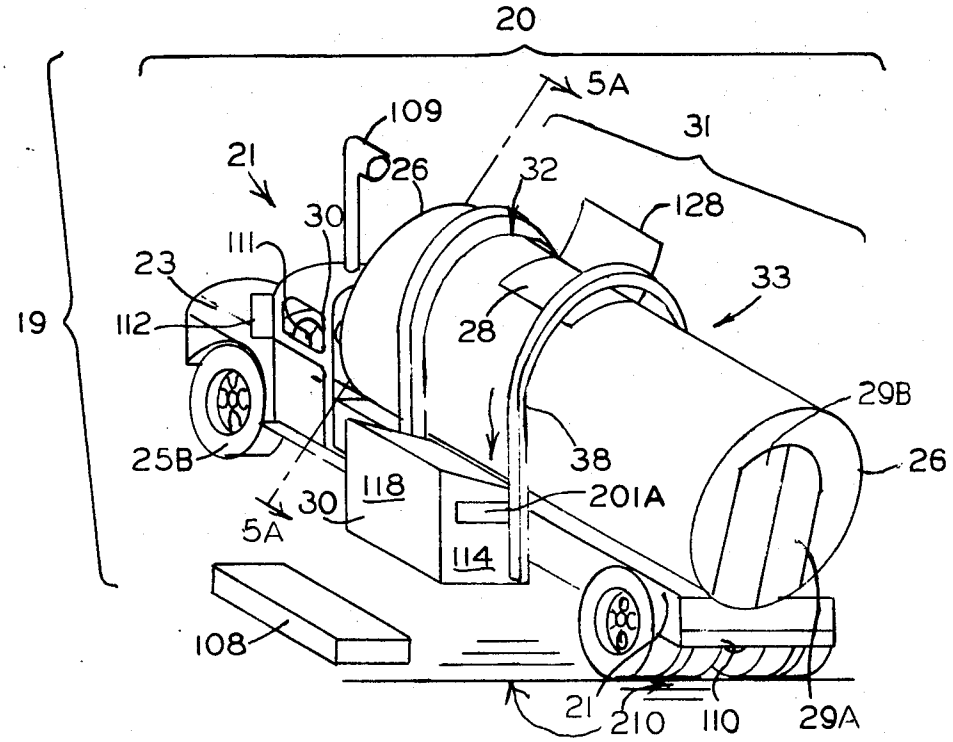


FIG. 1

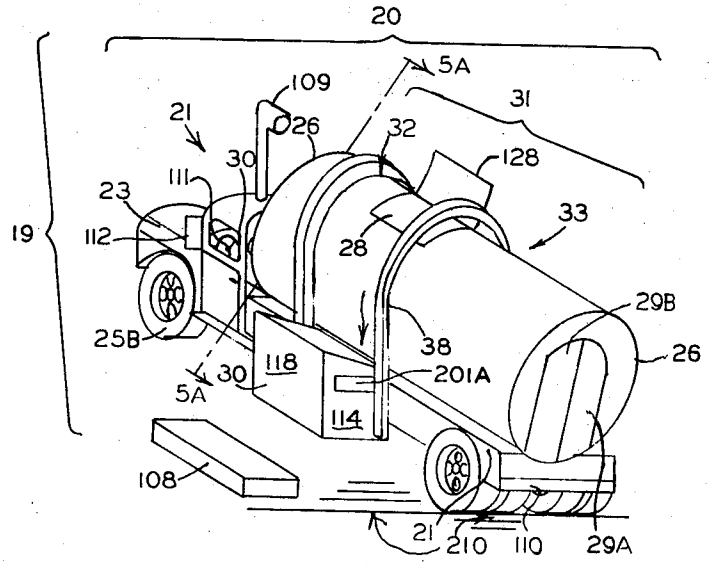


FIG. 2B

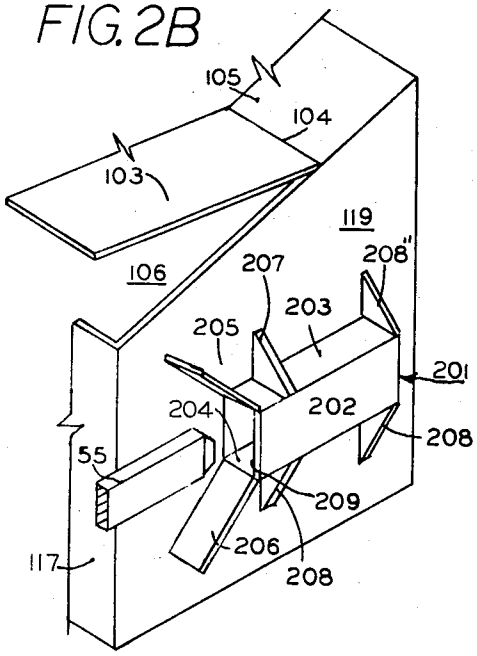


FIG. 2A

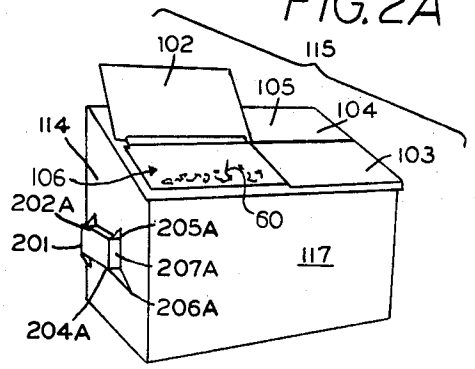
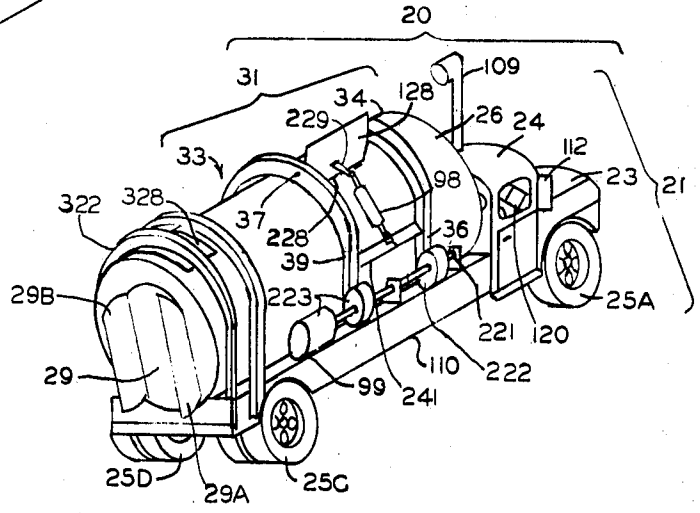


FIG. 3



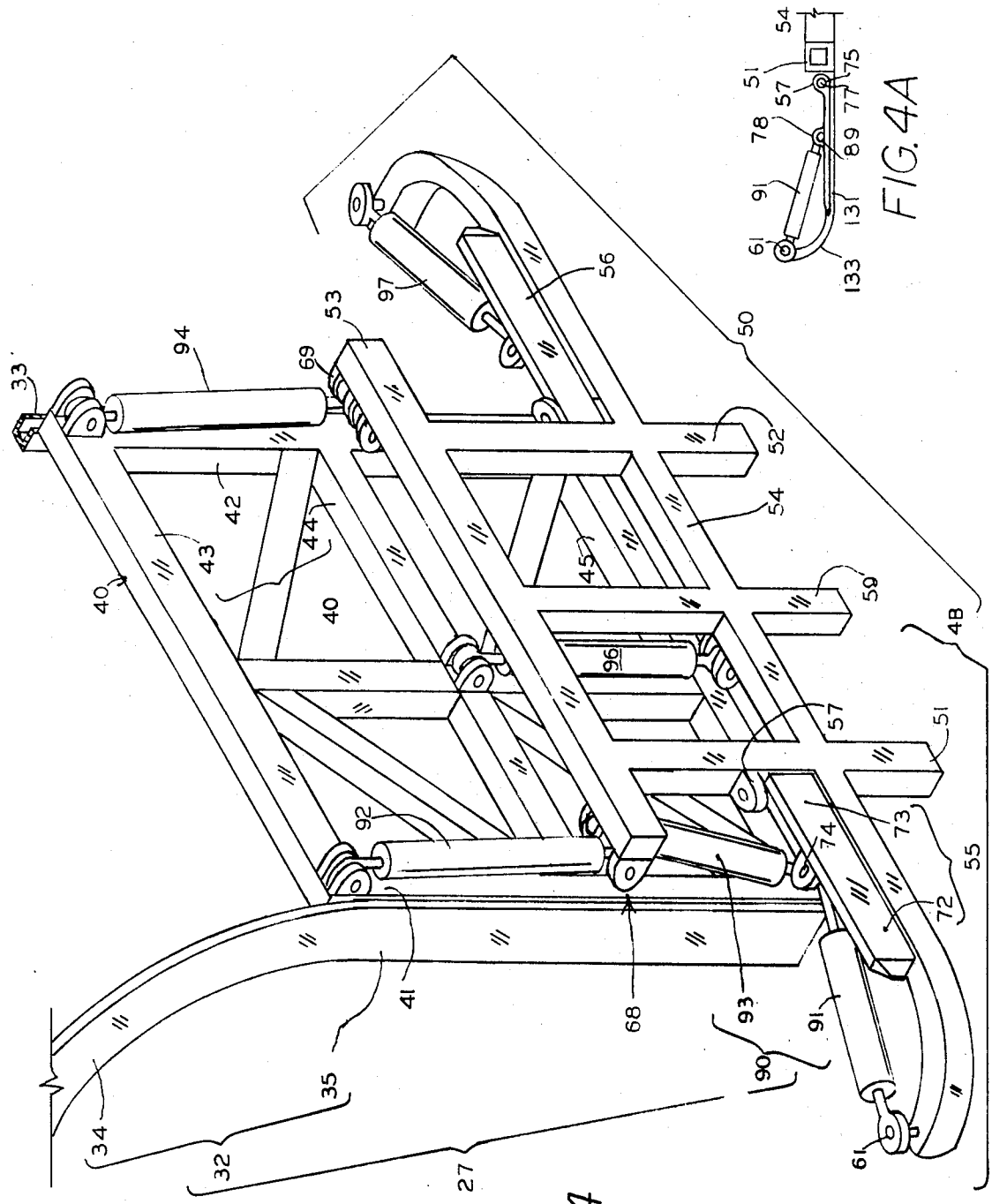

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FIG. 4

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FIG. 4A

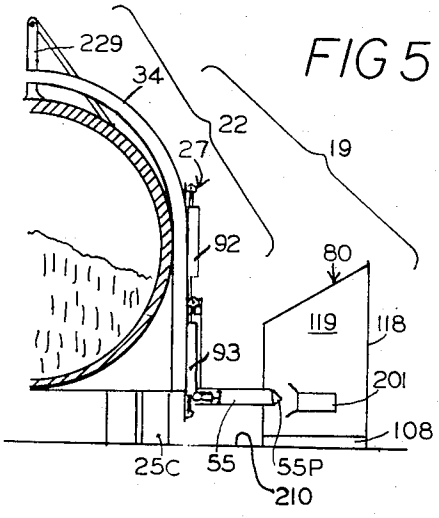


FIG 5

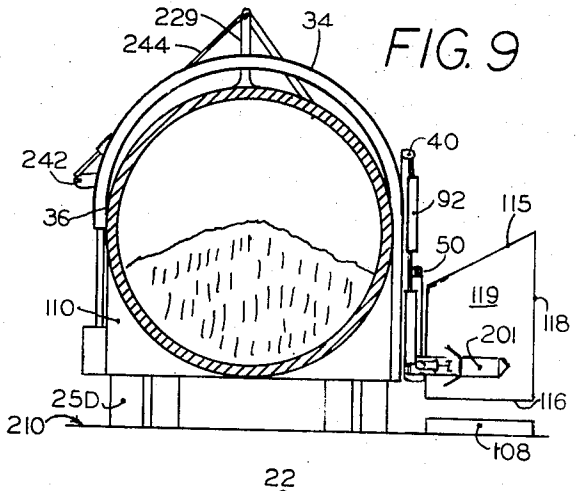


FIG. 9

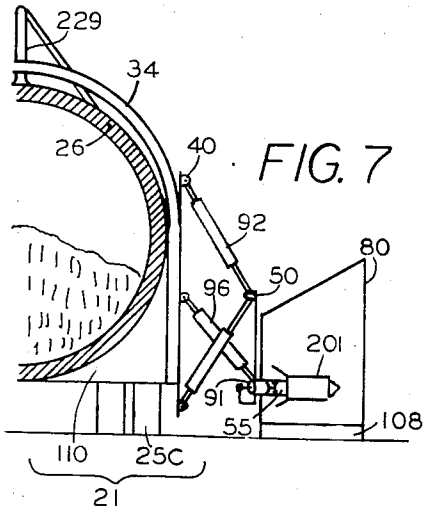


FIG. 7

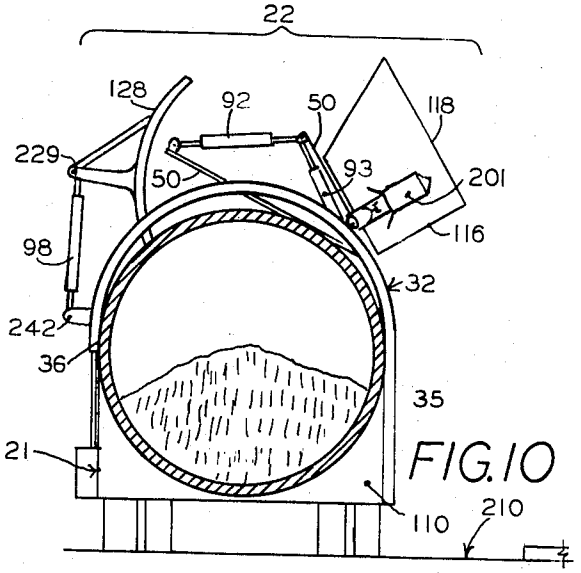


FIG.10

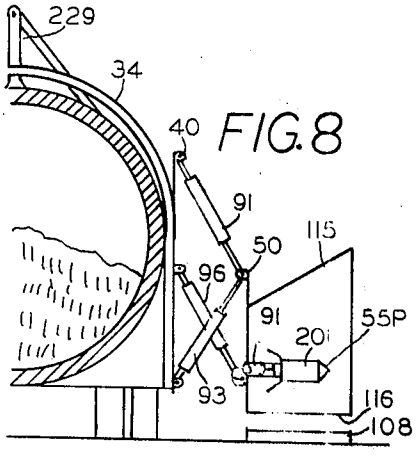


FIG.8

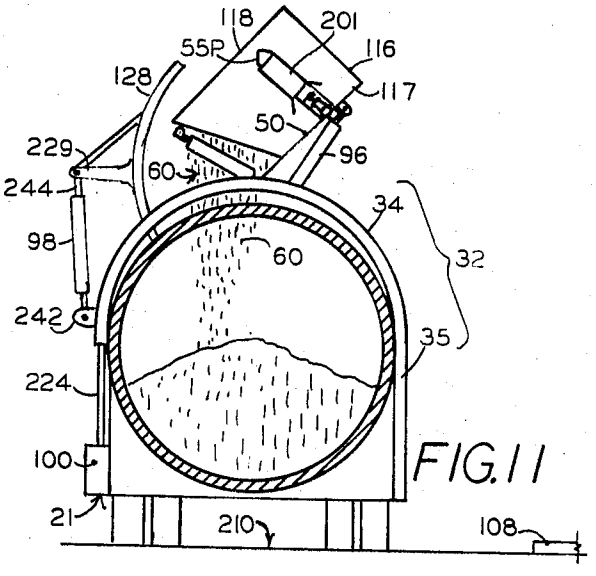


FIG.11

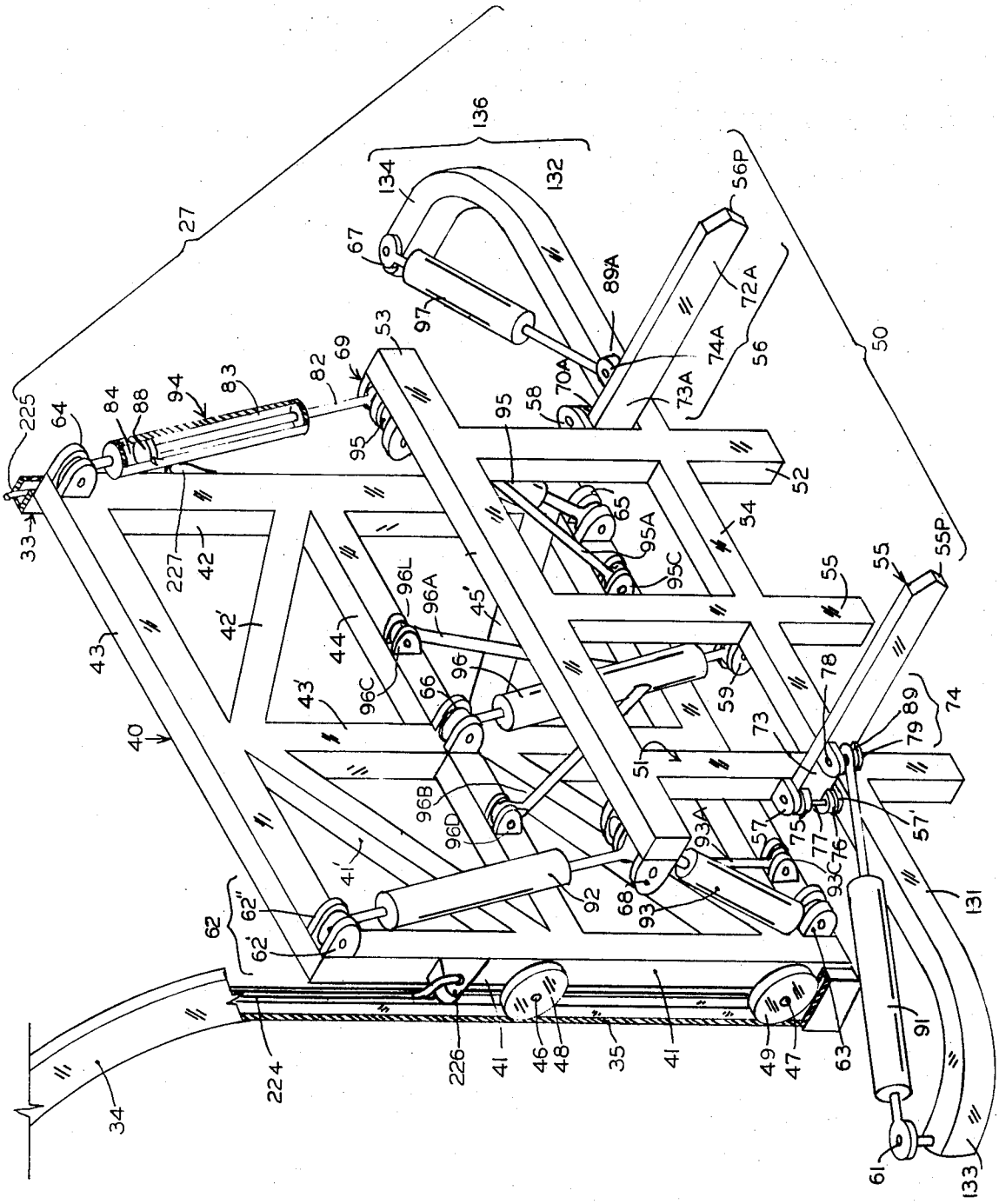
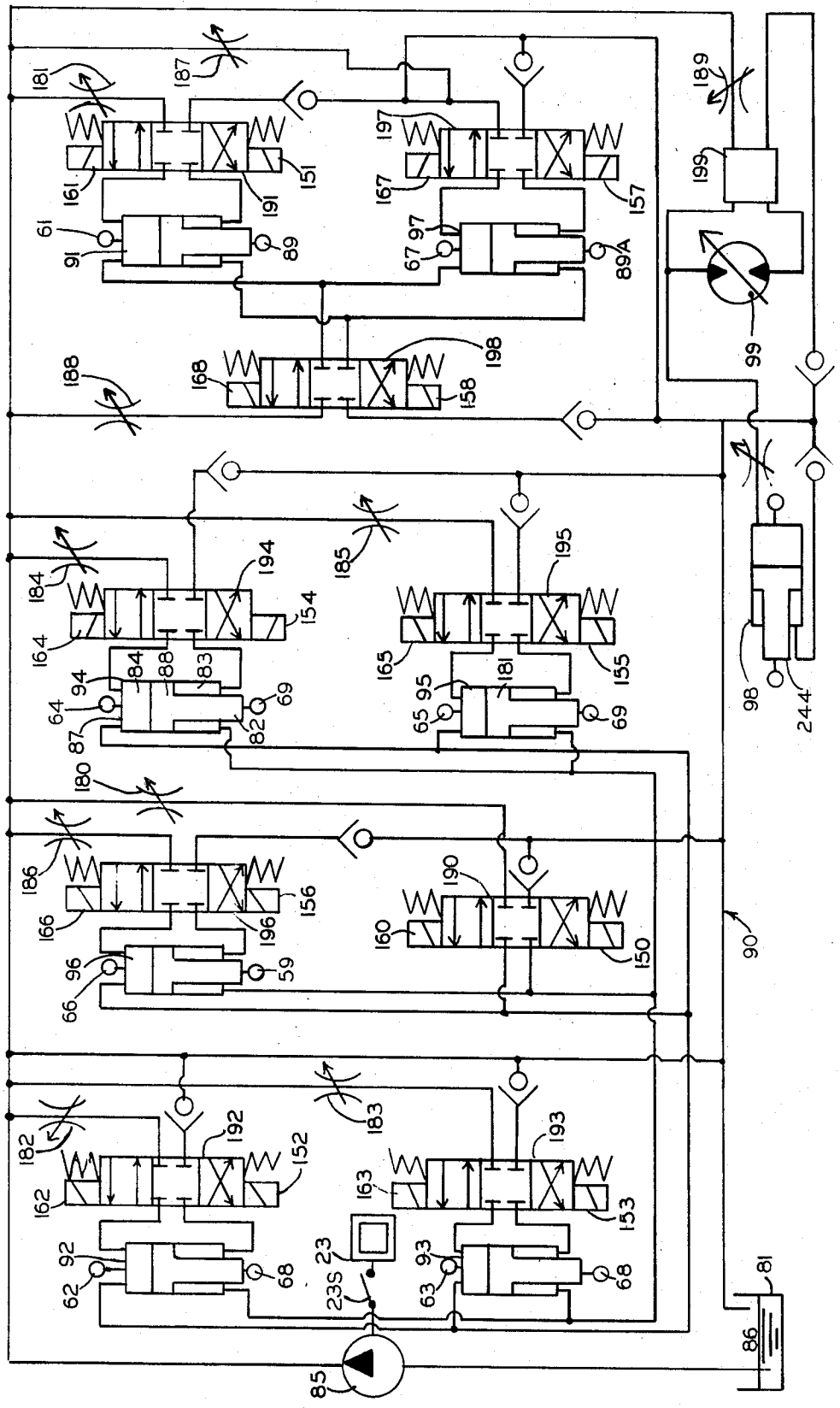

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42'
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FIG. 6

FIG. 12


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89A
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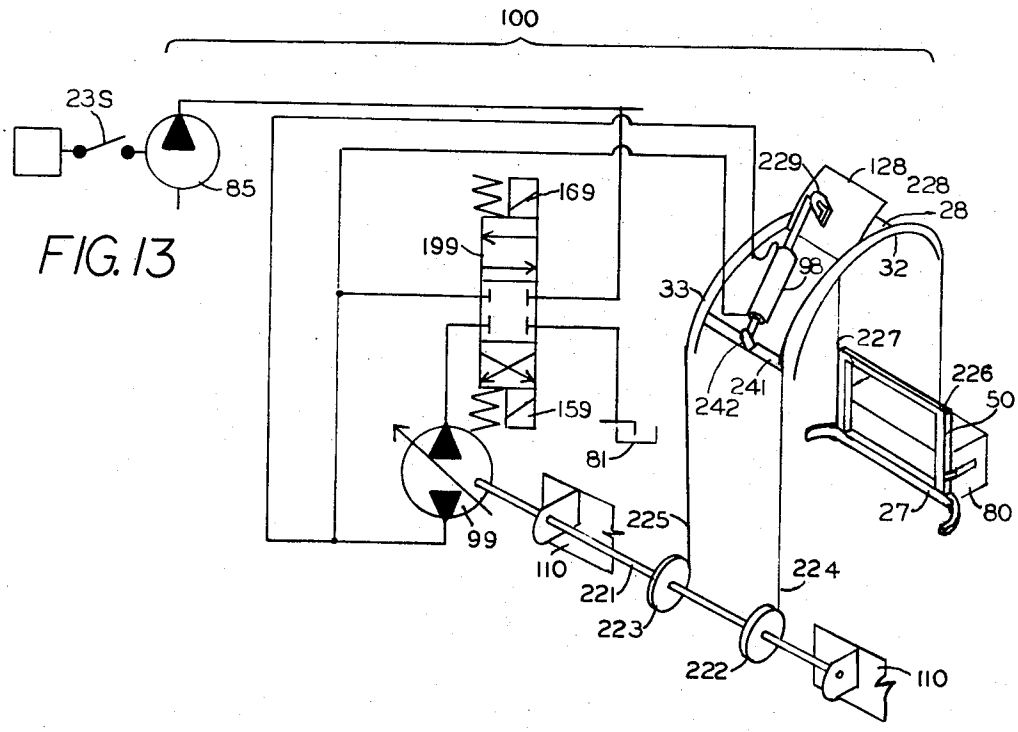

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FIG. 13

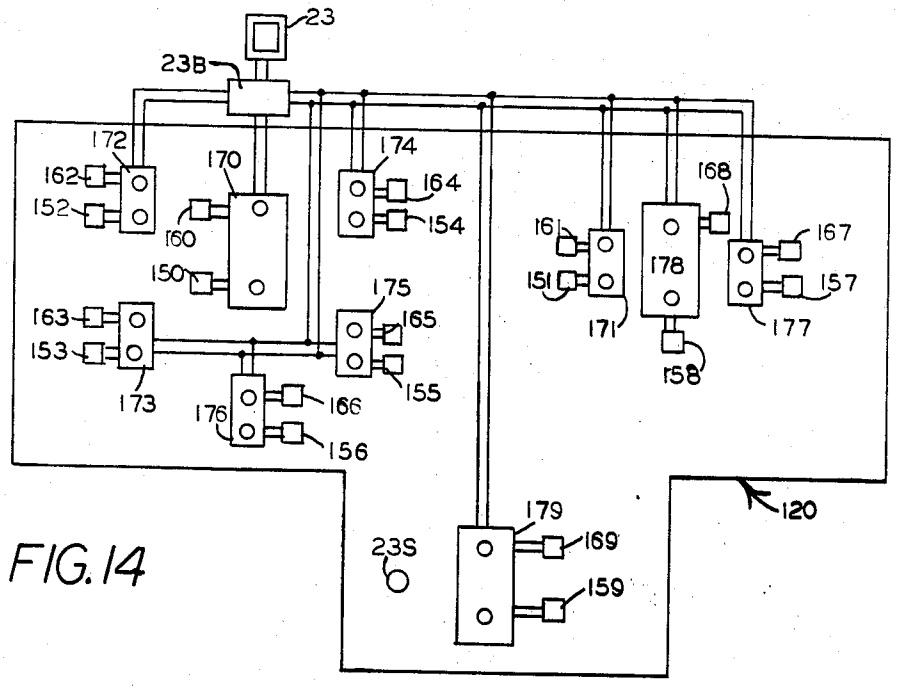

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FIG. 14

REFUSE CONTAINER LOADING AND TRANSPORT SYSTEM AND APPARATUSES THEREFOR

BACKGROUND OF THE INVENTION

1. THE FIELD OF THE INVENTION

The field of the invention is material handling wherein a storage bin type receiver is combined with a container emptying device and more particularly to a vehicle mounted device for lifting a refuse container and dumping the refuse into a receiver receptacle carried by the vehicle.

2. DESCRIPTION OF THE PRIOR ART

While side loading truck loaders are known, as in U.S. Pat. No. 1,820,526, which may be hydraulically operated, as in U.S. Pat. Nos. 1,953,579 and 2,290,738 and 3,008,593, such apparatuses require operators to manually manipulate the means by which to align and engage the to-be-emptied refuse containers with the lifting and emptying mechanism. As a result, much of the development in current art has been to front end loaders, as in U.S. Pat. Nos. 3,687,317 and 3,572,529. However, because of the usual back alley location of refuse containers, such prior art front end loader systems require an impractically large amount of space for maneuvering of the vehicle or undesirable obstructive location of such to-be-emptied refuse containers and require close positioning of the containers prior to their handling.

The instant system and process and apparatuses do not require obstructive location of containers and permits maximum vehicular traffic utilisation of the space of the roadway or alleyway in which the refuse containers are loaded and also provides for a one-man operation for engaging loading, emptying and returning refuse containers and also provides for manipulating the refuse containers gently and gradually as needed with continuous usual surveillance and mechanical control of such one-man operation.

BRIEF DESCRIPTION OF THE DRAWINGS:

FIG. 1 is an oblique isometric drawing of a container handling and transport assembly **20** from its left side rear and above in process of lifting a container **80.**

FIG. 2A is a rear and top oblique view of the container **80.** FIG. 2B is a front and top oblique view of the front of container **80** in Zone 2C of FIG. **7.**

FIG. 3 is an oblique isometric view of container handling and transport assembly **20** from its right side and rear and above in same stage as shown in FIG. **1.**

FIG. 4 is an enlarged diagrammatic isometric view of the engaging assembly **27** in its compacted traveling position. FIG. 4A is a plan view of Zone 4B of FIG. **4.**

FIG. 5 is the first of a series of diagrammatic frontal sectional views along section 5A—5A of FIG. 2 of the assembly **27** in the sequence of operation of the container handling and transport assembly **20:** the spear arm **55** is shown extended while the frames **40** and **50** are still in their compacted position. FIGS. **7, 8, 9, 10** and **11** show subsequent stages of operation viewed as in FIG. **5.**

FIG. **6** is a diagrammatic isometric view of assembly **27** enlarged to same scale as in FIG. **4** in a stage subsequent to that shown in FIG. **5** wherein the outer lateral frame **50** has been moved away from the inner or back frame **40** by the piston assembly **90** in a position whereat the arms **55** and **56** initially engage the carrier **80,** as shown in FIG. **7.** Assembly **32** is herein shown broken away in part.

FIG. **7** shows the front spear **55** in the expanded position of assembly **27** initially engaging the container **80.**

FIG. **8** shows the left arms engaging and lifting the container **80** in the fully expanded position of frame **50.**

FIG. **9** shows the lifted container in retracted position preparatory to raising the container **80.**

FIG. **10** shows the lifted and raised container in initial stage of being dumped.

FIG. **11** shows the raised container during dumping operation.

FIG. **12** is a diagram of the hydraulic valve and piston control assembly **90** for parts of engaging assembly **27.**

FIG. **13** is an isometric diagram of the components of the elevating assembly **100.**

FIG. **14** is a diagrammatic representation of the wiring diagram of the assembly **120** of operator switches to actuate the valves of control assembly **90.**

DESCRIPTION OF THE PREFERRED EMBODIMENT:

The one-man operator refuse container handling and transport system **19,** according to this invention, comprises, in combination, a refuse container handling and transport assembly **20** and a refuse container **80** for use therewith.

The garbage container handling and transport assembly **20,** according to this invention, comprises a garbage transport or carrier tank truck assembly **21** with a container handling and loading assembly **22** in operative combinations. The tank truck **21** comprises a sturdy frame **110** provided with front steering wheels **25A** and **25B,** and rear traction wheels **25C** and **25D.** The frame supports an internal combustion engine **23** as a power source and a steering gear **111,** a transport receptacle **26** and the container handling and loading assembly **22.** The steering gear is operatively connected to the wheels **25A** and **25B.** The motor **23** is operatively connected to the drive wheels **25C** and **25D** and is also operatively connected to a pump **85** for pumping hydraulic fluid for hydraulic power transmission to components of the container handling assembly **22.** The handling assembly **22** is firmly attached to and supported on the frame **110** so that it may be positioned and maneuvered by positioning and maneuvering of the tank truck assembly **21.** A passenger cab **24** is located on the frame **110** of assembly **21.** Controls for the motor **23** and the pump **85,** the steering gear **111** and the switch assembly **120,** for controlling the container handling assembly **22** are located in cab **24** and a seat is provided in that cab for location of an operator **30,** which operator **30** controls the vehicle **21** and the container handling assembly **22.**

Receptacle **26** is a rigid horizontally extending cylindrical rigid tank. It is closed at its sides, front and rear and open at its top at an intake opening **28.** It is firmly supported on the frame **110.**

The tank **26** also has a rear discharge opening **29** in its rear wall covered by discharged doors **29A** and **29B** and a cover **128** for the opening **28.**

The container handling assembly **22** comprises a container engaging assembly **27** and an elevating assembly **100.** The elevating assembly **100** is supported on the frame **110** and actuated by switches and powered by hydraulic and mechanical units which utilize the power of the motor **23** of the tank truck assembly **21.**

Thereby, the elevating assembly **100** and the frame **110** cooperate to support and move the container engaging assembly **27**.

The elevating assembly **100**, which is supported on frame **110** and actuated by motor **23** of the tank truck assembly **21** as below described, is operatively connected to and supports and moves the container engaging assembly **27** and any container, as **80**, engaged thereby.

The container engaging assembly **27** is thus operatively and movably supported on the truck **21** and moved by the elevating assembly **100** as below described.

The container engaging assembly comprises in operative combination, a track assembly **31**, an interior frame **40**, a lateral frame **50**, lift arms **55** and **56**, and a piston assembly **90**.

The container engaging assembly **27** is arranged to engage and move a garbage container **80** and hold it while it is moved upwardly on the frame **110** and above receptacle **26** so as to dump or empty the contents of the container **80** into the upwardly open inlet **28** of the tank **26** and to continue engagement with the container while returning the empty container **80** to a station therefor.

The track assembly **31** comprises a front vertically extending guide channel rail or track **32** and a rear like guide channel rail or track **33**. Rail **33**, like rail **32**, is in the overall shape of a downwardly open inverted "U." The front track or rail **32** has a circular top track portion **34** joined to and continuous with a vertical left side portion **35** and a right vertical portion **36**. The rear track rail **33** has a circular top track portion **37**, joined to and continuous with a vertical left side portion **38** and vertical right side portion **39**. The rails **32** and **33** are parallel to each other along their entire length and are longitudinally spaced apart along the length of the tank **26**. Generally, as shown in FIGS. **1**, **3**, **4** and **6**, these rails are "C" shaped in transverse cross section, as shown in FIGS. **4** and **6**.

The interior frame **40** is a flat rectangular rigid frame. It comprises a front vertical frame member **41**, a rear vertical frame member **42**, a top horizontal frame member **43**, a middle horizontal member **44**, a bottom horizontal member **45** and wheels, as **48** and **49**. Members **41–45** are rigid, steel box-type girders of equal transverse cross section and are firmly joined together to form a flat rigid base movable as a unit by the elevating assembly **100**. Each front and rear vertical member, as **41** and **42**, is provided with a top axle as axle **46** for member **41** and a bottom axle as axle **47** for member **41**. These axles are rigid cylindrical bars, each firmly affixed to the members **41** or **42** and are spaced apart from each other on each such member and extend forwardly and rearwardly of frame **40** and the axles are parallel to each other on each such member, as **41** and on both members **41** and **42**, the members **41** and **42** being parallel to each other. Axle **47** is parallel to the length of top horizontal bar **43** and is located with its central longitudinal axis at the level of the bottom surface of girder **43**. Axle **49** extends with its central longitudinal axis parallel to the lower bar or girder **45** and is located with its central longitudinal axis at the level of the top surface of the girder **45**. Rotatable wheels **48** and **49**, respectively, rotate about such axles **46** and **47**, respectively, and rotatably and slidably engage a groove or track in the front guide channel rail or track **32**. The rear vertical frame member **42** similarly supports a similar top rear axle like **46** and a bottom rear axle such as **47**, while wheels such as **48** and **49** are similarly rotatably located about such axle and rotatably and slidably engage the rear track or guide rail **33**. Fishplates may be used to reinforce the corners of frame **40** and, further, truss members of the same transverse cross section as the other members of frame **40** may run diagonally there across, as shown by truss members **40'**, **41'**, **42'**, **43'**, **44'** and **45'** in FIG. **6**; such truss members are not shown in FIG. **4** for purposes of clarity. The interior frame **40**, to which the lateral frame **50** and piston assembly **90** and lift arms **55** and **56** are attached, is moved up and down the rails **32** and **33** by the elevating assembly **100**.

The frame **40** also comprises rigid laterally extending piston hinge brackets firmly attached thereto for pivotally supporting the inner ends of units of the piston assembly **60** and the upper front corner of frame **40** has a front upper piston support bracket **62** to the front of rear edge of member **41** and near to the junction of girder members **43** and **41** and, to rear of front edge of member **42** has firmly attached thereto near junction of members **43** and **42** a rear upper piston hinge support bracket **64**. The front lower corner of frame **40**, to front of rear edge of member **41** at the junction of member **41** and **45**, has a front lower piston hinge support bracket **63**. The bottom rear portion of frame **40**, in front of the front edge of member **42** near junction of members **42** and **45**, has a bottom rear hinge support **65**, while the center member **44** supports, at its center, a center piston support bracket **66**.

The brackets **62**, **63**, **64**, **65** and **66** each comprises two parallel rigid ears as to **62'** and **62''** and support pins that are parallel to each other and cylindrical for pivotal support of and movement thereabout of units **92**, **93**, **94**, **95** and **96** of the piston assembly **90**.

The lateral frame **50** is a rigid, flat rectangular frame comprising front vertical member **51**, rear vertical member **52**, horizontal top member **53**, and horizontal bottom member **54** and a center vertical member **59**, together with front movable spear arm **55** and rear movable spear arm **56**.

Members **51–54** and **59** are rigid steel box-type girders of equal transverse section of the same size as members **41–45** and are firmly joined together to form a flat rectangular rigid frame movable as a unit by the members of piston assembly **60**. The lateral frame **50** also includes a movable front spear arm **55** and a movable rear spear arm **56**. The movable rear spear arm **56** is pivotally attached at rear spear hinge ears **58** and **58'** to the rear vertical frame member **52** of frame **50**, while the front arm **55** is pivotally attached by front spear hinge ear **57** and **57'** to the front vertical member frame **51** of the frame **50**. The movable arm **55** is a rigid steel plate, much longer from top to bottom than inner side to outer side, as shown in FIG. **4**, or much longer from top to bottom than from front side to back side as shown in FIG. **6**.

The rear arm **56** is a rigid plate of the same size and general shape as arm **55**, and is a mirror image thereof.

Frame **50** also comprises rigid centrally extending piston hinge brackets firmly attached thereto for pivotally supporting the outer ends of units of the piston assembly.

The frame **50** is provided with double piston hinge support brackets **68** and **69**, each with three ears, as

69', 69'' and 69''', at the front and rear ends of the upper horizontal member 53 and a piston hinge bracket 59 at middle of member 54.

The front spear arm 55 comprises a front arm end portion 72, a front arm base portion 73, a front arm base joint 70 and a front arm control hinge joint 74.

The rear end of base portion 73 has rigidly attached thereto and projecting centrally base hinge plates 75 and 76 at the rear end thereof (rear as shown in FIG. 4, although central as shown in FIG. 6). A base hinge pin 77 is supported in front frame hinge ears 57 and 57' which frame ears are each firmly attached to the front vertical frame arm member 51. Pin 77 passes through arm base hinge plates 75 and 76 and such hinge plates 75 and 76 and arm 55 pivot around pin 77 between the positions of spear arm 55 shown in FIGS. 4 and 6 and form front arm base joint 70.

Control hinge joint 74 comprises an upper and lower control joint ears 78 and 79 and a pin 89 firmly supported thereby and extending therebetween. Hinge plates 75, 76, 78 and 79 extend inwardly (as shown in FIG. 4) from the inner face of front spear arm 55 (the inner face being to the left as shown in FIGS. 4 and 6).

The front spear arm 55 is a mirror image of the rear spear arm 56. The description herein given of the front arm 55 is similar, therefore, to the description of the right arm 56 and the components thereof are substantially the same, except that these elements are mirror images of each other. The components of arm 56 corresponding to the components of arm 55 are illustrated with a referent numeral to which the letter A is added. More particularly, the rear spear arm 56 comprises a rear arm end portion 72A, a rear arm base portion 73A, a rear arm joint 74A and hinge plates assembly 74A. The rear end of base portion 73A has rigidly attached thereto a rear arm base joint 70A comprising hinge plates like hinge plates 75 and 76 at the front end thereof (front as shown in FIG. 4, although central as shown in FIG. 6). A base hinge pin as 97 is supported in rear frame hinge ears as 58 (and 58' not shown, but like 57 and 57', respectively) which ears are firmly attached to the rear vertical frame arm member 52. A pin like 77 passes through such ears and arm 56 pivots therearound between the position of spear arm 56 shown in FIG. 4 and FIG. 6.

The control hinge joint 74A comprises an upper and lower control joint ears like 78 and 79 and a pin 89A, like 89, firmly supported thereby and extending therebetween. Hinge plates of joints 74A and 70A extend inwardly, as shown in FIG. 4, from the inner face of rear spear arm 56, the inner face being to the left as shown in FIG. 4 and right as shown in FIG. 6.

The piston assembly 90 comprises a group of piston units 91–98, motor 99, a group of hydraulic control valves 190–199, a group of solenoid valve actuators 150–159 and 160–169, a group of flow control valves 180–189 and a group of electrical control switches 170–179. The switches are connected to and operate the solenoids; the solenoids are connected to and actuate the corresponding hydraulic valves, and the hydraulic valves 190–199 provide for the control of direction of hydraulic fluid to the corresponding piston units 91–99. The flow control valves 180–189 control the rate of flow to the corresponding piston units. The piston units 92 through 96 move the outer frame 50 relative to the inner frame 40 and also units 91 and 97 serve to move the arms 55 and 56 relative to the outer frame 50 and further, the piston assembly includes a motor 99 which forms a part of the elevating assembly 100 which moves the inner frame 40 relative to the frame 110 of the vehicle 21.

The main components of the piston assembly 90 is a front spear arm control piston unit 91, a top front piston unit 92, a bottom front piston unit 93, a top rear piston unit 94, a bottom rear piston unit 95, a center bottom piston unit 96, a rear spear piston unit 97, lid unit 98 and motor 99. Each of the piston units is a double-acting hydraulic piston unit and like unit 94, is composed of a rigid cylindrical shell as 84 within which, in fluid tight sealing yet movable relation, is a rigid piston head as 88 to which is firmly attached a rigid piston shaft, as 89. Each shell, as 87, is provided with one shaft extension chamber as 84 and another shaft retraction chamber as 83 to which the hydraulic lines from the control valve therefor, as 194 and 190 for piston 94, are operatively connected.

The shell of the piston unit 92 is firmly yet pivotally connected at its upper end to the pin in the ears of the front top hinge brackets, 62' and 62'' of hinge 62, while the free end of the movable piston shaft of the piston unit 92 is firmly yet pivotally connected to a pin in the ears front top bracket 68 on the front frame. The shell of the piston unit 93 is firmly yet pivotally connected at its lower end to the pin in the ears of the front bottom hinge bracket 63, while the free end of movable piston shaft of piston unit 93 is firmly yet pivotally attached to the pin around which the end of shaft 92 passes in the ears 68 although, as shown in FIG. 6, to the rear thereof. The shell of piston unit 94 is attached pivotally yet firmly at its upper end to a rigid pin on the ears of the rear top hinge bracket 64, while the shaft 62 of that piston is attached to the pin in the ears of the rear top hinge bracket 69 of outer frame 50. The piston unit 95 is pivotally attached at the lower end of its shell to the pin on the ears of the lower rear hinge bracket 65, while the free end of the movable shaft of that piston assembly 95 is pivotally attached to the pin on the ears or brackets of rear hinge bracket 69 on frame 50.

The shell of piston unit 96 is attached at its upper end to the pin held by the ears or lugs of the middle hinge bracket 66 on frame 40, while the movable shaft end of that piston unit 96 is pivotally attached to the pin held by the ears or lugs of the rear center hinge bracket 59 of the movable frame 50.

As below described detail, contraction of the piston units 92, 93, 94, 95 and 96 provide for movement of the movable outer frame 50 towards the inner frame 40, as shown in FIGS. 4 and 9, while expansion of the pistons 92, 93, 94, 95 and 96 provides for movement of and positioning of the frame 50 spaced away from and laterally of the frame 40, as shown in FIGS. 6, 7 and 8.

The piston assembly 90 also includes front and rear spear piston units 91 and 97. Front spear piston unit 91 is pivotally attached at a pivot pin 61 to front portion 135 near the front end of the lower arm 54. The lower frame arm 54 has firmly attached thereto extended portions 135 and 136 at, respectively, its front and rear ends. Portion 135 extends to the front of member 51 and portion 136 extends to the rear of member 52, respectively, as illustrated in FIGS. 4 and 6. A front base arm portion 131 of the extended portion 135 extends substantially in line with the plane of the flat surface formed by members 51, 52, 53 and 54 of frame 50. A

like rear arm base portion 132 of member 136, likewise, has its front surface coplaner, with such surface. Additionally, the front base arm portion 131 is connected at its front end to an inwardly extending front terminal portion 133 to which a upwardly extending front spear pivot pin 61 is firmly attached. The front spear piston unit 91 has its shell pivotally attached to pin 61 and extends from the pin 61 to the pin 89 of the joint assembly 74.

Similarly, the extended portion 136 has an inwardly extending rear terminal arm 134 which is joined to the rear end of rear base arm 132, while the base arm 132 is firmly joined at its front to the rear member 52 of the movable frame 50. At the rear end of the inwardly projecting rear terminal arm 134 is located a rear spear pivot pin 67. The rear spear piston unit 97 is located with its shell pivotally fixed to that rear pin 67, while the movable end of the shaft of that piston unit 97 is pivotally connected to a pin 89A of the joint assembly 74A on the rear movable or spear arm 56.

The front spear piston unit 91 serves on expansion to move the front spear arm 55 from its retracted position, whereat the length of the front spear arm 55 extends parallel to the length of frame 50 arm members 54 and 53, to the extended position of the spear arm 55, which extended position is shown in FIG. 6 and in which position the arm 55 extends perpendicularly to the members 52 and 54 of the frame 50; this movement is reversed on contraction of the piston unit 91.

Similarly, the rear spear piston unit 97 serves on expansion to move the rear spear arm 56 from its retracted position shown in FIG. 4, whereat the most lateral surface of that arm 56 is no further lateral than the outer face of the membersforming the frame 50, to the expanded position of the piston unit 97, wherein the arm 56 is firmly located so as to extend in a direction perpendicular to the plane of the outer surface of the frame 50: in such extended positions of piston units 91 and 97, the arms 55 and 56 are parallel to each other, as shown in FIG. 6.

The control of the piston units of piston assembly 90 is through the connections as diagrammatically shown in FIGS. 12, 13 and 14. More particularly and exemplary, piston 94 is controlled by the valve 194. The engine 23, under control of operator 30 in cab 24, drives a pump 85 which drives liquid 86 in the hydraulic sump 81 under pressure to either an upper chamber as 84 of the piston unit 94 or to the opposing chamber 83 for each of the units of assembly 90. Each valve as 194, in turn, is actuated to forward or reverse flow positioning of the valve core by solenoid valves 164 and 154 and is spring centered. Actuation of solenoid valve as 164 drives the plug or core of the control valve as 194 into a position whereat the high pressure fluid from the pump 85 enters the upper chamber 84 of the piston unit 94 and extends the shaft 82 thereof, while actuation of the solenoid 154 moves the valve core to provide for passage of hydraulic fluid into the opposing chamber 83 and causes the shaft 82 to move inward of the shell of the piston unit and causes contraction of the piston unit 94, such contraction bringing together the pins in hinges 84 and 69. The rate of flow to each of valves 190–199 is controlled by flow control valves 180–189, respectively.

The valve 194, accordingly, controls passage of fluid to the piston unit 94 and thereby controls its motion of expansion and contraction. The valve 165 similarly controls the passage of hydraulic fluid from the high pressure pump 85 to the piston unit 95 to provide for either its expansion or contraction. The piston unit 92 is controlled as to its expansion and contraction by the valve unit 192; the piston unit 93 is controlled as to its contraction or expansion by the hydraulic valve 193; the piston unit 96 is operatively connected to and similarly controlled as to its expansion or contraction by the hydraulic valve 196. Each of valves 190, 191, 192, 193, 194, 195, 196 and 197, 198 and 199 are controlled by one solenoid, as 160, 161, 162, 163, 164, 165, 166, 167, 168 and 169, respectively, for movement of the valve body to cause expansion of the piston units 91–97 and 99 and solenoid units 150, 151, 152, 153, 154, 155, 156, 157, 158 and 159 provide for reverse movement of such valves. The hydraulic valve 190 is operatively connected to and actuated by solenoids 160 and 150 and is operatively connected to the chambers of piston units 192, 193, 194, 195 and 196 directly so that movement of the one valve 190 provides for concurrent and simultaneous expansion of all of those units when the solenoid 160 of valve 190 is actuated, while actuation of the reverse soldnoid 150 of valve 190 provides for movement of the valve body or valve core of the valve 190 so that hydraulic fluid is passed to the piston units 92, 93, 94, 95 and 96 to provide for concurrent and simultaneous contraction of all of such piston units. Each of valves 191 and 197 are operatively connected to piston units 91 and 97, respectively; additionally, the valve 198 is operatively connected to the piston units 91 and 97 so that movement of the valve body or valve core of valve 198, by actuation of the solenoid 168 thereof, drives hydraulic fluid from the high pressure line of the discharge of pump 85 to the piston units 91 and 97 to provide for expansion thereof while actuation of the solenoid 158 of the valve 198 provides for simultaneous and concurrent contraction of such piston units; thereby, the piston units 91 and 97 are simultaneously actuated. As diagrammatically presented in FIG. 14, the motor 23 provides for charging in conventional manner a battery 23B which is operatively connected to a plurality of switches 170–179, each of which switches has two buttons or switches thereon. Switch 172 provides for actuation of either solenoid 162 or 152 and thereby controls separately the piston unit 92. Switch 173 separately controls solenoids 153 and 163 for control of the hydraulic valve 193. Switch 174 is operatively connected to and similarly provides for actuation of solenoids 164 and 154 of valve 194. Switch 175 is operatively connected to solenoids 165 and 155 for control similarly of valve 195, while switch 176 is operatively connected to solenoids 166 and 156 for similar control of the hydraulic valve 196. The switch 170 is similarly operatively connected to solenoids 160 and 150 to provide for control of the master hydraulic valve 190 and thereby on actuation of that one switch, 170, to concurrently and simultaneously actuate all of the piston units 92, 93, 94, 95 and 96. The switch 171 is operatively connected to solenoids 161 and 151 to provide for control of the hydraulic valve 191. Switch 178 is connected to solenoids 168 and 158 and accordingly provides for actuation of the hydraulic valve 198 so that hydraulic fluid under pressure from the pump 85 may be passed concurrently and simultaneously to both of piston units 91 and 97 to provide that those piston units expand, as shown in FIG. 6, or be contracted, as shown in FIG. 4.

The array of switches 170–179, accordingly, provides for concurrent or separate actuation of the piston units 92, 93, 94, 95 and 96 for movement of the girder members 51–54 of the outer frame 50 relative to the inner frame 40, as shown in FIG. 6 from the inner contracted position thereof as shown in FIG. 4 and the opposite motion.

Concurrent extension of piston units 92, 93, 94, 95 and 96 causes movement of girders 51–54 of frame 50 away from frame 40 from the position of frame 40 shown in FIGS. 4 and 5 while maintaining the girders 51–54 of frame 50 at all times parallel to frame 40. Pivotally mounted truss bars, as 96A, 96B and 93A and 95A, are firmly attached to the cylinders of piston units 96 and 93 and 95 and maintain the axes of the extendable shafts of such piston units at a right angle to the horizontal member of frame 40 to which such piston units are co-axially and pivotally attached by the hinge members therefor. Separate extension of piston units 92 and 94 causes a pivoting about pin of bracket 59 on girder 54 clockwise, as seen in FIGS. 4 through 11. Separate extension of piston unit 95 while piston units 92, 93, 94 and 95 are stationary— as when the spring return thereof holds the core of the control valve therefor in the blocking or hold position thereof as is diagrammatically illustrated in FIG. 12— the frame 50 pivots counterclockwise about the pins on the brackets 68 and 69, attached to the top horizontal girder 53, as shown in FIGS. 10 and 11.

Opposite (from the above) manipulation of switches 170–176 to effect concurrent contraction of piston units 92, 93, 94, 95 and 96 causes movement of frame 50 towards frame 40 from the position of frame 50, shown in FIGS. 6, 7 and 8, to the position of frame 50 relative to frame 40 shown in FIGS. 4 and 9, while maintaining the girder members 51–54 of frame 50 and frame 40 parallel to each other continuously.

Separate contraction of piston units 92, 93 and 96 and of units 94 and 95 and 96 and of 92 and 94 and of unit 95 causes the opposite movement above described for their extension.

The central longitudinal axis of the cylindrical piston unit 91, like in unit 94, is co-axial with the piston shaft therefor. The central longitudinal axis of piston unit 91 is coincident with a straight line extending from the center of cylindrical pin 69 on arm portion 133 to pin 89 of the hinge 74 of spear arm 55. As illustrated in FIG. 4A in the compacted position of arm 55, the straight line extends forward of the pin 77 which is held by hinge plates 75 and 76 and front frame hinge ears 57 and 57'. This straight line through the axis of piston unit 91 also clearly extends forward of hinge pin 77 of front arm of base joint 70 in the extended position of arm 55 as illustrated in FIG. 6. The spatial relation of longitudinal axis of piston unit 97, pin 67 on arm portion 134 and the pin 89A on spear arm 56 and pin of rear arm base joint 70A is functionally the same, although is mirror image relationship as above described for piston unit 91 and pins 61 and 89 and 77. These relationships provide for a positive turning action of piston unit 91 on arm 55 and piston unit 97 on arm 56 on expansion and on contraction of unit 91 and 97, respectively.

The movement of the spear arms 55 and 56 from their folded indrawn or compacted position parallel to the girder members 51–54 and 59 of frame 50, as in FIG. 4, to a expanded position extending in a direction away from the frame 40, as in FIGS. 5, 6 and 7, is simultaneously accomplished by the operator actuating the solenoid 168 through the switch 178. Hydraulic fluid then passes under pressure from the pump 85 to both of valves 191 and 192 and thence to both of piston units 91 and 92 and causes extension of such units. On such concurrent actuation of piston units 91 and 92, arms 55 and 56 are brought from the position thereof in FIG. 4 to the extended position thereof shown in FIGS. 5 and 6 concurrently and simultaneously. On release of switch 178, the spring centering of the spring centered valve 198 returns the core of such valve to the blocking or hold position as illustrated therefor in FIG. 12 and the piston units 91 and 92 then firmly hold the arms 55 and 56 respectively in such extended position.

Concurrent contraction of piston units 91 and 97, as by opposite manipulation of switch 178 to actuate solenoid 158 moves arms 55 and 56 concurrently and simultaneously from the extended position thereof shown in FIGS. 5 and 6 to the compacted traveling position thereof shown in FIG. 4. On release of switch 178, the spring centering of the spring centered valve 198 returns the core of such valve to the blocking or hold position and holds those spear members in such compacted position.

The separate switches 171 and 177 for piston units allow additionally separate actuation of either arm 55 or arm 56 so that such arms, especially the front arm 55, may, in their extended position, act as a guide member to locate frame 50 of assembly 27 while moving the frame 110 of the tank truck 21 relative to a container, as 80, to be engaged subsequently by the arms 55 and 56.

In general, refuse container 80 is a rigid open-tipped box provided with a hingedly attached lid 128 over the opening 28 therein and with horizontally elongated sleeve or pocket means 201 and 201A for engagement by the spear arms 55 and 56 whereby the container is engaged, lifted, moved, held, tipped and emptied, lowered and returned to its initial location for later filling. The container 80 comprises a front wall 119, rear wall 114, top deck 115, a bottom wall 116, inner wall 117, outer wall 118. The top deck 115 includes a pair of rigid lids 102 and 103 over top opening 106, each fastened by a hinge 104 to a top plate wall 105. Walls 105, 114, 116 and 117 are firmly joined at their edges and enclose a chamber 107 in container 80. The front and rear walls each have firmly attached to their exterior surface a rigid horizontally extending sleeve or pocket, as 201 on wall 119. The sleeve 201 has a horizontal top wall 203, vertical side wall 202, and horizontal bottom wall 204 and includes a centrally and upwardly sloped upper top mouth plate 205 and a lower mouth plate 206 that is sloped downwardly and centrally — walls 202, 203, 204 and plates 205 and 206 are formed of strong rigid steel plate firmly connected together. Rigid top and bottom buttressing plates 207 and 208, respectively (and 207' and 208') are firmly connected to the outer surface of wall 119 and to the top of top sleeve wall 203 and to the bottom of bottom sleeve wall 204, respectively, and to the outer surface of wall 119. The sloped mouth plates 205 and 206 serve to guide the end 55P of arm 55 into the pocket 209 formed between horizontal sleeve walls 203 and 204, as shown in FIGS. 5 and 7. The rear edges of plates 203–206 are firmly attached, as by welding, to container front wall 119; the lateral edge of plates 205 and 206 are firmly attached

to side walls 203 and 204 and encompass a front sleeve mouth 219 and serve as a tapered guide to pocket 209. The rear container wall 114 has a corresponding sleeve 201A with corresponding top wall 202A, bottom wall 204A, mouth top plate 205A and bottom plate 206A and encloses a rear sleeve pocket chamber 207A with a mouth 219A. Chambers 207 and 207A are accordingly open at one, central end but closed at top, bottom and front or rear end.

For purpose of the above description of the container 80, the front end 119 of the container is the end nearest the front end of the vehicle 21 and assembly 27, the rear end of the container 80 is the end thereof nearest the rear end of the truck 21 and assembly 27; the inner container wall 117 is the container wall nearest truck 21 and assembly 27 and the outer wall 118 is the wall of the container furthest from the truck 21. Walls 116, 117 and 118 are rectangular, imperforate and flat and walls 117 and 118 are parallel to each other and perpendicular to bottom wall 116.

In operation, the operator 30 guides the apparatus 20 to an area adjacent the location of a container as 80. Initially, the container 80, filled with refuse, is located at the side of a road 210 and the apparatus 20 is driven along the length of such road with the outer frame 50 in its compacted position and arms 55 and 56 in retracted position, as shown in FIG. 4. The operator 30 steers the apparatus 20 to array the frames 50 and 40 parallel to the inner face or wall 117 of container 80 and with the girders 51–54 of frame 50 spaced at a distance from wall 117 slightly more than the length of arm 55 with assembly 27 in its compacted position. The operator may partially extend frame 50 from frame 40 and while arm 56 is in its compacted position, as in FIG. 4, extend arm 55 while backing up the apparatus 20 to the container 80 to use such arm 55 as a guide to locate the point 55P of arm 55 (at end of portion 72 of arm 55) relative to the pocket 209 of container 80, then at its initial location 108. Then the operator, by use of switch 170 on panel 120, retracts frame 50 relative to frame 40 and by switch 177 extends arm 56 to the position shown in FIG. 5. Next, by switch 170, with arms 55 and 56 extended as in FIG. 6, the operator extends frame 50 relative to frame 40, as shown in FIGS. 6 and 7. The points 55P and 56P of the extended arms 55 and 56 are spaced apart the same distance as the center of pockets 209 and 209A, respectively, on container 80, and smoothly pass into such pockets. The apparatus 20 is sufficiently heavy and strong and forcefully actuated that the frame 50 may be used to push the edge of the container, e.g. the front edge of wall 117 (adjacent wall 119) if such edge be closer to the road 210 than the rear edge of wall 117 (adjacent wall 114) or the rear edge of wall 117 if needed, to bring the face 117 parallel to the frame 40 prior to engaging the tips of arms 55 and 56 in the pockets 209 and 209A. Also, as above described if needed, the frame 50 may be tilted about an axis parallel to the bottom girder member 54 of frame 50 or about the top girder 53 or about a vertical axis passing through bracket 62 and 63 or about a vertical axis passing through bracket 64 and 65 to expedite the location of arms 55 and 56 in pockets 209 and 209A of container 80.

On initial actuation of the lifting assembly, the frames 50 and 40 are slightly lifted in tracks 32 and 33, and container 80 is accordingly lifted from its prior location 108 by the arms 55 and 56, as shown in FIG. 8. Frame 50 is then retracted, as shown in FIG. 9 and moved closer to the frame 40.

After such inward movement engagement to position as shown in FIG. 9, the lid 128 of receptacle 26 is opened and the lifting assembly 100 lifts the assembly 27 and the container 80 thereon to the position shown in FIG. 10. Expansion of the piston unit 96 then rotates the frame 50 and container 80 thereon, as shown in FIG. 11 about an axis parallel to member 53 of frame 50 and contents 60 of container 80 are emptied into the chamber of transport receptacle 26.

Following emptying of the container 80, it is moved from position of FIG. 11 by contraction of the piston unit 96 to the position thereof as shown in FIG. 10, lid 128 is closed and the piston assembly 60, the assembly 27 actuated so that frames 50 and 40 are brought to their compacted and flattened position, as shown in FIG. 9 and the container 80 is lowered to the position thereof shown in FIG. 9 with the bottom of container 80 above the ground, so that assembly 27 continues to support that container: the operator 30 then extends frame 50 from frame 40, as above described, to relocate the container 80 above its prior location 108. The elevating assembly 100 is then operated by operator 30 to lower the assembly 27 and container 80 thereon and locate container 80 at its initial location with its weight resting entirely on the ground or other support at such location, as in FIG. 7. Then, by switch 170, the operator contracts piston units 92–96 and withdraws the arms 55 and 56 from the pockets 209 and 209A to bring the assembly 27 to the orientation of parts shown in FIG. 5. Then the arms 55 and 56 are driven by switch 170 to the contracted position shown in FIG. 4.

Thereupon, the apparatus 20 is moved to another location to again align the assembly 27 with another container as 80, and engage it with arms 55 and 56, lift it, dump it and return such other container to its location. Each such operation is controlled by the operator 30 in the cab 24 using the control assembly 120 and observing and controlling the operation as needed from the cab through a standard side mirror, as 112, and a periscope 109 to provide for view of the dumping operation of FIG. 11 in particular, as well as the separate stages of steering and the movement to the separate stages shown in FIGS. 5–11 and back again. One operator, 30, handles all components of the system.

The elevating assembly 100 comprises a variable displacement bidirectional motor 99, a shaft 221, reels 222 and 223, cables 224 and 225, a spring centered, solenoid controlled hydraulic central valve 199 and switch 179, in operative connection. The motor 99 is driven by valve 199 under control of switch 179 on assembly 120 in the cab 24 and is firmly supported on the frame of vehicle 21. The shaft 221 is rotatably supported on frame 110 and drives reels 222 and 223. Reels 222 and 223 each hold one end of cables 224 and 225 respectively. Cable 224 passes through front track 32, cable 25 passes through track 33: the other end of cable 224 is attached to an ear 226 on front end of member 41 of inner frame 40: the other end of cable 225 is attached to a like ear 227 on rear of frame member 42 of inner frame 40. Accordingly, the operator 30 readily controls the time and direction of movement of the frame 40 (and hence frame 50) while in cab 24.

In the preferred embodiment, dimensions are as follows:

Container 80 (3 cu. yard size):	inches

Wall 114 to wall 119	58
Pocket (209) length	16
Pocket (209) height	8
Mouth 219, max. length	12
Mouth 219, height	14
From front of Pocket* 209 to wall 117	16
From rear of Pocket 209 to wall 118	16
Height of pocket over floor 116	14 ½
Height of wall 117	42
Height of wall 118	53
Material, steel, thickness 12 gauge	

*The pocket may be added to usual pickup containers for use with the system 19.

Frames 40 and 50:

Arm 55 is 1½ × 3 inches × 34 inches steel

Pin 77 is 6 inches long, 1 inch diameter

Frame members 43, 44, 45 are 3 inches × 3 inches × ¼

Overall length of frame 40 is 84 inches

Overall height of frame 40 is 65½ inches

From top of 43 to top of 44 is 36¼ inches

Front edge of 41 to center of hinge 66 is 42 inches

All brackets of frames 40 and 50 spaced 13/16 inch apart

Center brackets are 1 1/16 inches thick

Other brackets are 1 inch thick

Distance from pin 77 to 89 is 5.8 inches, pin 89 is 1 inch diameter

Wheels 48 and the like are 4 inches diameter.

Tracks 32 and 33 are 4⅛ inches inside width and provided with grease fittings and are made of sturdy, rigid steel.

Outer frame 50 is 60 inches from front edge of member 51 to rear of member 52 and 14½ inches from bottom of 55 to bottom of arm 55.

Overall height from pin in hinge of 59 to pin of 68 is 36¼ inches (a shoulder may be placed on top of girder 53 to raise the support for hinges 68 and 69).

Container 26 is 18–42 feet long.

Container 26 is 6–10 feet diameter and up to 13 feet high.

The above dimensions are exemplary only.

A rigid straight horizontal bar 241 extends on the right side of tank 26 near its top from the rear of track 32 to the front of track 33 and is firmly attached at its front to track 32 and is firmly attached at its rear to track 33. The cylinder of a double-acting piston unit 98, which has a structure identical to that of unit 94, is pivotally attached to an ear 242 which is fixedly attached to the top of bar 241 at its middle and extends upwardly therefrom (FIG. 13). The outer end of piston shaft 244 of the piston unit 98 is pivotally attached to a pivot bracket at the outer end of a lid control arm 229 which is a rigid bar, while the other, base, end of arm 229 is rigidly attached to the lid 128 close to the lid hinge 228 therefor.

Tracks 32 and 33 are each formed of rigid steel C-sections and each is firmly attached at its bottom to the frame 110 and, further up, each is also firmly attached to the tank 26; the tank 26 is also firmly attached to the frame 110.

The valve 199 that controls the flow of hydraulic fluid to the piston unit 98 to actuate the shaft 244 thereof is the spring centered solenoid actuated valve 199 actuated by solenoid 169 to retract the piston 244 and solenoid 159 to advance it. The switch 170, which provides for actuating the elevating mechanism valve 99, thereby so actuating the piston unit 98 as well as the piston unit 99, as diagrammatically shown in FIGS. 12 and 13 and 14. Thereby, piston shaft 244 is actuated when the elevating assembly 100 is actuated to begin to open the lid 128 as soon as the assembly 27 begins to be raised from position of FIG. 9 and fully open it before container 80 is dumped into 28 and begins to close that lid when the assembly 27 begins to return to its lowered position, as shown in FIG. 9.

This invention thus provides an apparatus 20 and system 19 to effect the above-described process of handling and emptying refuse containers as 80. In summary, such process comprises the following steps:

Step 1:

Locating the side of a longitudinally elongated receptacle as 26 on a vehicle as 21 to bring its top opening 28 abreast of the container 80 with container 80 spaced laterally, as shown in FIG. 5, from vehicle 21. The container has a content of refuse 60 and such container also has a top opening 106 and a bottom 114 spaced away from each other with dimensions generally as above described for a three cubic yard container.

Step 2:

Moving the rigid frame assembly 27 with its container engaging arms 55 and 56 laterally from the vehicle 21 and extending the container engaging arms 55 and 56 from the lateral outline of the frame units 40 and 50 toward the refuse container 80.

Step 3:

Moving the container engaging arms 55 and 56 into the pockets of the sleeves 201 and 201A, followed by moving the assembly 27 up slightly, through the assembly 100, to support the container on such arms, by engaging such arms and sleeves.

Step 4:

Lifting the frames 40 and 50 and the container 80 off its former support and moving frame 50 and the container 80 thereon toward the vehicle 21 while bringing the assembly 27 into its compact position shown in FIGS. 4 and 9.

Step 5:

Raising the frame 40 and the container 80 thereon along and at the side of vehicle 21 while opening the lid 128 to the receptacle top opening 28.

Step 6:

Pivoting (relative to frame 40) the top of the container held on frame 50 in a clockwise direction, as shown in FIG. 10 (or in a directional lateral of the receptacle 26) while the container and the frame 50 pass centrally over the top by operator 30, or a programmed automatic procedure, selectively actuating extensible piston link elements 92 and 94 to tilt the rigid outer frame 50 with respect to the inner frame 40 while contracting the piston unit element 96 and expanding piston units 93 and 95. Such extension of piston units 94 and 92 and rotation of the exterior frame 50 clockwise, as shown in the FIGS. 10 and 11, or laterally of the tank 26, with the container 80 held relative to the frame 40, prevents leaking or discharge of the contents of the container 80, as it initially passes over the sloped and/or curved top of the container 26. This rotation prevents delays discharge of the contents of the container 80 until the tipping of the container 80 is rapidly effected (in step 10 following) by contraction of piston units 92 and 94 and extensions of pistons 96 after location of the container 80 with the center of its opening 106 substantially over the center of the tank opening 28. This step is accomplished utilizing the same components that were used to provide for contraction and expansion of the assembly 27 from the position shown in

FIG. 4 to that shown in FIGS. 6 and 7 so that no additional components are required for this additional movement.

Step 7:

Moving the top of the container 80 downward as the bottom of the container 114 is moved upward to a position above the opening 106 and emptying the contents 60 of the container 80 into the receptacle opening 28; this provides for a lack of leaking of the contents of the container 80 prior to when the dumping is begun, thus there isn't any substantial amount of tilting prior to the complete emptying of the container 80 into the tank 26. This avoids what would otherwise be a very undesirable dribbling of overflow from a container that had a large amount of high moisture garbage therein.

Step 8:

Returning container 80 to side of vehicle 21 in upright condition by extension of the cables 224 and 225 to allow the weight of the assembly 27 and container 80 to return the container on that assembly downward.

However, the control of the pump 85 through a switch 23S provides for a braking of the downward movement of the assembly 27 and the container 80 thereon. The mechanism for closing the lid 128 and moving the assembly 27 are so connected that the lid 128 is automatically closed over the receptacle opening 28 no later than the time of return of the container 80 to the side of the vehicle in the upright condition, as shown in FIG. 9.

Step 9:

Through the periscope 109 and mirror, as 112, the operator 30 may survey the operation of engaging, lifting, pivoting and emptying so as to control such steps through the switch assembly 120 in the cab 24.

Because of the separate control of the frame 50, with its arms 55 and 56, in compacted condition, as shown in FIG. 4, the operator, following location of the receptacle 26 with its opening 28 abreast of the container as shown in FIGS. 1 and 5, and while in cab 24, the operator 30 may move the rigid frame 50 to contact the refuse container 80 and forcefully move the container 80 to be parallel to the rigid frame 50, as well as 40. After so locating the receptacle, he moves frame 50 inward toward the vehicle 21, while still in compact condition. Following this, the container engaging arms 55 and 56 are extended from the frame 50 following which the arms 55 and 56 are engaged with the container sleeves 201 and 201A, as above described, through manipulation of control assembly 120 by the operator within the cab 24.

In this operation, the interior and exterior curved lips of each of tracks 32 and 33 hold the wheels, as wheels 48 and 49 in track 32, and thereby hold the frame 50 for movement within and along the tracks 32 and 33. This structure of the tracks 32 and 33 prevents the frame 50 from tipping, i.e. pivoting laterally about arm 45 or 43 and permits control of the position of the frame 40 relative to the tank 26 during the movement of the assembly 27 and the container 80 thereon, as above described and shown in FIGS. 4–11. The control, via assembly 120 of the frame 50 relative to the tank 28, permits the operator 30 in the cab 24 to most effectively control the above-described operations.

The distance from the bottom of container support 55 to the top bar, as 53, of outer frame 50 is the same as the distance from the bottom sleeve wall 204 to the top opening 106 of the container 80 adjacent the inner side wall 117. This provides for support of the tilted container 80 on the frame 50 during the tilting operation and emptying operation shown in FIG. 11.

The centers of sleeves 201 and 201A (measured between the inner wall 117 and outer wall 118) are vertically below the center of gravity of the container 80 in the positions of FIGS. 5 and 7 so as to provide the most stable support to the container 80 in the position of parts shown in FIGS. 10 and 11.

The container 80 has a content of refuse 60 which is predominantly solid, e.g. cans, paper, and compressable and composed of large particulate material or masses from pea-size (one-quarter inch diameter) to one-foot square package size. The term "refuse" includes garbage (60–70 percent moisture content), as well as rubbish (25–35 percent moisture content).

Because the lugs, as 62′ and 62″ of the hinges, as 62, as well as the other hinges (59–66), are heavy and wide and parallel to each other and closely embraced, the pivotal attachments of the piston units, as 92–96 thereto, the shafts of piston units 92–96 extend and retract in substantially parallel planes, although the planes in which extension and retractions occur are spaced apart from each other along the length of the frame 40 and tank 26.

Sturdy rigid diagonally extending steel truss bars as 96A and 96B (shown in FIG. 6) are firmly attached and fixed, as by welding, at their outer ends to the outer or shaft end of the piston cylinder of the piston unit 96. At the inner end of each such truss bar, as 96A, there is a lug, as 96L, whereby such bar is pivotally attached at its inner end to frame 50 by a pivot pin in a hinge (96C for shaft 96A) and the same structure is provided (at hinge 96D) for truss bar 96B. Each such truss bar hinge is formed of rigid truss bar hinge brackets (similar to brackets 62′ and 62″); each of such truss bar hinge brackets is firmly attached to the center horizontal rigid frame member 44. Each of the rear and front central piston unit hinge brackets 96C and 96D is spaced away slightly from (respectively to rear and front of) the central hinge 66 so that the length of the straight bars 96A and 96B will be at some substantial angle, e.g. 45°, to cylinder of piston unit 96 to provide strong mechanical support to the cylinder of piston unit 96.

Similar sturdy rigid truss bars 93A and 95A are similarly connected to the piston cylinder of piston units 93 and 95 respectively and hinge plates 93C and 95C, respectively. Hinges 93C and 95C on member 45 are similar to hinges 96C and 96D and are firmly attached to lower horizontal frame member 45 of frame 40 with such hinge plates located spaced away from the hinges 63 and 65 for piston units 93 and 95, respectively. The brackets of hinges 96C and 96D have pins with pivotal axes that are coaxial with each other and with the pivotal axis of pin of hinge 66 for the cylinder of piston unit 96; the brackets of hinges 93C and 95C have cylindrical pins with pivotal axes that are coaxial with each other and with the pivotal axis of pins in hinges 63 and 65 for the cylinders of piston units 93 and 95, respectively. Such truss bars provide, through the attachment of piston units 93, 95, 96 to the frame 50, support against longitudinal stress (stress parallel to length of frame 50) for frame 40 relative to frame 50 and resist any tendency for skewing of frame 50 relative to frame 40 during load-bearing operations of the assembly 27, especially during its extended position, as illustrated in FIG. 7. The truss bars 96A, 96B, 93A and 95A, through

their attachment to the cylinders, maintain the axes of the extendable and retractable shafts of piston units 93, 95 and 96 (and thereby, the remaining piston units also) at right angles to the horizontal member of frame 40 to which member such piston units are pivotally attached by the hinge members therefor (63, 65 and 66, respectively).

The wheels 25C and 25D of the vehicle are the conventional automotive truck vehicle drive wheels that rotate about horizontal axes in places parallel to the direction of the length of the frame 110 and tank 26, while the front steering wheels 25A and 25B are supported pivotally as well as rotatably supported for pivoting about vertical axes while rotating about horizontal axes.

Assembly 22 may be located as a mirror image 322 of the assembly 22 as above described, i.e. with the motor 98 and reels 223 and 222 of assembly 100 on the left side of vehicle 21 and the assembly 27 located on the right side of vehicle 21 to pick up containers as 80, on the right side of the vehicle 21 rather than as shown with motor 99, on the right and assembly 27 on left side of tank 26, as in FIGS. 1 and 3. The outline of the track assembly (as 31 of assembly 20) of such mirror image assembly 322 is shown in FIG. 3. Also, the system 19 may include the apparatus 22 as shown and another mirror image thereof as 322 to provide for engaging and lifting containers on either side of truck assembly 21; then the mirror image assembly 322 is located and operated to the rear of such assembly 22, such second assembly being located in the position shown in FIG. 3 with another opening 328 in the tank 26 to the rear of opening 28.

In summary, system 19 embodies the concept of a side loading receptacle (26)-carrying vehicle assembly 20 with only one operator required, that automatically manipulates a container 80 to align such container as needed and extends and retracts arms 55 and 56 to engage and disengage such container holding means 55 and 56 with such refuse container 80. System 19 also utilizes the ready back and forth maneuverability of the vehicle 21 relative to the pockets 201 and 201A of the container 80 while compensating, by extensible frame assembly 27, for the lack of rapid accurate controlled sideways movement of such wheeled support (21) for the container engaging means. The structure 20 also permits dumping the contents of the refuse container without dripping or dribbling prior to rapid emptying of contents 60 of container 80 into the tank opening 28 and avoids forceful and noisy engagement of the to-be-emptied container on the body or frame of the receptacle into which the contents 60 of such refuse container is to be emptied.

We claim:

1. A system for handling, lifting, emptying and returning a refuse container comprising a refuse container handling and transport assembly and a refuse container for use therewith, said refuse container handling and transport assembly comprising a wheeled support frame, an elevator assembly on the wheeled frame, and a container engaging assembly movably supported by said elevator assembly frame,

1. said wheeled support frame comprising a rigid base frame, a mechanical power source on said base frame, a steering assembly comprising steering wheels operatively attached to the frame and traction wheels operatively connected to said power source; a refuse receptacle supported on said frame and open at its top, at a top opening for said receptacle, a top lid movable over said top opening into opening and closing relationship therewith; means for closing and opening said lid over said top opening operatively attached to said lid, and

2. said elevator assembly comprising a track assembly and a frame moving means,

a. said track assembly comprising a pair of parallel rigid vertically extending tracks, both of said tracks firmly attached to the base frame and longitudinally spaced apart along the said frame, one near each end of said top opening of said receptacle, each track also extending upwards along one side of said receptacle and over a portion of the top thereof;

b. the frame moving means comprising a power source supported on said base frame and operatively connected to said container engaging assembly;

3. said container engaging assembly comprising an expansible frame assembly, a container engaging means, and a positioning control assembly therefor, said container engaging means supported on said expansible frame assembly, which assembly is movably supported on said track means and operatively connected to said frame moving means;

a. said expansible frame assembly comprising an interior frame, an exterior frame with a container engaging means and a control and positioning assembly;

i. the interior frame comprising rigid vertically spaced apart horizontally extending upper and lower members and rigid horizontally spaced apart vertically extending front and rear members firmly joined together and forming a rigid flat frame, said interior frame also including movable support means extending to and movably held on said track assembly, said frame moving means comprising power means and power transmission means connected thereto for moving said interior frame along said track means by support means connected to said interior frame;

ii. the exterior frame comprising vertically spaced apart horizontally extending exterior frame front and rear vertical members and horizontally spaced apart vertically extending exterior frame horizontal top and bottom members firmly joined together to form a rigid outer frame located lateral of said interior frame;

b. said container support engaging means comprising rigid container arm support means movably supported on said exterior frame and extensible at right angles from said exterior frame, and extension and retraction means on said outer frame connected to said container arm support means to position said rigid container arm support means on said exterior frame;

4. said frame positioning control menas comprising means for supporting said outer frame on said inner frame and for moving said outer frame toward and away from said inner frame and for pivoting said outer frame about horizontal axes relative to said inner frame, and

5. said refuse container comprising vertically extending imperforate rigid front wall, rear wall, inner

side wall and outer side wall and a rigid horizontal bottom wall, all firmly joined together, and a top opening between said front, rear, and side walls, a movable cover over said top opening, and,

a. on the front wall of said container, a horizontally extending pocket chamber formed by a horizontally extending rigid top sleeve wall firmly attached to the exterior of said front wall, a horizontally extending rigid, bottom sleeve wall firmly attached to the exterior of said front wall, and a rigid vertical wall between said front top sleeve wall and front bottom sleeve wall and spaced away from said front wall, whereby said front, top and vertical walls define a front pocket open to the plane of said inner side wall; and also, on the rear wall of said container, a horizontally extending rigid top sleeve wall firmly attached to the exterior of said rear wall between said side walls, and a horizontally extending rigid rear bottom sleeve wall firmly attached to said rear wall and a vertical wall between said rear top sleeve wall and rear bottom sleeve wall and spaced away from said rear wall and said sleeve walls and forming a rear pocket facing the plane of said inner side wall, said front and rear pockets each having a cross-section parallel to the plane of the inner side wall which is larger than the cross-section of the rigid container arm support means on said exterior frame, said rigid container arm support means on said exterior frame being a distance from each other that is the same distance as the distance between the front and rear pockets on said container.

2. Apparatus as in claim **1** wherein said frame control and positioning means comprises, in operative combination, a plurality of extensible double-acting piston units, each such piston unit comprising a piston cylinder and an extensible shaft therein, each such piston unit having a pivotal connection means at each end thereof;

a. one pair of said piston units extending from a first pair of co-axial pivotal connections at the front and rear upper portions of the inner frame to a second pair of co-axial pivotal connections at the front upper and rear upper portion of said outer frame;

b. a second pair of piston units each vertically spaced away from and below said first piston units and extending from a third pair of co-axial points of pivotal attachment on said inner frame to a fourth pair of co-axial pivotal connections on the outer frame near the lower portion of said outer frame, said third pivotal connections and said first pivotal connections being vertically spaced apart from each other in one direction and said fourth pivotal connections and said second pivotal connections being vertically spaced apart from each other in the same one direction, and

c. a third piston unit extending from a fifth pivotal connection on the lower portion of said inner frame to a sixth pivotal connection on the upper portion of said outer frame, said fifth pivotal connection on said outer frame and said sixth pivotal connection being vertically spaced apart, and

d. said sixth pivotal connection being co-axial with said second pivotal connections.

3. Apparatus as in claim **2** comprising also, in operative connection,

a. a driver's seat, controls for said steering assembly and power source adjacent said driver's seat,

b. first control means operatively connected to all of said double-acting pistons to concurrently expand or contract all of said first pair of piston units, said second pair of said piston units and said third piston units,

c. and second control means operatively connected to said frame moving means and, for concurrent operation thereof, to said means for closing said lid over said top opening,

d. and separate control means for said first piston units, separate control means for said second piston units and separate control means for said third piston unit, and

e. means for surveillance of said top opening and lid located adjacent said first and second control means, said first control means and said second control means and said separate control means and said means for surveillance being located in a zone adjacent said driver's seat.

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