A refuse disposal system includes a relatively small refuse collection truck including a chassis and a hopper, including a packer, for receiving refuse. A body has a bottom, side walls, and a cover and defines an opening in a side wall. The chassis includes detachment and manipulation apparatus with the body being detachably mounted on the detachment and manipulation apparatus in communication with opening for moving refuse thereto with the body in a collecting position. The detachment and manipulation apparatus is designed to move the body from the collecting position to a hauling position and to detach the body in the hauling position. A relatively large haul vehicle has a chassis with a plurality of body receiving frames mounted thereon positioned to receive the body from the collecting truck when the body is moved by the detachment and manipulation apparatus from the collecting position to the hauling position.
REFUSE COLLECTION SYSTEM AND METHOD

FIELD OF THE INVENTION

[0001] This invention relates to a refuse collection system and more specifically to a refuse collection system utilizing collection trucks with removable bodies.

BACKGROUND OF THE INVENTION

[0002] In the refuse collection industry, a large variety of different trucks are used to travel door-to-door for the collection and ultimate disposal at a refuse site. In recent years there has been a tendency toward increasing the size of the collection trucks so that the trucks could stay on a route longer without having to travel to the disposal site so often. Further, increase in size and therefore payload has been needed because disposal sites have become fewer and further apart in response to regulatory requirements, and therefore hauls of longer and higher payloads are needed.

[0003] Because of this increase in size and consequently the weight, there is a substantial increase in the cost of the collection trucks and in maintenance. By increasing the size, fewer trucks are used, to reduce costs, and, thus, any downtime or maintenance cuts into the operating fleet to a greater extent. Also, the need to travel to and from disposal sites reduces actual collection time. Further, because of the increased size, maneuverability is reduced and it is more difficult for drivers to access small alleys, cul de sacs, and other physically restricted areas in which refuse containers are most likely to be situated. Thus, the increased size can further increase collection time and, therefore, costs.

[0004] It would be highly advantageous, therefore, to remedy the foregoing and other deficiencies inherent in the prior art.

[0005] Accordingly, it is an object of the present invention to provide a new and improved refuse collection system and method of operation.

[0006] Another object of the invention is to provide a new and improved refuse collection system that is easier to manufacture and maintain.

[0007] And another object of the invention is to provide a new and improved refuse collection system that is less expensive to manufacture and operate.

[0008] Still another object of the present invention is to provide a new and improved refuse collection system that includes more maneuverable collection trucks.

[0009] A further object of the present invention is to provide a new and improved refuse collection system including detachable truck bodies or refuse containers that greatly simplify manufacturing, operation, and maintenance.

[0010] A further object of the present invention is to provide a new and improved hauling method whereby the maximum loads permitted on the highways may be hauled.

[0011] A still further object of the present invention is to provide a new and improved flexible system where hauling can be scheduled at convenient times for hauling and collection can be independently scheduled at convenient times for collecting.

SUMMARY OF THE INVENTION

[0012] Briefly, to achieve the desired objects of the instant invention in accordance with a preferred embodiment thereof, provided is a refuse disposal system including a refuse collection truck with a chassis and a hopper for receiving refuse and the hopper includes a packer. A body has a bottom, side walls, and a cover and an opening in the front wall to receive refuse from the hopper. The chassis includes detachment and manipulation apparatus with the hopper being mounted on the detachment and manipulation apparatus and the body being detachably mounted on the detachment and manipulation apparatus so that the opening is in communication with the hopper for receiving refuse therefrom with the body in a collecting position. The detachment and manipulation apparatus is designed to move the body from the collecting position to a hauling position and to detach the body in the hauling position. In this specific embodiment, packer reciprocating apparatus is included for reciprocating the packer within the hopper to move refuse from the hopper into the body through the opening with the body in the collecting position, although other packer apparatus (e.g., a swinging platen) could be used.

[0013] From the disclosure, it will be understood that the collecting truck is capable of moving full bodies from the attached collecting position to a detached hauling position at a body receiving station, which can be the ground, a haul vehicle, or any intermediate location. Further, the collecting truck can also pick up empty bodies from the body receiving station, moving the bodies from the detached haling position at the body receiving station to an attached collecting position on the collecting truck.

[0014] To further achieve the desired objects of the instant invention in accordance with a preferred embodiment thereof, a haul vehicle is provided including an elongated chassis with wheels attached thereto. A plurality of body receiving frames are transversely mounted on the chassis with each body receiving frame being positioned to receive a body from a refuse collecting truck when the collecting truck is moved to a position adjacent the haul vehicle. Each body receiving frame of the plurality of body receiving frames includes transversely extending support members affixed to the chassis and a lifting frame pivotally attached to the support members with the lifting frame further including attachment apparatus to detachably couple bodies to the lifting frame. Each body receiving frame of the plurality of body receiving frames includes a hydraulic cylinder coupled between the lifting frame and the transversely extending support members for moving the lifting frame between a horizontal body receiving position and a raised body dumping position.

[0015] A preferred method, of disposing of refuse in accordance with the present invention includes the steps of providing a relatively small collection truck including a chassis and a first detachable body attached to the chassis; filling the first detachable body with refuse; providing a relatively large haul vehicle designed to receive a plurality of detachable bodies thereon; using the collection truck, moving the filled first detachable body to the haul vehicle, placing the filled first detachable body on the haul vehicle, and detaching the first detachable body from the collection vehicle and attaching the first detachable body to the haul vehicle; moving the collection vehicle to an empty second
detachable body attached to the haul vehicle, detaching the second detachable body from the haul vehicle and attaching the second detachable body to the collection truck; and filling the second detachable body with refuse. The process is continued until all of the available detachable bodies are filled or until the refuse in that specific area is collected.

[0016] It is anticipated that in at least some instances the haul vehicle will be a trailer. Further, in some systems or methods of operation, the haul vehicle with a plurality of empty bodies thereon might be hauled by the collection truck, using an appropriate converter dolly adapter, to the collection site. The collection process is performed by the collection truck until the some or all of the empty bodies are filled and reassembled on the haul vehicle. The haul vehicle can then be hauled to a disposal site by a larger tractor normally assigned to several haul vehicles.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The foregoing and further and more specific objects and advantages of the instant invention will become readily apparent to those skilled in the art from the following detailed description of a preferred embodiment thereof taken in conjunction with the drawings, in which:

[0018] FIG. 1 is a perspective view of a refuse collection truck in accordance with the present invention;

[0019] FIG. 2 is a perspective view of the collection truck of FIG. 1, illustrating detachment of the body;

[0020] FIG. 3 is an enlarged perspective view of the refuse hopper of the collection truck of FIG. 1;

[0021] FIG. 4 is an enlarged sectional side view of the hopper as seen from the line 4-4 of FIG. 1;

[0022] FIG. 5 is a top sectional view of the hopper and operating mechanism as seen from the line 5-5 of FIG. 4;

[0023] FIG. 6 is an exploded view in perspective of the body detaching and manipulating apparatus of the collection truck of FIG. 1;

[0024] FIG. 7 is an enlarged sectional view, portions thereof broken away, illustrating one of the body latching mechanisms incorporated in the body detaching and manipulating apparatus of FIG. 6.

[0025] FIG. 8 is a sectional view of the refuse hopper and body inlet as seen from the line 8-8 of FIG. 1, illustrating refuse collection in broken lines;

[0026] FIG. 9 is a side view of the collecting truck of FIG. 1 illustrating steps in the body detachment operation in broken lines;

[0027] FIG. 10 is a view in top plan of the collection truck of FIG. 1, illustrating the body position in broken lines;

[0028] FIG. 11 is an enlarged sectional view, portions thereof broken away, as seen from the line 11-11 of FIG. 10;

[0029] FIG. 12 is a perspective view of a haul vehicle with several collection truck bodies affixed thereon;

[0030] FIG. 13 is a perspective view of a trailer for the hauling of multiple collection truck bodies, illustrating the body detaching and manipulating apparatus;

[0031] FIG. 14 is an enlarged side/rear view of a collection truck detaching a body and placing it on a haul vehicle or, conversely, removing the body from the haul vehicle and attaching it to the collection truck;

[0032] FIG. 15 is a rear view of a haul vehicle dumping a body at a disposal site;

[0033] FIG. 16 is an enlarged, exploded perspective view of one of the body detaching and manipulating apparatus of the haul vehicle in FIG. 12 or 13;

[0034] FIG. 17 is a view in top plan of one of the body detaching and manipulating apparatus of the haul vehicle, portions of the haul vehicle broken away;

[0035] FIG. 18 is a sectional view of the body detaching and manipulating apparatus of the haul vehicle as seen from the line 18-18 of FIG. 17 with an adjacent body attached and partially broken away;

[0036] FIG. 19 is an enlarged sectional view of the latching mechanism, portions thereof broken away, as seen from the line 19-19 of FIG. 18;

[0037] FIG. 20 is an enlarged sectional view of the dumping mechanism for a haul vehicle with the cover latching mechanism for a body latched and the relative position of the cam actuating mechanism on the haul vehicle;

[0038] FIG. 21 is a sectional view similar to FIG. 20, illustrating the cover unlatching and dumping operation; and

[0039] FIG. 22 is a side view illustrating a trailer coupler for coupling the trailer of FIG. 13 to the collection truck of FIG. 1.

DETAILED DESCRIPTION OF THE DRAWINGS

[0040] Turning now to the drawings, attention is first directed to FIG. 1, which illustrates a refuse collection truck, generally designated 10, in accordance with the present invention. Truck 10 includes a cab and attached chassis and wheels 12, a detachable body 14, and a refuse hopper 16. The attached chassis of truck 10 includes body detaching and manipulation apparatus, generally designated 20 and explained in more detail presently, which is maneuverable to move detachable body 14 and hopper 16, as illustrated in FIG. 2 for transfer of body 14 to a haul vehicle or to the ground as shown. Generally, body detaching and manipulation apparatus 20 holds body 14 in a collection position, shown in FIG. 1 and moves it to a haul position, shown in FIG. 2, when full. Conversely, body detaching and manipulation apparatus 20 moves an empty body 14 from the haul position to the collecting position on truck 10 after a full body 14 is removed. Generally, bodies 14 in the haul position, stored temporarily or otherwise, will be located at a body receiving station, which may be on the ground, on a haul vehicle (described in more detail presently), or at any other convenient location. It can also be seen from FIG. 2 that detachable body 14 has a refuse inlet opening 30 in front wall 32 which is situated to receive a front hopper end 34 (directed rearward on the chassis) of hopper 16 therein when attached to the frame of truck 10.

[0041] Referring to FIG. 3, hopper 16 is illustrated and includes a housing 36 with a bottom 38 and opposed generally L-shaped sides 39 and 40 defining a refuse receiv-
A packer 44 is mounted in refuse receiving area 42 for horizontal reciprocating movements between a forwardly extended packing position and rearward-at-rest position designed to force refuse out of area 42, through opening 30 in body 14, and to pack the refuse within body 14. An inclined surface 45 is positioned between the vertically upwardly extending portions of L-shaped sides 39 and 40 to aid in directing refuse dumped onto hopper 16 into refuse receiving area 42, i.e. on the exposed surface of bottom 38 and in front of packer 44. A horizontally slideable or extendable curtain 46 is attached to packer 44 and prevents refuse from falling into the area behind packer 44, as packer 44 moves horizontally forward to the packing position in hopper 16. As packer 44 moves rearwardly (i.e. returns to the at-rest position), curtain 46 retracts or slides beneath inclined surface 45 to force any refuse residing therein into area 42 in front of packer 44.

Referring additionally to FIG. 4, it can be seen that the ends of bottom 38 and sides 39 and 40 define the front end 34 of hopper 16 which extends a short distance into opening 30 of body 14. Packer 44 is operated by a pair of hydraulic cylinders 50 which move packer 44 between the at-rest position adjacent a rear wall of hopper 16 and the packing position extending partially into opening 30 of body 14, as shown in FIG. 5. As can be seen best in FIG. 4, the rear end of curtain 46 is slideably engaged along either edge in guide tracks 52 and the front end is attached to packer 44. As packer 44 reciprocates between the at-rest and the packing positions, curtain 46 slides in guide tracks 52 from a position in which it is substantially enclosed beneath inclined surface 45 into the covering position over refuse receiving area 42, illustrated in FIG. 4.

Referring to FIG. 6, body detachable and manipulation apparatus 20 of the collection truck is illustrated in detail. Apparatus 20 includes a chassis frame 60, a hoist frame 62, and a slide frame 64. Chassis frame 60 is a fixed part of the chassis of truck 10 and basically serves to mount the other components of apparatus 20. The rear end of chassis frame 60 has pivot plates 65 attached to opposite corners so as to extend rearwardly from chassis frame 60. Hoist frame 62 has downwardly extending pivot plates 66 attached to opposite corners so that hoist therethrough coaxially mate with holes through pivot plates 65. Pivot pins 67 extend through the holes in pivot plates 65 and 66 to pivotally attach hoist frame 62 to chassis frame 60.

Downwardly extending struts 70 are attached midway along the length of chassis frame 60 at opposite sides thereof to horizontally mount an axle 72 under chassis frame 60. A hydraulic cylinder 74 has one end attached to axle 72 and the opposite end attached to a pivot plate 75 at the front end of hoist frame 62. It will of course be understood that a pair of hydraulic cylinders 74 could optionally be used on either side of chassis frame 60, as illustrated in FIG. 10, if preferred. When activated, hydraulic cylinder 74 moves hoist frame 62 from the horizontal position, shown in solid lines in FIG. 9, to a vertical position, shown in partially broken lines in FIG. 9.

Referring again to FIG. 6, it can be seen that the elongated side members of hoist frame 62 are formed as horizontal guides to slideably receive elongated side members of slide frame 64 therein. As explained in detail below, body 14 of truck 10 is detachably connected to slide frame 64. Slide frame 64 is constructed to move between a forward position, in which body 14 is fixedly latched thereto and end 34 of hopper 16 is engaged in opening 30 of body 14, and a rearward position in which body 14 is detached from slide frame 64 and hopper 16. A hydraulic cylinder 80 has one end pivotally attached to a cross member at the rear end of hoist frame 62 and the other end pivotally attached to the under side of slide frame 64. Thus, activation of hydraulic cylinder 80 causes slide frame 64 to move within hoist frame 62 between the forward, or body latched, position and the rearward, or body unlatched, position. It should be understood that hydraulic cylinder 80 is designed so that it may be used to raise body 14 if needed to place it on the haul frame or to lower body 14 if needed to place it on the ground, depending on the location of body receiving stations or the like.

The forward ends of the elongated side members of slide frame 64 are formed in an upwardly offset configuration and bottom 38 of hopper 16 is affixed thereto so as to be vertically offset slightly above the remainder of the elongated side members. Slide frame 64 also includes a pair of cross-member plates 82 and 84 spaced apart along the length thereof. Each cross member plate 82 and 84 has a central portion that extends slightly above the upper surfaces of the elongated side members of slide frame 64 and the elongated side members of hoist frame 62 to aid in supporting body 14 therewith.

Body 14 is provided with a pair of elongated, spaced apart runner-like members 86 that extend along the lower surface and up the rear side (see FIGS. 1 and 6). With body 14 correctly positioned on slide frame 64, runner-like members 86 (on the lower surface) are slideably positioned on the upper surface of cross member plates 82 and 84. When body 14 is moved to a haul vehicle (described in detail below) runner-like members 86 on the rear surface are slideably positioned on the haul vehicle. Each runner-like member 86 has a pair of spaced apart forwardly opening hooks 90 fixedly attached thereto. Each hook 90 is formed with a generally L-shape and the end of one arm is attached to one of runner-like members 86 and the other arm extending forwardly (see FIG. 7). Hooks 90 are positioned to slide under the rear edges of cross member plates 82 and 84 to firmly engage body 14 on slide frame 64. Hooks 90 on the rear surface of body 14 open upwardly (see FIGS. 1 and 6) for a similar purpose when positioned on haul vehicles.

A pair of latches 92 are pivotally attached to the underside of cross member plate 84 and positioned to engage a rear surface of each hook 90 as they engage the rear edge of cross member plate 84, as illustrated in FIG. 7. Each latch 92 has a hydraulic or air actuated cylinder 94 attached thereto for pivoting latch 90 between a locked position in which the associated hook 90 is latched in position (see FIG. 7) and an unlocked position in which the associated hook 90, and body 14, are free to slide rearwardly with respect to slide frame 64. It can be seen that the front end of latch 92 is formed to engage the leading end of hook 90 and cam the latch downwardly to allow hook 90 to slide into the engaged position with cross member plate 84 even when latch 92 is initially in the locked position. Thus, the four hooks 90 hold body 14 firmly on slide frame 64 and the two latches 92 lock body 14 firmly in the engaged position.

With body 14 firmly engaged and locked onto slide frame 64 and with hoist frame 62 in the horizontal position
and slide frame 64 in the body latched position, as shown on FIG. 1, refuse can be dumped into hopper 16 (see FIG. 8) and packer 44 is operated to force the refuse into body 14 and pack the refuse until body 14 is filled. At this time the operator of collection truck 10 drives the truck to a position adjacent a haul vehicle, or other body receiving stations (e.g. on the ground, etc.), for detaching and transfer of the full body 14 to the haul vehicle or other body receiving stations and for removing and attaching an empty body 14 onto collection truck 10.

[0050] Referring to FIG. 12, a typical haul vehicle can be, for example, a much larger semi-truck 100 including a tractor 102 and a trailer 104. In a typical example, a single body 14 can hold approximately a five ton load (fully loaded), and the complete weight of collection truck 10 with fully loaded body 14 is approximately 26,000 pounds (13 tons). In addition to being highly maneuverable and small enough to gain easy access to alleys and other physically restricted areas, an added advantage of a collection truck of this size is that the gross weight is below the 26,000 GVW dictated by federal regulations to require an additional license.

[0051] In the disclosed collection system, haul vehicle 100 can be designed to carry, for example, five bodies 14 with the number of bodies depending upon the specific system or application. While designing trailer 104 to carry five bodies 14 results in a haul vehicle length approximately equal to a standard semi truck, it will be understood that a haul vehicle can be designed to carry substantially any number of bodies 14. In practice, it is contemplated that haul vehicle 100 could include trailer 104, which attaches directly to tractor 102, and/or one or more trailers 106, as illustrated in FIG. 13, that attach to tractor 102 in a conventional manner. In the collection method, it is preferred that haul vehicle 100 or 106 is parked at an easily accessible intermediate point generally centrally located in the collection area for minimum travel by collection truck 10.

[0052] Here it should be understood that as a part of the collection process, either trailer 104 or trailer 106, containing a plurality of empty bodies (i.e. body 14) thereof, is towed to the intermediate point in the collection area. To perform this part of the process, haul vehicle 100 could be driven to the intermediate point and simply parked as the collection process proceeds. In a more efficient procedure, tractor 102 could tow trailer 104 to the intermediate point, unhook trailer 104, and proceed to tow other trailers to other intermediate points. Alternatively, collection truck 10 could tow trailer 106 with empty bodies therein to the intermediate point, complete the collection process, and a larger tractor, e.g. tractor 102 could come to tow trailer 106, with filled bodies 14 thereon, to the disposal area. To aid in coupling trailer 106 to collection truck 10, a wheeled connection dolly 107, similar to that illustrated in FIG. 22, can be used if desired. It will be understood that, generally, collection truck 10 is too small to tow trailer 106 when it contains a plurality of filled bodies 14 but in many instances it is large enough to tow trailer 106 when it contains empty bodies 14. Thus, for example, collection truck 10 could tow trailer 106 to the intermediate point, proceed to collect refuse until the bodies on trailer 106 are all filled, at which time larger tractor 102 would arrive and tow trailer 106 to the disposal area.

[0053] As can be seen in FIGS. 12 or 13, haul vehicle 100 or 106 includes a plurality of body receiving frames 110 spaced therealong. Body receiving frames 110, as will be explained in more detail presently, extend generally transverse to the longitudinal axis of haul vehicle 100 or 106 and each body receiving frame 110 is designed to have a body 14 detachably positioned thereon. As stated above, the operator of collection truck 10 drives to a position adjacent haul vehicle 100 or 106 for detaching and transfer of the full body 14 from collection truck 10 to the haul vehicle. Similarly, the operator drives to a position adjacent haul vehicle 100 or 106 for transfer and attaching of an empty body 14 from the haul vehicle to collection truck 10.

[0054] Referring additionally to FIG. 14, an intermediate step in the transfer is illustrated. The operator backs collection truck 10 adjacent to and in lateral alignment with one of the body receiving frames 110 on haul vehicle 100 or 106. Hydraulic cylinder 74 is actuated to move hoist frame 62 from the horizontal position to the vertical position as shown in FIG. 14. Body 14 is now positioned on the aligned one of body receiving frames 110 on trailer 104. When the positioning process is completed, the two hydraulic cylinders 94 are activated to disengage latches 92 from hooks 90. If a filled body 14 is being transferred to the haul vehicle, in this instance trailer 104, hydraulic cylinder 80 (see FIG. 6) is actuated to move slide frame 64 vertically upwardly to disengage hopper 16 from opening 30 in body 14 and to disengage hooks 90 from cross-member plates 82 and 84 so that body 14 is detached from collection truck 10. Collection truck 10 is then moved into alignment with an empty body 14 on trailer 104 and the process is reversed to attach the empty body 14 to collection truck 10. The process is repeated as many times as is required to either fill all of the bodies 14 on the haul vehicle or to complete refuse collection in the specific area.

[0055] Turning to FIG. 16, an exploded view of a single body receiving frame 110 is illustrated with an assembled view illustrated in FIG. 17. Since body receiving frame 110 can be mounted on either trailer 104 or trailer 106 (or any other haul vehicle that might be devised) a pair of spaced apart channels are illustrated to represent the chassis (hereinafter designated 112) of the haul vehicle. A pair of spaced apart transversely extending support members 114 is attached to the upper surface of chassis 112. A cross-plate 116 is attached to the outermost end of support members 114 and carries blocks 118 adjacent the ends of support members 114, positioned to form yokes for the mounting of a lifting frame 120. The ends of support members 114 and blocks 118 are bored to provide an axially extending opening for receiving pivot pins 122. As shown in FIG. 18, additional braces 123 may be provided to add support to the extended end of body receiving frame 110.

[0056] Lifting frame 120 includes a pair of transversely extending support members 124 affixed together by crosspieces 126 and 128. Support members 124 are spaced apart such that in the horizontal position they are positioned between and parallel with support members 114 and the ends, which are positioned in the yokes formed by blocks 118, are bored so that pivot pins 122 extend therethrough and pivotally mount lifting frame 120 for movement between the horizontal position and a vertically raised position. A pair of lifting hydraulic cylinders 130 is provided with one end of each being attached by a pair of yokes 132
to chassis 112 and the other ends attached to cross-piece 128 by yokes 134 formed therewith. Activation of hydraulic cylinders 130 moves lifting frame 120 between the horizontal and the vertically raised positions, as illustrated in FIG. 18.

[0057] Four attaching pins 140 are affixed to the inner surfaces of support members 124 so as to extend inwardly therefrom. Attaching pins 140 are positioned to be engaged by the four hooks 90 on the rear wall of body 14 (best seen in FIG. 1) for attaching body 14 to lifting frame 120. A pair of latches 142 (similar to latch 92 in FIG. 7) are pivotally attached, one each, to the inner surfaces of support members 124. A pair of air or hydraulic cylinders 144 is attached to latches 142 to move latches 142 between latched and unlatched positions with hooks 90 (a latched position is illustrated in FIGS. 18 and 19). It should be noted that in some instances air cylinders work better because the air can be compressed to act like a spring, which lets the hook open when the body is slid into place and then close automatically to lock the body in place.

[0058] Thus, when the operator of collection truck 10 backs the truck into position adjacent body receiving frame 110, as shown in FIG. 14, hooks 90 of body 14 engage attaching pins 140 to attach body 14 to body receiving frame 110. If a full body 14 is positioned on lifting frame 120, air or hydraulic cylinders 94 are activated to unlatch or disengage latches 92, air or hydraulic cylinders 144 are activated to engage latches 142 (or air cylinders automatically open sufficiently to receive the body and then close to lock it in place), and hydraulic cylinder 80 is activated to raise sliding frame 64 so that hooks 90 are disengaged and hopper 16 is removed from opening 30. Once the delatching operation is completed, the operator can pull collection truck 10 forward and align it with an empty body 14 on the haul vehicle or on the ground and initiate a latching operation for the next body.

[0059] When all, or at least some, of the bodies 14 on either trailer 104 or 106 are filled, haul vehicle 100 transports the trailer to a disposal area. Hydraulic cylinders 130 on each body receiving frame 110 with a filled body 14 are activated to raise lifting frame 120 vertically, as shown in FIG. 15. As explained and shown, opening 30 in side 32 of body 14 is disposed upwardly during the transfer procedure. Body 14 also includes a cover 160 which is oriented on the top of body 14 when body 14 is positioned on collection truck 10 for the collection operation (see FIG. 1). After body 14 is moved to the haul vehicle and detached from collection truck 10, cover 160 is oriented on the side facing away from collection truck 10 (see FIG. 14). Thus, when lifting frame 120 and attached body 14 are raised vertically refuse within body 14 can flow out when cover 160 is disengaged.

[0060] Referring to FIGS. 20 and 21 it can be seen that cover 160 is held in a closed position by two pivotally mounted latches 162. Latches 162 are pivotally mounted, one each, on runner-like members 86 on the rear side wall (the wall opposite front wall 32 with opening 30 therein) adjacent the upper end so as to latch cover 160 firmly closed in the cover engaging orientation (see FIG. 20). Latches 162 are each biased into the closed position by compression springs 164 positioned between a surface of latches 162 and members 86. Also, each latch 162 includes a cam follower surface 166 formed in a lower surface thereof. To perform the cover disengaging operation, a pair of cam acting protrusions 168 are affixed to cross-plate 116 of body receiving frame 110. Protrusions 168 are positioned to engage cam follower surfaces 166, one each, so as to disengage latch 162 from cover 160, as lifting frame 120 is moved from the horizontal position to the vertically raised position. With the disengagement of latch 162, cover 160 is free to swing open and allow refuse to flow from body 14, as illustrated in FIGS. 15 and 21. Because of the angled shape of the front of latch 162, when cover 160 is swung back toward the closed position latch 162 will be cammed open against the bias of spring 164 sufficiently to allow cover 160 to close and to be re-engaged by latch 162.

[0061] While the embodiments illustrated include a body with an opening in the front wall and a cover on the top, it will be understood that other structures might be utilized in specific applications. For example, in some applications it may be desirable to have the option to dump refuse from the body directly from the collection truck. This may be especially true under certain circumstances, e.g. breakdowns or maintenance problems in either the collection truck of the hauling vehicle. However, in the embodiment illustrated, the detachment and manipulation apparatus rotates the body ninety degrees, which is sufficient to bring the cover and top opening into a vertical position but is not sufficient for convenient and complete dumping of refuse from the body. Thus it may be convenient to provide the primary cover and dumping opening in the top and/or a second cover and dumping opening in the back wall or in one of the side walls.

[0062] Also, in the embodiment illustrated, the body is rotated ninety degrees as it is positioned on a haul vehicle. However, it will be understood that in some applications it may be convenient to simply slide the body rearward or sideways onto a haul vehicle. With only slight modifications to the detachment and manipulation apparatus, the body could be rotated (as shown) and/or slid rearward or sideways to move it from the collection position to a hauling position and to detach the body. Also, in such systems the additional or differently positioned cover and dumping opening might be used in place of the cover illustrated.

[0063] Thus, a new and improved refuse collection system and method of operation are disclosed. The new and improved refuse collection system is easier and less expensive to manufacture, maintain and operate. Also, the new and improved refuse collection system includes more maneuverable collection trucks that can easily gain access to and maneuver in close or small alleys and other physically restricted areas in which refuse containers are most likely to be situated. From the above description it will be understood by those skilled in the art that the detachable bodies, collection trucks and hauling vehicles can be provided in a variety of different configurations but the disclosed body, collection truck and hauling vehicles are preferred because of the disclosed advantages in operation. For example, in some instances it may be convenient to slide the body rearwardly or sideways to the haul vehicle.

[0064] Various changes and modifications to the embodiment herein chosen for purposes of illustration will readily occur to those skilled in the art. To the extent that such modifications and variations do not depart from the spirit of the invention, they are intended to be included within the scope thereof which is assessed only by a fair interpretation of the following claims.
[0065] Having fully described the invention in such clear and concise terms as to enable those skilled in the art to understand and practice the same, the invention claimed is:

1. A refuse disposal system comprising:
   a refuse collection truck including a chassis and a hopper for receiving refuse, the hopper including a packer;
   a body having a bottom, side walls, and a cover and defining an opening in the side walls;
   the chassis including detachment and manipulation apparatus, the body being detachably mounted on the detachment and manipulation apparatus with the opening in communication with the hopper for receiving refuse therefrom with the body in a collecting position, the detachment and manipulation apparatus being designed to move the body from the collecting position to a hauling position and to detach the body in the hauling position; and
   packer operating apparatus for operating the packer to move refuse from the hopper into the body through the opening with the body in the collecting position.

2. A refuse disposal system as claimed in claim 1 wherein the detachment and manipulation apparatus includes a hoist frame movably between a horizontal position and a vertical position, and a slide frame coupled to the hoist frame and movable vertically, the body being detachably latched to the slide frame, the body and slide frame being moveable with the hoist frame from the collecting position to a hauling position and the slide frame being moveable vertically to detach the body.

3. A refuse disposal system as claimed in claim 2 wherein the hoist frame is elongated with one end pivotally attached to the chassis for movement between the horizontal position and the vertical position, and the hoist frame further including a hydraulic cylinder for moving the hoist frame between the horizontal position and the vertical position.

4. A refuse disposal system as claimed in claim 3 wherein the slide frame is elongated and slideably coupled to the hoist frame for relative sliding movements therebetween, and the slide frame further including a hydraulic cylinder for moving the slide frame vertically with the hoist frame in the vertical position.

5. A refuse disposal system as claimed in claim 1 further including hooks attached to the floor of the body and positioned to detachably engage the slide frame in the collecting position and further including at least one releasable latch mounted on the slide frame so as to latch the hooks in engagement with the slide frame.

6. A refuse disposal system as claimed in claim 1 wherein the body is designed to receive up to five tons of refuse.

7. A refuse disposal system as claimed in claim 6 wherein the gross weight of the truck with a fully loaded body is less than 26,000 pounds.

8. A refuse disposal system as claimed in claim 1 wherein the cover is hinged to the side walls along one edge and is releasably latched to the side walls along an opposing edge.

9. A refuse disposal system as claimed in claim 8 wherein the cover is hinged to the side walls along one edge adjacent the opening and is releasably latched to the side walls along an opposing edge opposite the opening.

10. A refuse disposal system as claimed in claim 1 wherein the hopper is mounted on the detachment and manipulation apparatus.

11. A refuse disposal system as claimed in claim 10 wherein the hopper includes a slideable curtain attached to the packer for movement therewith and positioned to prevent refuse from entering an area behind the packer.

12. A method of disposing of refuse including the steps of:
   providing a relatively small refuse collection truck with a detachable body defining a refuse receiving opening in a side wall thereof, detachment and manipulation apparatus mounted on the collecting truck for moving the body between an attached collecting position and a detached hauling position, and the collecting truck further including a hopper and a packer with the hopper mounted in communication with the open body when the body is in the collecting position and the packer positioned to move refuse from the hopper to the body through the opening;
   moving the collecting truck to various refuse receptacles and emptying each refuse receptacle into the hopper, operating the packer to move refuse from the hopper to the body;
   moving the collecting truck to an adjacent body receiving station when the body is substantially full of refuse; and
   operating the detachment and manipulation apparatus mounted on the collecting truck to move the body from the attached collecting position to the detached hauling position at the body receiving station.

13. A method as claimed in claim 12, subsequent to the step of operating the detachment and manipulation apparatus mounted on the collecting truck to move the body from the attached collecting position to the detached hauling position, the method further including the steps of moving the collecting truck to a position adjacent an empty body in a hauling position at the body receiving station, operating the detachment and manipulation apparatus mounted on the collecting truck to move the empty body from the detached hauling position at the body receiving station to an attached collecting position on the collecting truck, and moving the collecting truck to various refuse receptacles and emptying each refuse receptacle into the hopper.

14. A method as claimed in claim 13 wherein the provided detachment and manipulation apparatus includes a hoist frame for moving the body between the collecting position and the hauling position and a sliding frame having the body detachably coupled thereto, and the method includes operating the hoist frame to move the body from the collecting position to the hauling position and operating the sliding frame to detach the body from the sliding frame.

15. A method as claimed in claim 13 wherein the body receiving station includes one of a haul vehicle and the ground.

16. A refuse disposal system comprising:
   a relatively small refuse collection truck including a chassis and a hopper for receiving refuse, the hopper including a packer;
   a body having a bottom, side walls, and a cover and defining an opening in the side walls;
   the chassis including detachment and manipulation apparatus, the body being detachably mounted on the detachment and manipulation apparatus with the opening in communication with the hopper for receiving refuse therefrom with the body in a collecting position,
the detachment and manipulation apparatus being designed to move the body from the collecting position to a hauling position and to detach the body in the hauling position;

packer reciprocating apparatus for reciprocating the packer within the hopper to move refuse from the hopper into the body through the opening with the body in the collecting position; and

a relatively large haul vehicle having a chassis with a plurality of body receiving frames mounted thereon, each body receiving frame being positioned to receive the body from the collecting truck when collecting truck is moved to a position adjacent the haul vehicle and the body is moved by the detachment and manipulation apparatus from the collecting position to the hauling position.

17. A refuse disposal system as claimed in claim 16 wherein the detachment and manipulation apparatus includes a hoist frame movable between a horizontal position and a vertical position, and a slide frame coupled to the hoist frame and movable vertically, the body being detachably latched to the slide frame, the body and slide frame being movable with the hoist frame from the collecting position to a hauling position and the slide frame being movable vertically to detach the body.

18. A refuse disposal system as claimed in claim 17 wherein the hoist frame is elongated with one end pivotally attached to the chassis for movement between the horizontal position and the vertical position, and the hoist frame further including a hydraulic cylinder for moving the hoist frame between the horizontal position and the vertical position.

19. A refuse disposal system as claimed in claim 18 wherein the slide frame is elongated and slideably coupled to the hoist frame for relative sliding movements therebetween, and the slide frame further including a hydraulic cylinder for moving the slide frame vertically with the hoist frame in the vertical position.

20. A refuse disposal system as claimed in claim 16 wherein each body receiving frame of the plurality of body receiving frames includes transversely extending support members affixed to the chassis and a lifting frame pivotally attached to the support members, the lifting frame further including attachment apparatus to detachably couple bodies to the lifting frame.

21. A refuse disposal system as claimed in claim 20 further including a first set of hooks attached to the floor of the body and positioned to detachably engage the slide frame in the collecting position and further including at least one releasable latch mounted on the slide frame so as to latch the first set of hooks in engagement with the slide frame.

22. A refuse disposal system as claimed in claim 21 further including a second set of hooks attached to the side walls of the body and positioned to detachably engage the lifting frame in the hauling position and further including at least one releasable latch mounted on the lifting frame so as to latch the second set of hooks in engagement with the lifting frame.

23. A refuse disposal system as claimed in claim 20 wherein the cover is hinged to the side walls along one edge and is releasably latched to the side walls along an opposing edge.

24. A refuse disposal system as claimed in claim 23 wherein the cover is hinged to the side walls along one edge adjacent the opening and is latched to the side walls by at least one releasable latch along an opposing edge opposite the opening.

25. A refuse disposal system as claimed in claim 24 wherein each body receiving frame of the plurality of body receiving frames includes a hydraulic cylinder coupled between the lifting frame and the transversely extending support members for moving the lifting frame between a horizontal body receiving position and a raised body dumping position.

26. A refuse disposal system as claimed in claim 25 wherein each body receiving frame of the plurality of body receiving frames includes at least one cam positioned to engage the at least one releasable latch and unlatch the cover from the side walls when the lifting frame is moved from the horizontal to the raised dumping position.

27. A refuse disposal system as claimed in claim 16 wherein the body is designed to receive up to five tons of refuse.

28. A refuse disposal system as claimed in claim 27 wherein the gross weight of the collecting truck with a fully loaded body is less than 26,000 pounds.

29. A refuse disposal system as claimed in claim 28 wherein the gross weight of the haul vehicle with a plurality of fully loaded bodies is greater than 50,000 pounds.

30. A refuse disposal system as claimed in claim 16 wherein the hopper is mounted on the detachable and manipulation apparatus.

31. A refuse disposal system as claimed in claim 30 wherein the hopper includes a slideable curtain attached to the packer for movement therewith and positioned to prevent refuse from entering an area behind the packer.

32. A method of disposing of refuse comprising the steps of:

providing a relatively small collection truck including a chassis and a first detachable body attached to the chassis;

filling the first detachable body with refuse;

providing a relatively large haul vehicle including a plurality of body receiving apparatus for positioning a plurality of detachable bodies, one each, thereon, at least some of the plurality of body receiving apparatus including empty detachable bodies in an attached position thereon;

using the collection truck, moving the filled first detachable body to the haul vehicle, placing the filled first detachable body on the haul vehicle and detaching the first detachable body from the collection vehicle, and attaching the first detachable body to an empty one of the plurality of body receiving apparatus on the haul vehicle;

moving the collection vehicle to an empty second detachable body attached to the haul vehicle, detaching the second detachable body from the haul vehicle and moving the second detachable body from the haul vehicle to the collection truck, and attaching the second detachable body to the collection truck; and

filling the second detachable body with refuse.

33. A method as claimed in claim 32 wherein the steps of providing the collection truck includes providing detachment and manipulation apparatus mounted on the collecting
truck and the step of moving the filled first detachable body to the haul vehicle includes operating the detachment and manipulation apparatus mounted on the collecting truck to move the first body from the attached collecting position on the collecting truck to the detached hauling position, and attaching the filled first detachable body to the haul vehicle.

34. A method as claimed in claim 33 wherein the step of moving the collecting truck to a position adjacent an empty body in a hauling position on the haul vehicle includes operating the detachment and manipulation apparatus mounted on the collecting truck to move the empty body from the attached hauling position on the haul vehicle to an attached collecting position on the collecting truck.

35. A method as claimed in claim 34 wherein the step of providing detachment and manipulation apparatus includes providing a hoist frame for moving the filled first detachable body between the collecting position and the hauling position and a sliding frame having the filled first detachable body detachably coupled thereto, and the method includes operating the hoist frame to move the filled first detachable body from the collecting position to the hauling position and operating the sliding frame to detach the filled first detachable body from the sliding frame.

36. A method as claimed in claim 32 further including the steps of, with substantially all of the detachable bodies filled, moving the haul vehicle to a disposal area and maneuvering each of the filled detachable bodies to dump refuse therefrom into the disposal area.

37. A method as claimed in claim 36 wherein the step of providing a body includes providing a body with bottom, sidewalls, and a cover, with one of the side walls including an opening for receiving refuse therethrough and the cover hinged to the one of the side walls along one edge adjacent the opening and latched to an opposed side wall by at least one releasably latch along an opposing edge opposite the opening.

38. A method as claimed in claim 37 wherein the step of providing a relatively large haul vehicle including a plurality of body receiving apparatus includes providing each body receiving apparatus of the plurality of body receiving apparatus with a hydraulic cylinder coupled between a lifting frame and transversely extending support members for moving the lifting frame between a horizontal body receiving position and a raised body dumping position.

39. A method as claimed in claim 38 wherein the step of providing a relatively large haul vehicle including a plurality of body receiving apparatus further includes providing each body receiving frame of the plurality of body receiving frames with at least one cam positioned to engage at least one releasably latch and unlatch the cover from the side walls when the lifting frame is moved from the horizontal to the raised dumping position and the step of maneuvering each of the filled detachable bodies to dump refuse therefrom into the disposal area includes moving the lifting frame from the horizontal to the raised dumping position of each body receiving apparatus having a filled body attached thereto.

40. In a refuse disposal system, a haul vehicle comprising: an elongated chassis with wheels attached thereto; a plurality of body receiving frames transversely mounted on the chassis, each body receiving frame being positioned to receive a body from a refuse collecting truck when the collecting truck is moved to a position adjacent the haul vehicle; each body receiving frame of the plurality of body receiving frames including transversely extending support members affixed to the chassis and a lifting frame pivotally attached to the support members, the lifting frame further including attachment apparatus to detachably couple bodies to the lifting frame; and each body receiving frame of the plurality of body receiving frames including apparatus coupled between the lifting frame and the transversely extending support members for moving the lifting frame between a horizontal body receiving position and a raised body dumping position.

41. A haul vehicle as claimed in claim 40 wherein each body receiving frame of the plurality of body receiving frames includes at least one cam positioned to engage a releasable latch on a body attached thereto and unlatch a cover when the lifting frame is moved from the horizontal to the raised dumping position.

42. A haul vehicle as claimed in claim 40 wherein the apparatus coupled between the lifting frame and the transversely extending support members includes a hydraulic cylinder.

43. A method of disposing of refuse in a refuse disposal area comprising the steps of:

- providing a haul vehicle including an elongated chassis with wheels attached thereto, a plurality of body receiving frames transversely mounted on the chassis, each body receiving frame being positioned to receive a body from a refuse collecting truck when the collecting truck is moved to a position adjacent the haul vehicle, each body receiving frame of the plurality of body receiving frames including transversely extending support members affixed to the chassis and a lifting frame pivotally attached to the support members, the lifting frame further including attachment apparatus to detachably couple bodies to the lifting frame, and each body receiving frame of the plurality of body receiving frames including apparatus coupled between the lifting frame and the transversely extending support members for moving the lifting frame between a horizontal body receiving position and a raised body dumping position; and
- attaching filled bodies to at least some of the plurality of body receiving frames; and
- moving the lifting frame from the horizontal body receiving position to the raised dumping position of each body receiving frame having a filled body attached thereto.

44. A method as claimed in claim 43 wherein each of the bodies includes a cover hatched by a releasable latch, and the step of moving the lifting frame having a filled body attached from the horizontal body receiving position to the raised dumping position includes unlatching the cover of the filled body as the lifting frame and attached filled body are moved to the raised dumping position.

45. A method as claimed in claim 44 wherein the step of providing a plurality of body receiving frames includes providing a cam-acting latch release on each of the body
receiving frames, and the step of moving the lifting frame into the raised dumping position includes automatically engaging the releasable latch on the body with the cam-acting latch release to unlatch the cover when the lifting frame is moved from the horizontal to the raised dumping position.

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