United States Patent

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[72] Inventors **Waldo H. Gray**
Dearborn;
Lyle J. Ritchie, St. Clair Shores, both of, Mich.

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[73] Assignee **Automatic Refuse Systems, Inc.**
St. Clair Shores, Mich.

[54] **COMPACTOR EQUIPMENT**
19 Claims, 19 Drawing Figs.

[52] **U.S. Cl.** **100/215,** 53/124, 92/14, 92/30, 100/53, 100/221, 100/226, 100/229, 100/255, 100/269, 100/295, 141/73
[51] **Int. Cl.** **B30b 15/30**
[50] **Field of Search** 53/124; 141/73; 100/53, 215, 221, 52, 224, 225, 226, 229, 255, 269, 295; 92/14, 30

[56] **References Cited**

UNITED STATES PATENTS

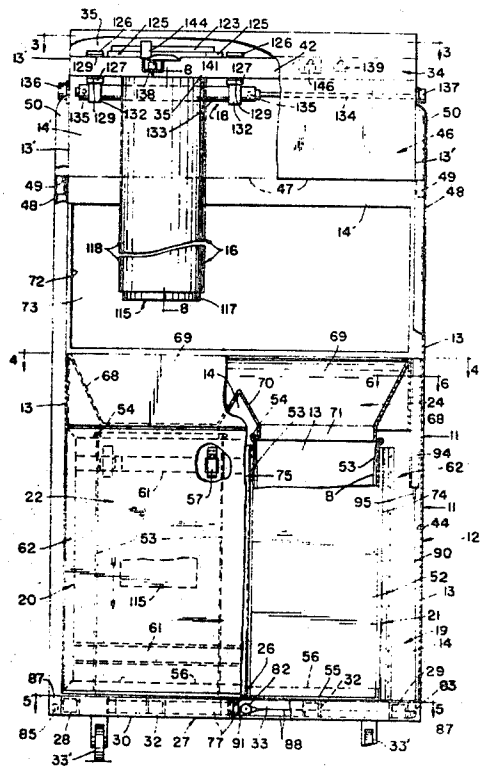
2,240,630	5/1941	Stacy	100/53 UX
2,539,635	1/1951	Ritchie	100/224 X
2,605,697	8/1952	Bell et al.	100/229 X
2,798,348	7/1957	Weber et al.	100/221 UX
3,371,515	3/1968	Munschauer	100/229 X
3,413,913	12/1968	Smedlund	100/221
3,438,321	4/1969	Gladwin	100/229 X
2,933,068	4/1960	Johnson et al.	92/30 X
3,353,478	11/1967	Hopkins	100/52
3,537,390	11/1970	Hinkel et al.	100/229 X

FOREIGN PATENTS

1,112,958	5/1968	Great Britain	100/221
530,834	11/1921	France	92/30

Primary Examiner—Billy J. Wilhite
Attorney—Whittemore, Hulbert and Belknap

ABSTRACT: The compactor features a vertically reciprocable compacting ram unit shielded externally in its compacting stroke. A bag is supported beneath the ram by a relatively rigid but movable holder; and in one version this holder is a pivoted one. In another embodiment it is a bodily movable, dolly-type. In a dual bag installation, the ram unit shifts between two side-by-side holders as the bag contents are successively compacted. The contents reach the bag through a hopper unit which is vertically shiftable relative to the holder in a rather limited stroke. The ram is pneumatically operated by a vertically acting piston in a fixed cylinder; the hopper is operated up and down by a pneumatically powered cable and pulley arrangement in one adaptation, while in another form it is operated by mechanical link means; and the ram unit is reciprocated horizontally by a pneumatic unit.



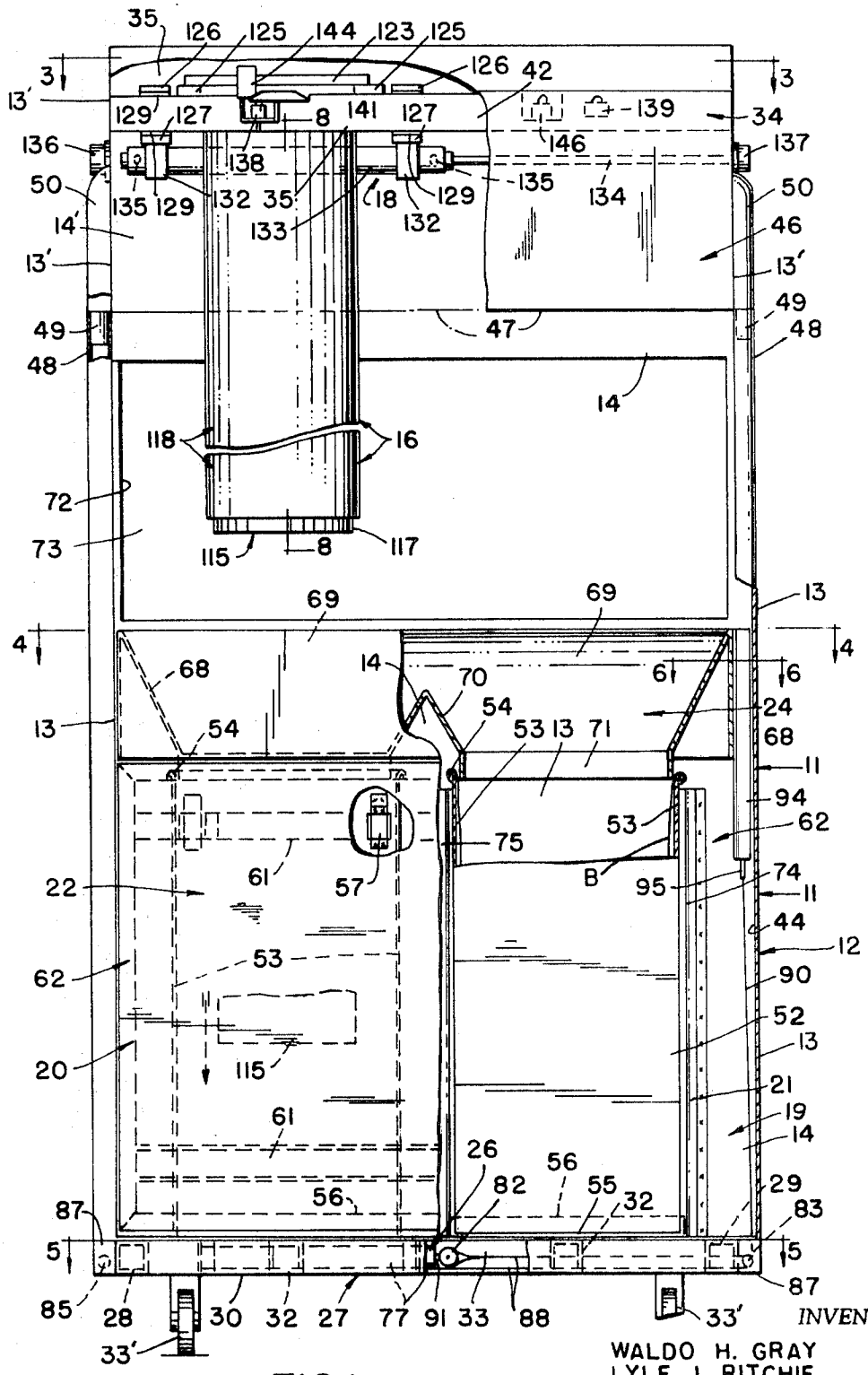


FIG.1

INVENTORS
WALDO H. GRAY
LYLE J. RITCHIE

BY Whittemore, Hulbert & Belknap

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FIG. 10

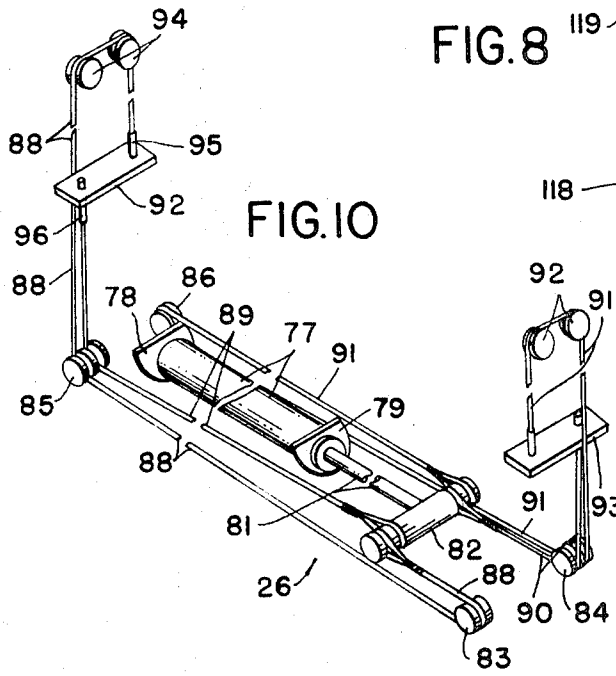


FIG. 8

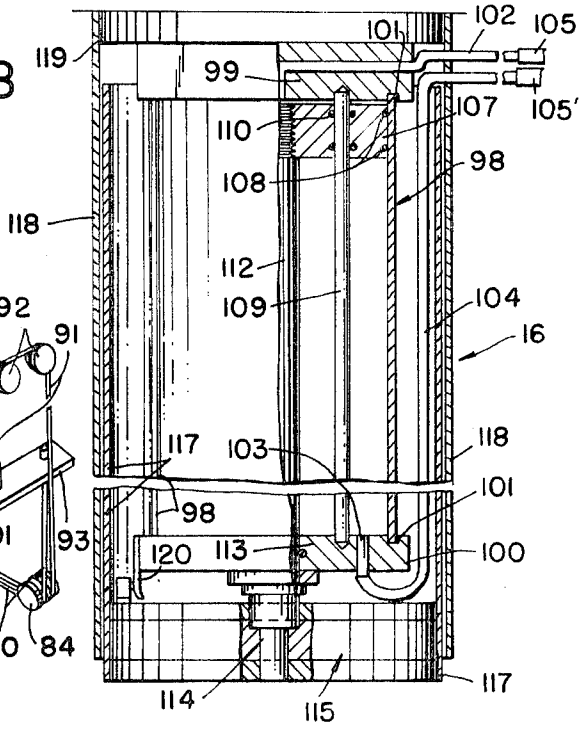


FIG. 12

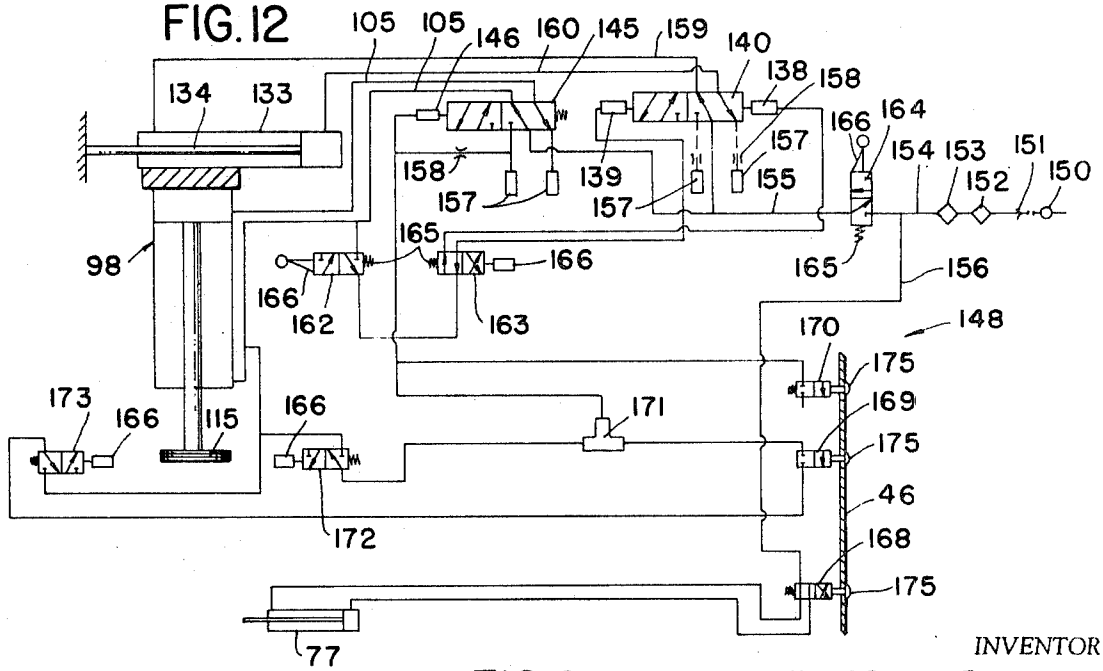
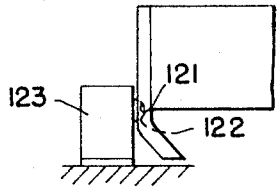


FIG. 9



INVENTORS
WALDO H. GRAY
LYLE J. RITCHIE

BY Whittemore, Hulbert & Belknap

ATTORNEYS

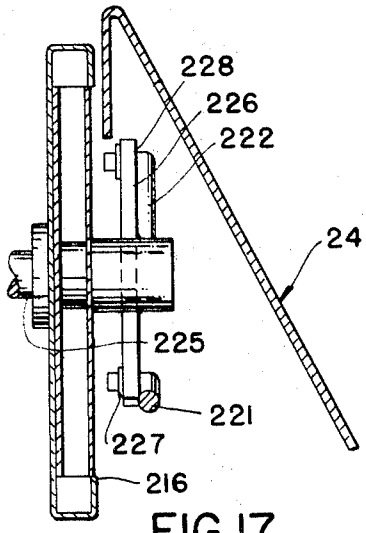


FIG.17

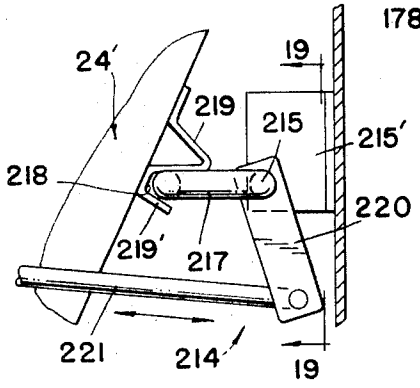


FIG.18

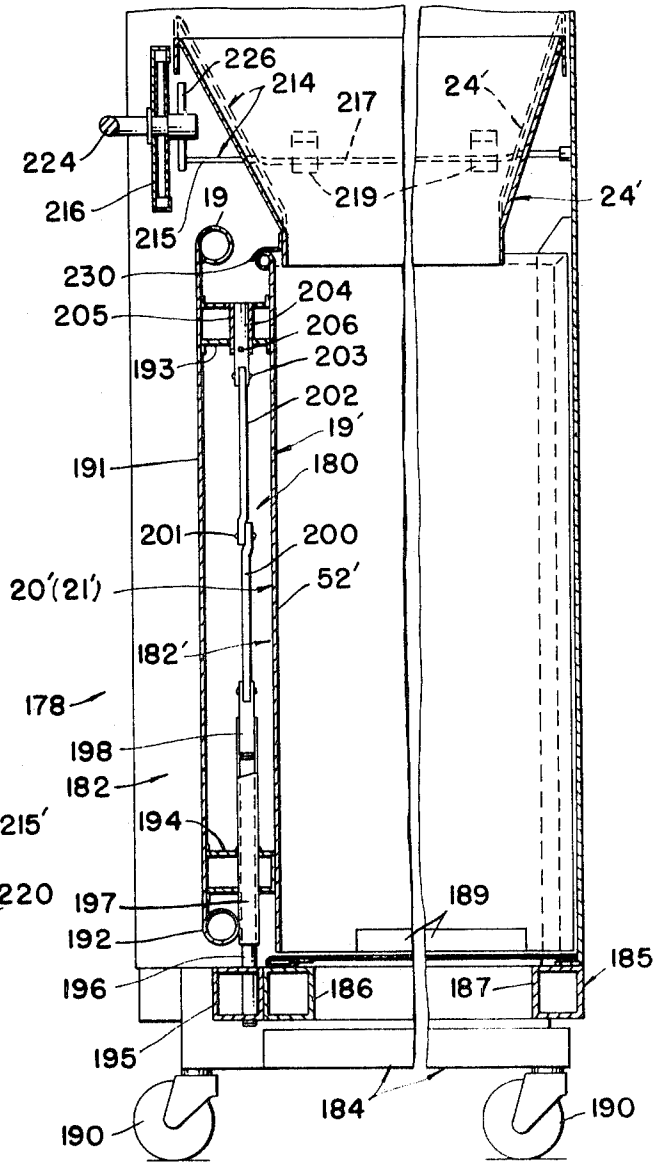
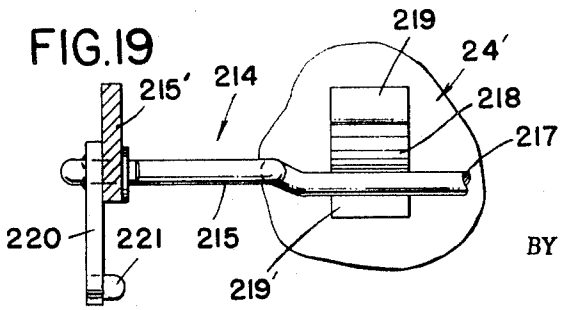


FIG.16

FIG.19



INVENTORS
WALDO H. GRAY
LYLE J. RITCHIE

BY Williamson, Hei Chuff & Berry

ATTORNEYS

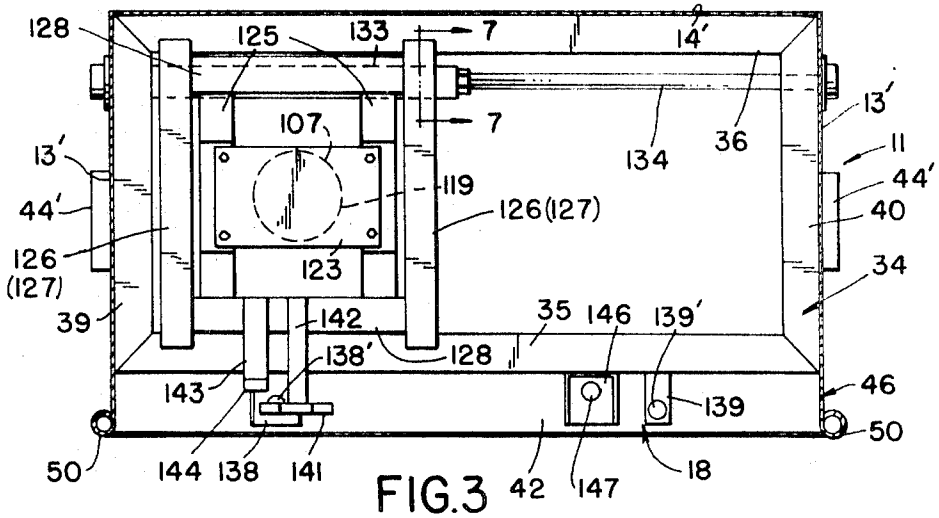


FIG.3

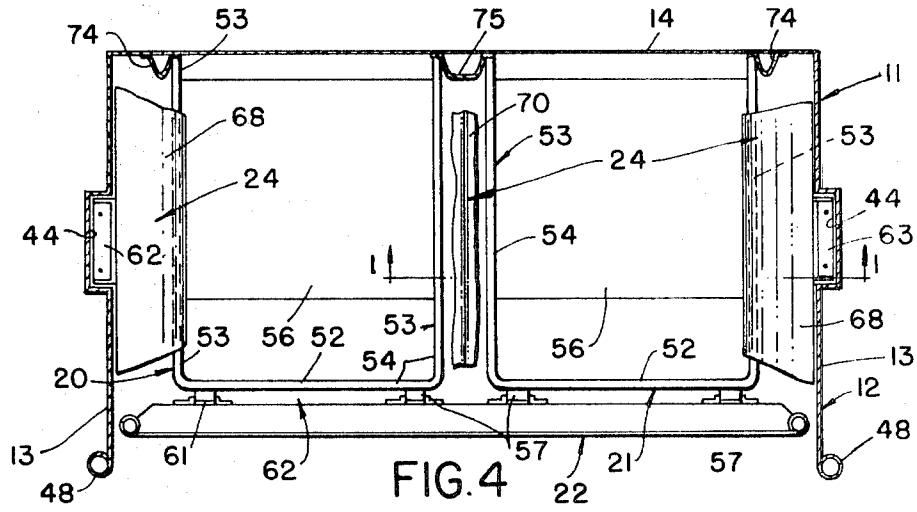


FIG.4

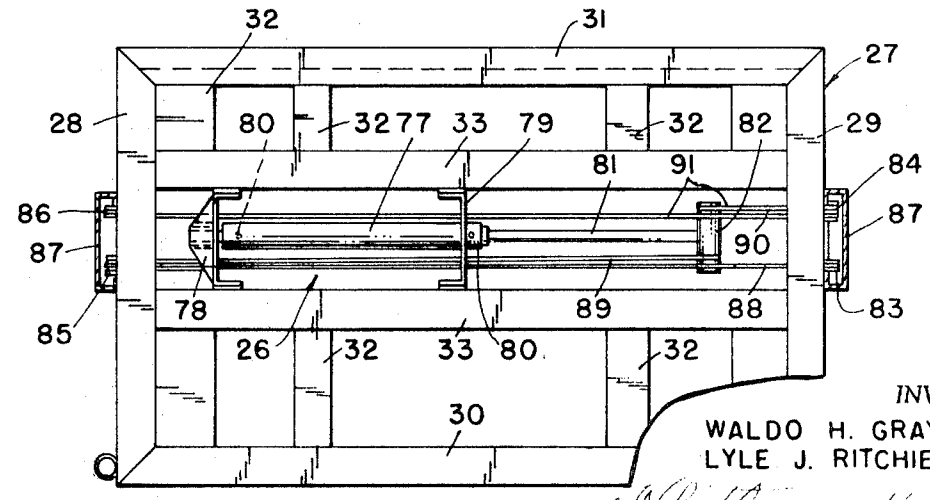


FIG.5

INVENTORS
WALDO H. GRAY
LYLE J. RITCHIE

BY

ATTORNEYS

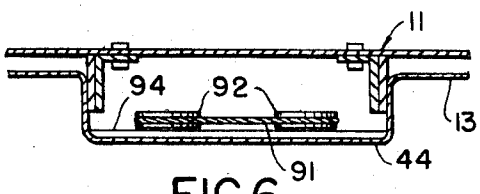


FIG.6

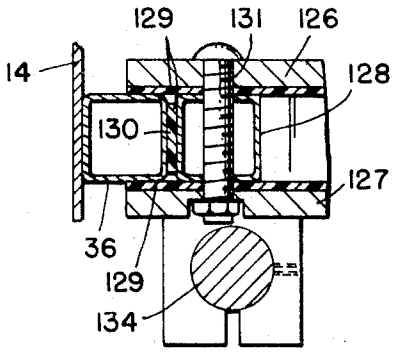


FIG.7

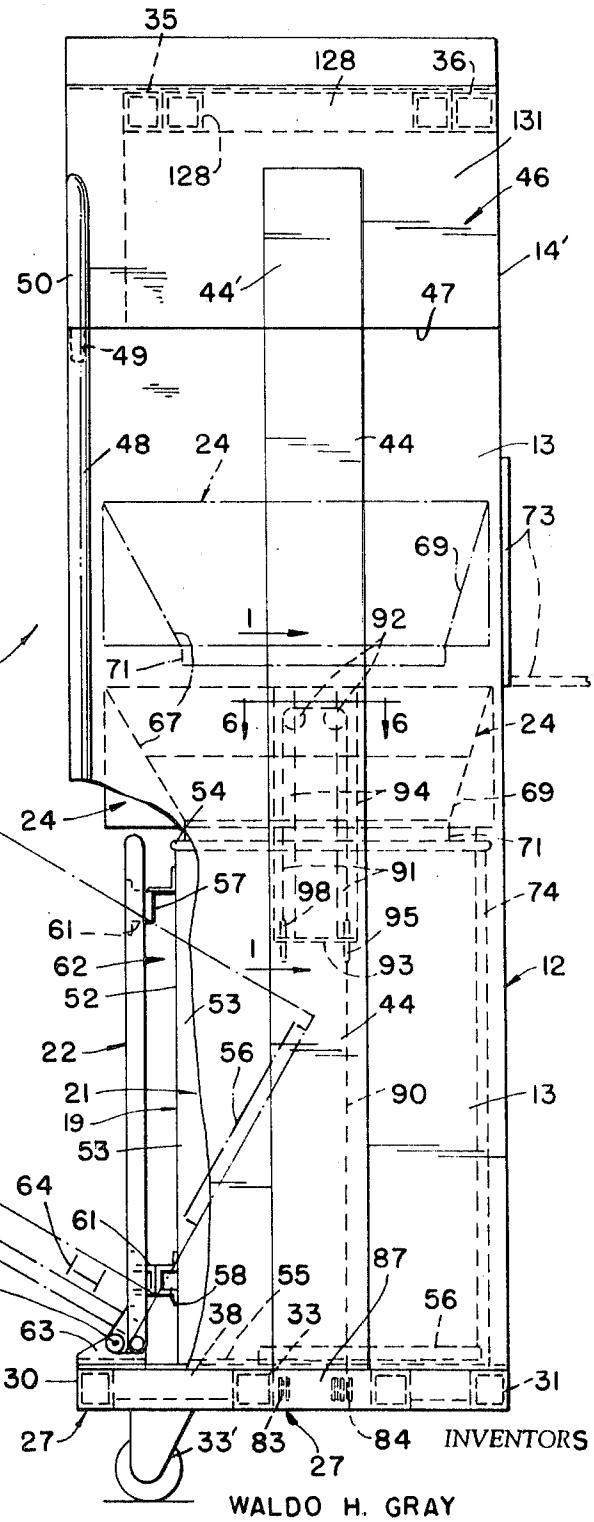


FIG.2

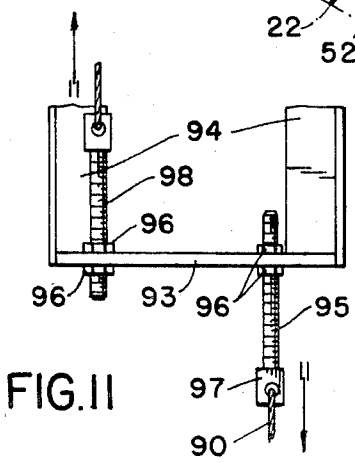


FIG.11

INVENTORS
WALDO H. GRAY
LYLE J. RITCHIE

BY

ATTORNEYS

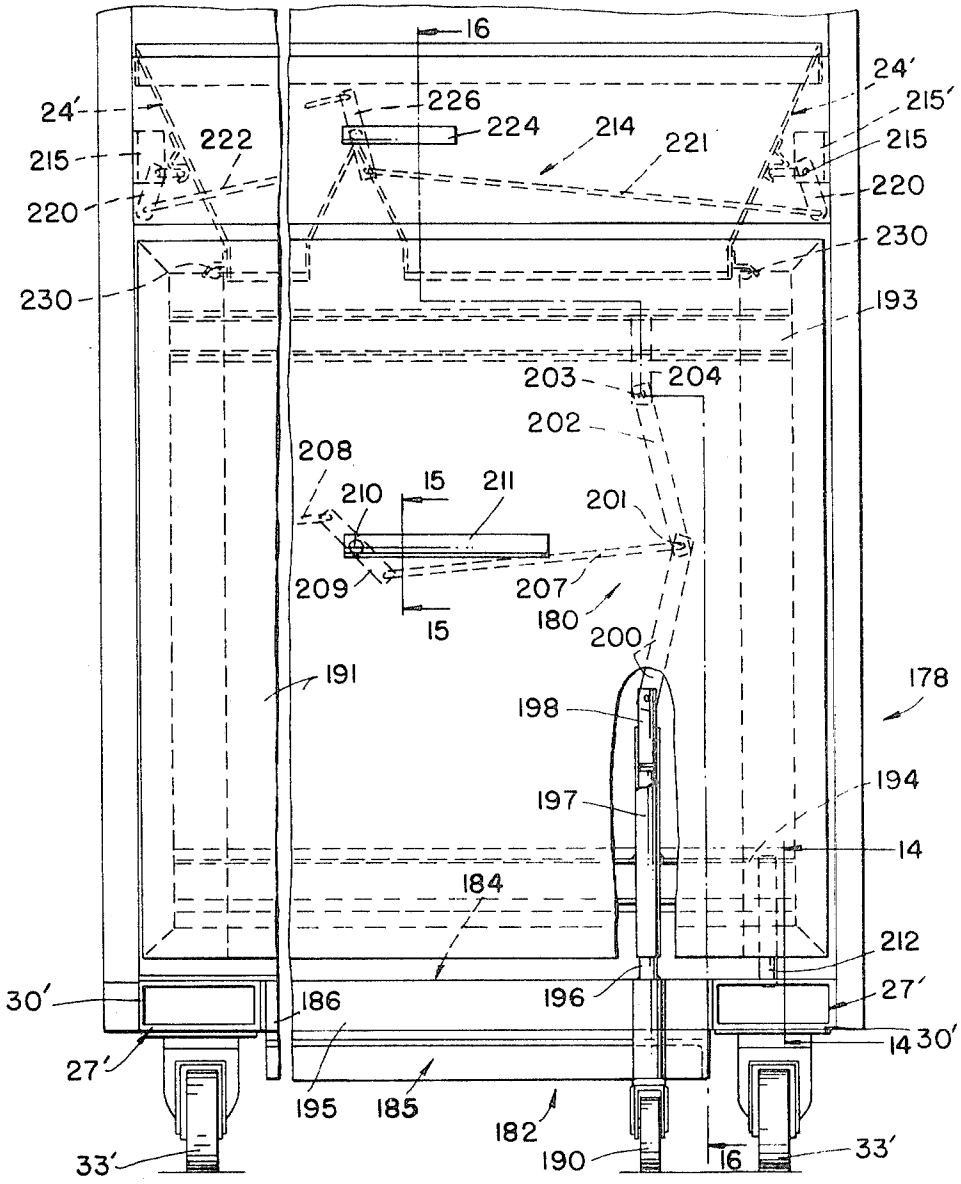


FIG.13

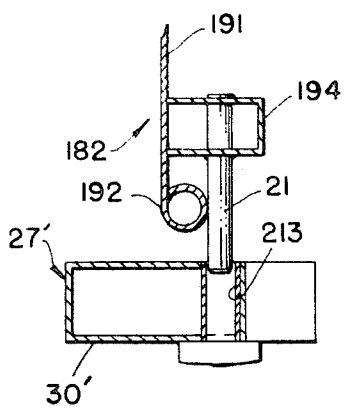


FIG.14

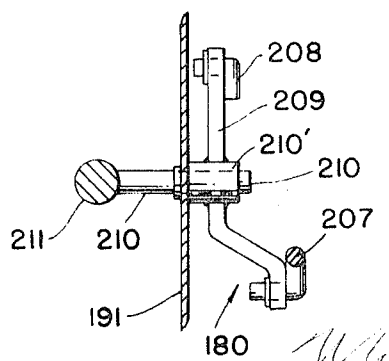


FIG.15

INVENTORS
WALDO H. GRAY
LYLE J. RITCHIE

BY Williamson, McCollister & Phillips

ATTORNEYS

COMPACTOR EQUIPMENT

BACKGROUND OF THE INVENTION

1. Field of the Invention

The compactor finds wide use in factories, hotels, restaurants, hospitals, schools, apartments and many other sorts of municipal, industrial or commercial buildings. Typically, although not necessarily, the compactor is an adjunct of a school cafeteria area in which discarded food and like containers, rigid or collapsible, rubbish, etc., may be highly compacted in disposable bags to a small relative volume, then removed from the site for incineration or other disposal.

2. Description of the Prior Art

The most pertinent prior art disclosure of which I am aware is contained in U.S. Letters Pat. No. 2,984,957 to Gunner Lundgren of May 23, 1961. This patent discloses a reciprocating ram-type compactor, unprotected as to the stroke of the ram and, moreover, with the ram acting into refuse containers arranged in a circular, rotatively movable or carrousellike array, rather than of a type in which the ram is rectilinearly shiftable sidewise relative to a set of bag holders.

SUMMARY OF THE INVENTION

The compactor comprises a strongly reinforced and attractive sheet metal cabinet which supports adjacent the bottom thereof a pair of side-by-side arranged bag holders. In one illustrated embodiment these are of U-shaped cross section in plan, being arranged to swing outwardly from the cabinet for removal of the compacted bags and contents; while in another illustrated form the holders roll bodily as a unit on casters. Each holder is capable of having a vertically elongated flexible polyethylene plastic bag inserted therein and supported suspendingly by the walls thereof. A single vertically reciprocable ram unit shifts laterally from vertically lined relation above one of the bag holders to the same relation to the other holder, this shift being powered by appropriately valve-controlled pneumatic cylinder means. The ram unit is externally shielded by a cylindrical sleeve of considerable vertical extent; and it is powered for its vertical stroke, for example, under about 3,000 lbs. force, by an air-operated piston within a fixed cylindrical wall of the ram unit, again under the control of suitable valved means. Such means, as in the case of the ram shift unit, constitutes no part of the invention, but is illustrated in a general way in FIG. 12.

A hopper unit, as shown in one of the illustrated embodiments, is mounted for relatively slight vertical shift in the compactor's cabinet, in order to enable the bag holders to be tilted outwardly without interference with the hopper for removal of the compacted bags. This hopper unit is operated vertically through an arrangement of cable and pulley elements, which are powered at the bottom of the cabinet structure by an appropriate valve controlled, horizontal pneumatic cylinder unit, or subassembly, the general arrangement of which is shown in FIG. 10.

In a second embodiment the bag holders are mounted on a dolly-type support for rolling translational, rather than pivotal shift, into and out of vertical alignment with the compactor ram unit. A manually actuated linkage unlocks the holder unit from the machine's frame structure for the movement, coordinately with an elevation of the bag holder unit a slight amount relative to the dolly to clear the latter's translation relative to and above the machine frame. Also in this form, a further manually operated linkage elevates the hopper unit relative to the bag holder unit to accommodate the rolling translation of the latter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view, partially broken away and in part in vertical section on a line corresponding to line 1–1 of FIGS. 2 and 4, illustrating the arrangement of the basic cabinet, ram, hopper and bag holder components of the compactor, and indicating in a general way the means for operating the same;

FIG. 2 is a side elevational view of the compactor, also partially broken away, with operative and retracted positions of its hopper unit and bag holding units being shown respectively in solid and a dot-dash line;

FIGS. 3, 4 and 5 are respectively views in horizontal cross section on lines 3–3, 4–4 and 5–5 of FIG. 1;

FIG. 6 is an enlarged scale fragmentary view on line 6–6 of FIGS. 1 and 2, illustrating a portion of the cable and pulley-type hopper raising and lowering mechanism of the compactor, and the cabinet provision receiving the same;

FIG. 7 is a fragmentary view in enlarged scale and transverse vertical cross section on line 7–7 of FIG. 3, showing a detail of the ram traversing slide structure of the compactor;

FIG. 8 is a view, partially broken away and in enlarged scale, taken along in vertical and diametral section along line 8–8 of FIG. 1, showing structural features of the vertical pneumatic operating means for the compacting ram unit;

FIG. 9 is a fragmentary view in a quite enlarged scale of a simple antigravity device associated with the ram head and cylinder of the compactor to hold the head in its upper position against gravity when the compactor is not in use;

FIG. 10 is a schematic perspective view, partially broken, of the pneumatic cylinder, cable and pulley arrangement for raising and lowering the hopper unit of the compactor;

FIG. 11 is a fragmentary view in vertical side elevation, as from line 11–11 of FIG. 1, more clearly showing certain details of cable and connector components involved in the raising and lowering of the hopper unit of the compactor;

FIG. 12 is a schematic layout of the system of pneumatic and electrical control provisions, none part of the invention, by which the operation of the compactor of FIGS. 1—11, inclusive, is governed.

FIG. 13 is a fragmentary front elevational view, partially broken away, illustrating the lower part of a modified version of the compactor, which is characterized in that rolling or dolly-type bag holder means is employed in lieu of the pivoted type shown in FIGS. 1 and 2, and in that the hopper is raised and lowered by a manually operated linkage;

FIGS. 14 and 15 are respectively fragmentary views in vertical section on lines 14–14 and 15–15 of FIG. 13;

FIG. 16 is view partially broken away and in vertical section along a line corresponding to broken line 16–16 of FIG. 13;

FIG. 17 is a fragmentary view in vertical cross section and somewhat enlarged scale disclosing part of the hopper elevating and lowering linkage;

FIG. 18 is a view similar to FIG. 17, showing the remaining portion of the linkage in question; and

FIG. 19 is of said linkage portion as seen in elevation from the line 19–19 of FIG. 18.

DESCRIPTION OF PREFERRED EMBODIMENTS

The general arrangement of basic operating units or subassemblies of one of two generally similar embodiments of the compactor, which is generally designated by the reference numeral 10, is illustrated in FIGS. 1 and 2. These include an upright cabinet structure 11 of attractive, glazed enamel appearance, which is rectangular in horizontal cross section and vertically elongated in shape.

It generally comprises a four-walled sheet metal lower casing 12 made up of vertically elongated and parallel side wall panels of part 13 (see FIGS. 4 and 5 in particular), and a rear panel 14, all extending downwardly from adjacent the top of the structure 12. The latter augmented by upper superstructure and movable front panel means to be described.

Compactor 10 also essentially comprises:

a. a single compacting ram unit, generally designated 16, shown in FIGS. 1, 3 and 8, as being supported by the superstructure of casing 12, along with its pneumatic operating and control mechanism 18 (to be considered with FIG. 12);

b. a bag holder subassembly 19 comprised of a pair of side-by-side sheet metal bag holding and restraining units, generally designated 20 and 21, which are rigidly mounted as a unit to a pivotally movable front wall closure panel 22, which in effect constitutes the lower front wall structure of cabinet casing 12; and

c. a vertically movable hopper unit 24 which is operated by a pneumatic cylinder, cable and pulley subassembly 26, best shown schematically in FIG. 10. One function of unit 24 is to size the charge to be compacted and to direct it properly into the bags in the units 20, 21 of subassembly 19.

In addition to the cabinet wall panels 13 and 14 referred to above, the casing structure 12 comprises a basic bottom frame subassembly 27, which is fabricated of hollow tubular steel members, preferably square in cross section, as best illustrated in FIGS. 1, 2 and 5. These include opposite side or end frame members 28, 29 which are welded at 45° bevel corners to front and rear members 30, 31, respectively, of like section; this structure being ruggedly reinforced by cross members 32 butt-welded flush and at 90° to members 30 and 31 at laterally spaced points, as well as to a pair of spaced, parallel and elongated tubular side-to-side members 33. The latter, in addition to greatly rigidifying the bottom frame substructure 27, serve as mounts for the pneumatic cylinder, cable and pulley subassembly 26 for hopper unit 24, through means shown in FIGS. 5 and 10, in a manner to be described. The wall panels 13 and 14 are welded atop the tubular bottom side or end and rear frame members 28, 29 and 31 to be flush with the external surfaces of the latter. This completes a rigid union of the cabinet structure 11 to the basic bottom frame unit 27. Castors 33' support the latter.

FIG. 3 illustrates a top frame subassembly 34 of the cabinet structure 12, which, like the bottom subassembly 27, is a rectangular outline but of somewhat lesser front-to-rear dimension. Frame subassembly 34 includes front and rear frame members 35, 36, respectively, and end members 39, 40, respectively, all similar to the bottom frame sections 28—30 and bevel-welded together at the corners. This frame superstructure serves as a support slidably mounting the ram unit 16 and the latter's pneumatic operating and control subassembly 18, in a manner to be described.

An additional upper frame component is in the form of a horizontally elongated front shelf or bracket 42 abutting and paralleling front top frame member 35 but at a slightly lower elevation; which bracket 42 mounts certain pneumatic valve components of the system of FIG. 12, these components being operated by the slidable cylinder and control subassembly 18, again in a manner hereinafter described.

Reference being had to FIGS. 4, 5 and 6, in conjunction with FIGS. 1 and 2, the sidewalls 13 of casing structure 12 are shown as being formed to have integral rectangular, external and inwardly opening recesses or bays 44 at the front-to-rear midpoint thereof, these formations extending vertically parallel to one another and housing portions of the cable components shown in FIG. 10, as well as certain plate parts by which the hopper unit is raised and lowered in the operation of compactor 10.

By preference, and as a matter of substantial improvement in detail best illustrated in FIGS. 1 and 2, the topmost part of cabinet structure 11 of compactor 10 is comprised of a separate inverted boxlike, sheet metal cabinet casing part 46 having its lower open edge 47 dimensioned to come downwardly flush with the main side and rear cabinet walls 13, 14. Corresponding walls of casing member 46 are designated 13', 14'; and a rigid union between the casing or cabinet parts 11 and 46 is effected by forming vertically elongated, integral stiffening bights 48 along the front margins walls 13, the open upper ends of which telescopingly receive rigid dowel formations 49 carried by front bight formations 50 of partial height on the front corners of the casing structure 46.

Thus the latter, with the frame superstructure 34 of FIG. 3 and the ram unit 16 and its valved pneumatic control mechanism 18 permanently secured thereto, may be removed from the lower frame and casing structure for repair or maintenance, if necessary. Yet the overall frame and cabinet combination presents ample antiwrack rigidity and ruggedness to withstand the forces to which it is subjected.

Structural features of the bag holding and retaining units 20, 21 are best illustrated in FIGS. 1, 2 and 4. They are, as indicated above, of identical U-shaped cross section in plan, being open at the rear thereof. That is, each has a rectangular, vertically elongated front wall 52 integrally joined by parallel sidewalls 53; and the upper edges of these walls are roll-beaded at 54 to receive and support a polyethylene disposal bag B, FIG. 1 with the upper flexible edge of the latter wrapped about the beading 54 to suspend the bag in place. A flat rectangular bottom 55 completes each of the holders 20, 21, the bottom being reinforced by a pressure block or plate 56 normally resting on the frame substructure 27 to take the force of the compacting ram stroke.

As best illustrated in FIG. 2, the front wall 52 of each bag holder 20 or 21 has a pair of laterally spaced brackets 57 welded thereto to project forwardly therefrom adjacent the top of the holder; while adjacent the bottom of the latter each wall 52 has a horizontally elongated projecting bracket 58 welded thereto and extending a substantial part of the distance thereacross. These bracket components are for the purpose of securing the bag holders 20, 21, as an unitary pair, to the rear of a single pivoted front closure or door panel 22 which is swingable forwardly and outwardly, along with the holders 20, 21, about a horizontal bottom axis from an operative position illustrated in solid line in FIG. 2 to an opened or withdrawn position shown in dot-dash line, in which last position the filled and compacted bag B may be readily removed from a holder, tied shut and transported away for incineration or other disposal.

For the indicated purpose, the closure 22 has a pair of vertically spaced, horizontally elongated brackets 61 welded across the rear thereof and adjacent its top and bottom; and these brackets are in turn welded or otherwise rigidly secured to the upper pairs of bracket elements 57 and the lower elongated bracket elements 58 of the two bag holders 20, 21, so that the latter become unitary components of a tiltable holder and closure unit. The closure panel 22 is of full rectangular width to forwardly conceal holders 20, 21.

For the purpose of pivotally mounting the combined closure and holder unit, generally designated 62, on the frame structure, the tubular bottom frame subassembly or substructure 27 has a pair of forwardly projecting brackets 63 fixedly welded thereto adjacent the corners thereof, while the closure panel unit 22 similarly has a pair of forwardly projected brackets 64 rigidly secured thereto; and the respective brackets 63, 64 at opposite front corners are hingedly connected to one another, as by a pivot pin at 65, to swing between the solid and dot-dash line positions of FIG. 2. If desired, a suitable catch may be applied between the upper bracket elements 57 and 61 to releasably retain the closure panel 22 and bag holders 20, 21 in their operative position.

The hopper unit 24, which is shiftable vertically a limited distance for the purpose of providing clearance for the outward swing of the bag holding subassembly, as indicated by solid-dash line in FIG. 2 comprises, as best illustrated in FIGS. 1 and 2, a sheet metal stamping structure having rectangularly related front, side and rear walls 67, 68, 69, respectively, which are subdivided equally by an integral triangular partition wall 70 to define like hopper halves. The wall members referred to converge downwardly to an integral rectangular throat 71 which is received within the mouth of bag B when hopper unit 24 is in its lowered, operative illustrated in FIGS. 1 and 2. Refuse to be compacted, such as paper products, solid waste, cans, bottles, garbage, etc., is manually deposited in the top of one or the other of the two hopper subdivisions, access being through the open front of the compactor 10 between its cabinet superstructure 46 and its lower cabinet structure 11. If desired, a horizontally elongated opening 72

(FIG. 1) may be provided in the rear wall panel 14 of the cabinet for convenience in depositing refuse into the hopper unit 24 from either the rear or the front of the compactor, and similarly, if desired, this opening may be removably covered by a closure plate 73 pivoted on rear wall 14, as indicated in FIG. 2.

The improvement incorporates special means whereby the otherwise laterally unsupported vertical sidewalls 53 of the two bag holders 20, 21 are quite rigidly braced against spreading under the force of compaction as the initially cushioned buildup of bag content proceeds under the action of ram unit 16.

To this end, and as best illustrated in FIGS. 1 and 4, the rear wall panel 14 of casing 12 has welded thereto a pair of upright flanged side confining plates 74, these being located adjacent the respective side cabinet walls 13, and and intermediate upright flanged confining plate 75 midway between and paralleling the members 74. The members 74, 75 are shown (see FIG. 4) as being vertically elongated U-shaped stampings welded to wall 14, although they might well be integral stamped formations of the latter. However formed, the formations 74, 75 receive the rear edges of the bag holder's side walls 53 therebetween, as best illustrated in FIG. 4, thus in a positive way confining those walls against spreading as compacting goes on.

The cylinder-operated cable and pulley arrangement for raising and lowering the hopper unit 24 is best illustrated in FIGS. 1, 5, 6, 10 and 11, considered in conjunction with FIG. 2. Referring first to FIG. 5, the subassembly 26 comprises a fixed, horizontally elongated air cylinder 77 rigidly mounted adjacent its ends, as by means of brackets 78 and 79, between the horizontally elongated, tubular bottom frame members 33, this cylinder being adapted to be pressurized through suitable air fittings 80 adjacent its ends from the valve-controlled fluid pressure circuitry or system of FIG. 12 which, as indicated above, constitutes as such no part of the invention. A plunger rod 81 operated by an appropriate piston (not shown) in cylinder 77 projects from one end of the latter and at its own end carries a transverse cable actuating head 82. This member is provided with pairs of annular grooves at its ends, to which certain cable components are fixedly secured, in such manner as to be tensioned for a positive lifting and lowering of hopper unit 24, under horizontal strokes of the plunger rod 81 to the right and to the left, as viewed in FIG. 5.

In supplementation of this actuating air cylinder arrangement, reference being had to FIGS. 1, 2 and 5, the front-to-rear side frame members 28, 29 of the frame substructure 27 have pairs of idler pulleys rotatably mounted thereon within the respective recessed bay members 44, adjacent the bottom of the latter. As best depicted schematically in FIG. 10, these pulleys include a single grooved idler 83 and a coaxial double grooved idler 84 in one bay 44, for example, the right-hand one as viewed in FIGS. 5 and 10, and at the opposite side bay 44 a double grooved idler pulley 85 coaxial with a single grooved idler 86. Idlers 83—86 are housed in sheet metal shields 87 affixed to the sides of bottom frame structure 27, in alignment with the bay formations 44.

A first flexible cable 88, as secured to the pneumatic plunger head 82, is trained to the right over and about idler 83, thence to the left and upwardly about one groove of idler pulley 85. A second cable 89, as secured to head 82, goes to the left and upwardly about the second groove of pulley 85. A third cable 90, as secured to plunger head 82, passes to the right and upwardly about one groove of double idler 84; while a fourth plunger head-attached cable 91 goes to the left and downwardly around the single grooved pulley 86, thence to the right and upwardly about the second groove of pulley 84. Other cable and pulley relations will be later described.

Referring now to FIG. 11 in conjunction with FIGS. 2 and 10, the hopper unit 24 is provided adjacent each of its opposite ends with fixedly mounted, laterally projecting connector plates 92, 93, which travel vertically up and down within the side bay formations 44 of the casing structure 12, in the manner indicated in FIGS. 2 and 4. The formations 44 are matched from above by correspondingly spaced bay members 44' of casing top 46, for a primarily appearance reason. The plates 92, 93 may have welded or otherwise fixedly secured thereto a pair of angle pieces 94, by which the fixed connection to hopper unit 24 is made; and by which certain further idler pulleys are mounted.

Illustratively, right-hand plate 93 adjustably receives a threaded connector 95, which is, as best shown in FIG. 11, held in adjusted position by lock nuts 96, the connector 95 depending from plate 93; and the cable 90 is fixedly connected at its top to the connector 95, as at an eye member 97 on the connector screw. The same plate 93 has another adjustable screw 98 projecting upwardly therefrom in laterally spaced, parallel relation to screw connector 95 and similarly held, to which connector 98 the cable 91 is connected at its bottom, having been trained upwardly and forwardly about identical, single grooved idler pulleys 92 (FIGS. 2 and 6). These are rotatively mounted by the connector plate angle extensions 94 adjacent the level of the top of hopper unit 24, as appears in FIG. 2.

Similarly, the cable 88 passes upwardly (FIG. 10) from double grooved idler pulley 85 about upper idlers 94, thence downwardly to an adjustable screw connector 95 on hopper connector plate 92, while the cable 89, passing upwardly about the second groove of idler 85, is attached to an adjustable connector 96 on plate 82.

Accordingly, upon a retractile stroke of pneumatic plunger rod 81, i.e., to the left as viewed in FIGS. 1, 5 and 10, cable 88 is placed in tension, with the result that the left-hand end of hopper unit 24 is elevated at the cable connection 95 to its plate 92. Cable 91 is simultaneously tensioned identically, with the result that the opposite hopper plate 93 is elevated correspondingly and hopper unit ascends to its inoperative position. On the other hand, under a push stroke of plunger rod 81, the cables 89 and 91 are tensioned, with the result that plates 92 and 93 are drawn down and hopper unit 24 is lowered from its raised, dot-dash line position of FIG. 2 to its operative, refuse receiving position.

FIG. 8 of the drawings shows operating features of the ram unit 16 by which the refuse or rubbish is compacted. They comprise a fixed air cylinder 98 which is of relatively large diameter and sealed airtight at its top and bottom by and between cylindrical cap or closure plates 99, 100, respectively. These are of substantial axial thickness for desired cylinder rigidity; and sealing rings 101 are interposed at the joints to insure against leakage of air pressure within cylinder 98. Top plate 99 is cored to provide a radial pressure passage 102, while bottom plate 100 has a passage 103 therethrough to which an air conduit 104 is applied, this conduit and passage 102 connecting to a pneumatic pressure line 105 from the pneumatic system of FIG. 12; and appropriate reversing valve means in that system controls the flow of air under pressure to the upper cylinder space. Similarly, the lower cylinder space is pressurized from a separate system line 105' connected to the air conduit 104.

A cylindrical platelike piston 107 slides vertically within cylinder 98, with appropriate seals 108 interposed for airtight action. Piston 107 is slidably guided and held from rotation by a set of elongated upright guide and restraining rods 109, which are fixedly connected at top and bottom to the respective cylinder cap plates 99, 100. Again, O-ring type seals 110 are interposed between piston 107 and the guide rods 109 to prevent air leakage at the opposite axial ends of the piston.

An axially elongated drive or thrust rod 112 is fixedly coupled airtight to piston 107 at its top, as by a tight threaded connection, thus completing what is in effect a cylindrical piston component of continuous area exposed at its top to pressurized air from passage 102, and at its bottom to air from passage 103 and conduit 104. Rod 112 extends slidably through a sealed bore 113 in the bottom cylinder closure plate 100, beneath which the rod 112 is reduced in diameter and fixedly connects downwardly, through the agency of ap-

propriate threaded connector extension means 114, to an enlarged diameter ram head 115. This head actually performs the compacting operation.

However, a vertically elongated protective sleeve 117 is fixedly applied to ram head 115 and acts vertically with the head. Sleeve 117 prevents access of refuse to the top of ram head 115; and an external protective and shielding sleeve 118, as fixedly applied to a cylindrical mounting plate 119 atop cylinder cap 99, surrounds the moving parts of the ram structure 16 to prevent inadvertent entry of an operator's hand and possible injury.

It is seen from the above that the large upper diameter of the piston 107, as exposed to pressurized air from passage 102, affords a stroke of great power for the compacting operation; while the somewhat smaller effective lower area of the piston, as pressurized from below through conduit 104, still affords ample force to elevate ram 115 to its upper position.

In this connection, means are provided to hold the ram in the elevated position against the force of gravity when the compactor 10 is out of operation and depressurized. This may be in the form of a fixed detent member 120 (FIGS. 8 and 9) depending from the bottom cylinder cap 100 and provided with a small keeper depression at 121 to receive a spring-urged detent ball 122 carried by a bracket piece 123 fixed atop the ram head 115. The relatively slight force exerted between these parts is ample to hold the ram from gravitating downwardly when the compactor is out of operation.

Reference may be had to FIGS. 1, 3 and 7 for a showing of the manner and means for shifting ram unit 16 from right to left, and vice versa, for the purpose of compacting material in the side-by-side arranged bag holders 20, 21. Thus, the cylinder-mounted top plate 119 appearing in FIG. 8 may be suitable secured, as through the agency of a further rectangular plate 123 and transverse mounting members 125, to pairs of parallel slide bars 126, 127 (FIG. 7), which are transversely elongated in nature and extend from front to rear between the respective front and rear top frame parts 35, 36 respectively.

Members 126, 127 are vertically spaced from one another by elongated tubular bars 128; and they overlap the top and bottom of the respective front and rear top frame parts 35 and 36, as appears in FIGS. 3 and 7. Antifriction Teflon strips 129 are secured to the facing surfaces of slide bars 126, 127, and similar strips 130 are secured to the outer surfaces of spacer bars 128, thus providing a minimum friction sliding mount for slides 126, 127 and the ram load that they support on the top frame superstructure 34 as the ram unit 16 traverses between operative positions above the respective bag holders 20 and 21. The slides and spacers 128 may be held in unitary assembly by screws 131 (FIG. 7), or the like.

Referring to FIGS. 1 and 3, the bottom slide bar members 127 carry horizontally spaced and aligned depending bosses 132 in which an elongated pneumatic cylinder 133 is fixedly mounted adjacent its ends for travel with the slide structure, the cylinder being arranged adjacent the rear of the compactor. Cylinder 133 slides relative to a fixed piston therein (not shown), which piston is fast on an elongated rod 134 fixedly mounted at its right-hand end in the side wall 13' of the top casing part 46.

Pressurized air, under the control of a reversing valve unit of the system of FIG. 12, enters cylinder 133 at fittings 135 adjacent its ends; and a removable closure cap 136 covers an opening in the left-hand sidewall 13' of casing part 46, through which opening access to cylinder 133 may be had for the adjustment or servicing. A similar cap 137 applied to the opposite wall is simply a dummy to harmonize the appearance of the apparatus. Accordingly, as the cylinder 133 is reversibly pressurized it carries the entire ram unit 16 with it from side-to-side, into operative compacting position above one or the other of the bag holders 20, 21. The cylinder sustains the left-hand end and piston of the rod 134.

The shelf or bracket part 42 adjoining front top frame member serves as a mount for two spaced reversing actuators 138, 139 of directional control or reversing valve 140 (see also FIG. 12), the spring-urged plungers 138', 139' of which actuators project upwardly for operation by a T-shaped traveling tappet 141. This tappet is carried by an arm 142 fixedly secured to the forward spacer bar 128 of the ram-carrying slide structure. Bar 128 also carries an arm 143 having a second tappet 144 thereon which is adapted to actuate another valve unit 145 of the spring loaded diaphragm type (FIG. 12), in cammingly engaging a spring-urged diaphragm unit 146 of the latter.

Thus, the ram slide during and at the ends of its horizontal traverse stroke trips the valves 140 and 145. These are directional controls whose respective functions are to set the direction of air flow to the ram traverse cylinder 133 and to the ram power cylinder 98 for the down stroke of the ram. The remainder of the pneumatic control system, in part governed by the valves 140 and 145, appears in FIG. 12.

This system, generally designated 148 in FIG. 12, contains various pilot or master valve devices which act automatically, sound mufflers, manual control valves, pneumatic connections, and the like, through the agency of which an unfailing and reliable operation of compactor 10 is insured, with ample provisions for safeguarding both an attendant and the apparatus itself from injury or damage in any possible circumstance. As indicated above, the pneumatic system is not to be considered part of the present invention, although assuredly developed by the present inventors, inasmuch as other fluid system arrangements, either pneumatic or hydraulic might well replace it. Indeed, the compactor 10 might be mechanically or electrically operated. Accordingly, only the highlight features of system 148 will be referred to.

Compressed air from an appropriately rated compressor (not shown), enters the system through an appropriate coupling 150 and nipple 151, passing through a suitable filter 152 and lubricator 153 arranged in an air supply line 154. The pressurized air then diverts through two branch conduits 155 and 156, the former supplying pressure for cylinders 98, 133 and the latter for pressurizing the hopper operating cylinder 77.

Conduit 155 leads to the intake fittings of the two main directional or reversing valves 140 and 145, FIGS. 1 and 3, these valves being equipped with appropriate sound muffling units 157, including interposed needle valves 158.

Conduits 159, 160 from directional valve 140 connect to opposite ends of the ram traverse cylinder 133 at the fittings 135 of the latter (FIG. 1), while compressed air goes from the other main valve 145 to the upper and lower ends of ram cylinder 98 through the conduits 105 and 105' mentioned above. Pilot valves 162, 163 and 164 are disposed in the conduitry for cylinder 98 and reversing valves 138, 140, for the purpose of insuring safety, for example when the hopper and ram units 24, 16 are elevated, for guaranteeing precise timing and the like. These pilots all being variously controlled by springs 165 and/or sliding type cam means 166.

Manually operated valves 168, 169 and 170 respectively control:

a. the operation of the hopper actuating cylinder 77, the valve 168 being in the branch pressure conduit 156;
b. the supply of air through a shuttle valve 171 to the ends of the reversing valves 140 and 145, as well as to a pair of cam and spring operated pilot valves 172 and 173 in the ram cylinder circuit; and
c. to the reversing valves in a supplemental circuit, in the event it is desired to make an emergency return of ram unit 16 to elevated position. Operators 175 for the several valve units 168, 169 and 170 which are of similar design (as are the pilot valves 162, 163, 165, 172 and 173), are mounted upon the front panel of the top casing part 46.

In the operation of compactor 10, the vertical stroke of its ram head 115 is set to terminate downwardly at an elevation of, say, 10 inches above the bottom of the bag holder 20 or 21. Accordingly, actual compression under force of the material does not commence until it has reached this level. As compression proceeds thereafter, the ram has cushioned engage-

ment with the bag content, spreading it at first towards the bag sidewalls, and the cushioning effect continues until substantial pressurization has been reached. Thus, the tendency to unduly stress or rupture the bag walls is minimized, as is the spreading force taken by the bag holder side walls 53, which are in any case laterally braced by the wall confining members or formations 74 and 75. The length of the stroke may be diminished automatically as automation proceeds by suitable provisions in the system circuitry of FIG. 12.

FIGS. 13—19, inclusive, illustrate a modified and considerably simplified embodiment 178 of the compactor; and since the version 178 incorporates many structural features identical or very similar to those of the earlier described modification 10, such corresponding features are denoted by corresponding reference numerals, primed, and further description thereof is dispensed with.

Generally speaking, and by comparison with the first embodiment 10 of the equipment, the compactor 178 substitutes for the latter's pneumatically operated cable and linkage mechanism 26 for elevating and lowering the hopper unit 24 a structurally simpler mechanical toggle-type linkage, generally designated 180; and instead of the pivotally mounted bag holder unit 19 of the first form the machine 178 uses a rolling dolly-type double bag holder unit, generally designated 182. In all other respects, including general frame structure, the pneumatically operated ram unit and the pneumatically operated means for shifting the ram unit from side to side, as incorporated in the compactor 178 are the same as those of the earlier version 10.

The rolling bag holder unit 182, as shown in FIGS. 13 and 16, comprises a rolling dolly 184 fixed beneath and supporting a base structure 185. The latter is quite similar in nature to the main machine base structure 27', in that it is fabricated of parallel front and rear tubular members 186, 187, respectively, of rectangular cross section and like end or side members 188, all these members being welded together in a rectangular outline and braced by front-to-rear intermediate members of similar section. Dolly base structure 185 has an impact receiving pressure block 189, similar to the part 56 of the first embodiment, mounted thereon, through which the thrust of the compacting ram strokes is transmitted directly downwardly from the bag holders 20', 21' to the compactor's main bottom frame structure 27' when the holders are placed in a lowered, operative position through the agency of the linkage 180, as will be described. Pivotal casters 190 at the four corners of the dolly base 185 mount the unit 182, as comprised of holders, 20', 21', base 185 and dolly 184, for its translation movement front-to-rear and vice versa, relative to the remainder of the machine 178 for the removal of compacted bags and their replacement by fresh ones.

FIGS. 13 and 16 show the bag holder unit 182 as having a full width front cover panel 191, appropriately finished attractively at its top and bottom by rolled formations 192, the panel being provided adjacent and between those formations with top and bottom bracket means 193 194, respectively, for purposes to be described. Such bracket means rigidly spaced panel 191 from the forward holder wall 52', between which panel and wall they are welded, thus constituting the holders and the cover panel 191 to be an unitary subassembly 182' of the holder, base and dolly assembly 182 movable on casters 190. The holders 20', 21' are similar to those of the first embodiment 10, and are similarly braced at their rear by antispread means corresponding to the members 74 and 75 of the first embodiment.

As shown in FIG. 2, the bottom dolly base structure 185 includes a second forward tubular cross member 195 which is rigidly connected, as by welding, to the front of the forward base member 186, and assists in the mounting of the linkage 184 as will be described.

A vertically elongated rod 196 penetrates and is welded in place adjacent each of the two ends of forward crossmember 195, being shown in FIGS. 13 and 16 as being in front-to-rear alignment with the mount or the forward dolly casters 190. The rods 196 each extend upwardly into a cylindrical sleeve 197 surrounding the same in fixed relation thereto, the rod 196 terminating at a point adjacent but downwardly of the top of the sleeve; and each of the sleeves 197 receives in its top a bottom cylindrical reaction piece 198 of the linkage 180, this piece bottoming on the top of the rod 196 as a reaction support for the toggle linkage 180. Reaction piece 198 pivotally mounts at 199 a lower link 200 of said linkage, which link is in turn pivotally connected at 201 to an upper link 202 of equal length.

The top end link 202 is itself pivoted at 203 to a lifting piece 204 of the linkage 184; and the piece 204 telescopes into a short sleeve 205. This sleeve is supported by a weld connection in aligned apertures of the upper cover panel bracket 93 which mounts cover panel 191 to the bag holders, sleeve 205 being in vertical alignment with the bottom guide sleeve 197. A roll pin extends through sleeve 205 linkage lift piece 204, thus fixedly connecting the upper end of toggle linkage 180 to the combined and unitary bag holder and cover panel subassembly 182' (FIG. 16).

It is to be understood that the linkage adjacent one horizontal side of the machine 178, as just described, is duplicated by an identical toggle linkage adjacent the other side. Operating connecting rods 207, 208, respectively (FIG. 13), connect the central pivots 201 of these linkages with the ends of a single actuating arm 209 (FIGS. 13 and 15) approximately centered in relation to and inwardly of the cover panel 191, this arm being suitably pivoted medially of its length to the panel, as by a shaft 210 carrying a boss enlargement 210' on which arm 209 is centrally fixed. Linkage 180 is completed by an operating handpiece 211 fixedly connected to operating shaft 210. Accordingly, upon an approximately 90° **turn of handle** 210 **in the clockwise direction, as viewed in FIG.** 13, **the linkage connecting rods** 207, 208, **as pivotally connected to links** 200 **and** 202 **at the latter's own pivotal connection** 201, **will straighten said links from the broken toggle relationship appearing in FIG.** 13. **The result is that upward lifting effort is exerted by toggle top piece** 204 **on the bag holder and panel subassembly** 182', i.e., at the connections of the toggle lift piece 204 to the upper bracket parts 193 welded to cover panel 191 and bag holder walls 52'. The vertical shift of the subassembly 182' may amount only to three-eights inches, say, but this is sufficient to elevate the holders 20', 21' sufficiently above the base structure 185 of the dolly 184 to enable the holders to upwardly clear in relation to the basic machine bottom structure 27'. This permits a free forward and rearward bodily action of the dolly and its load in moving from an operative position of the holders 20', 21' in the vertical path of action of the ram unit to a withdrawn position for removal of the filled and compacted bags, and vice versa.

As a further feature of improvement of the modified compactor 178, the linkage 180 which affords the described moving clearance, as operated by handle 211, also serves to releasably lock the panel, bag holder and dolly assembly 182 in the operative position for compacting mentioned above. To this end, and as shown in FIGS. 13 and 14, the bottom cover bracket part 194, as it overlies the end bottom frame members 30' of the basic machine, has a depending shot pin 212 welded thereto and projected therebeneath. When the bag holders 20', 21' as resting on the impact receiving block 189, have been lowered by the breaking of toggle linkage 180 to rest upon the machine's bottom frame 27', the shot pins 212 are received in appropriate detent or keeper sleeves 213 carried by the machine base end members 30', thus locking the combined panel, dolly and bag holder structure 182 against undesired translational movement from the operative position of the bag holders 20', 21' beneath the ram unit of the machine. When panel and holder subassembly 182' is lifted the structure 182 is unlocked for movement under a pull on handle 211. Accordingly, linkage 180 and its described connections serve a dual function in a very simple and inexpensive manner, structurally speaking.

An equally similarly simple link mechanism, generally denoted 214, is employed for the raising and lowering of the hopper unit 24' of the compactor 178. Thus, as best shown in FIGS. 17, 18 and 19, considered with FIGS. 13 and 14, a front-to-rear elongated crank rod 215 is pivotally mounted to a forward panel portion 216 of the machine casing structure, as at a bracket part 215' welded to the latter, and a pivotal mount of crane rod 215 is also made to the rear of the casing structure. Such a crank rod and its mount are provided adjacent each side of the machine, and each rod 215 has an eccentric offset 217 between its pivoted ends, the eccentric being spaced substantially from those ends so that crank rod 215 may have direct lifting and lowering action on the hopper unit 24' at opposite sides of the latter.

In exerting this action the operating rod offset or eccentric 217 is received in recessed formation 218 of each of a pair of small stamped brackets 219 at each hopper end, which brackets are welded in place as unitary parts of hopper unit 24'. Each of the crank rods 215 has fixed thereto at its forward end, just to the rear of the casing part 216, a radial crank arm 220; and an elongated connecting rod 221 is pivotally connected to the end of crank arm 220. A similar connecting rod 222 extends to a similar hopper control subassembly at the opposite side of the machine.

An operating handle or handpiece 224, generally centered in relation to the casing panel part 216 and pivotally mounted on the latter by a stem portion 225, fixedly carries at that stem an operating arm 226 at the latter's midpoint; and the elongated connecting rods 221, 222 are pivotally coupled at 227, 228, respectively, to the ends of arm 226.

Accordingly, a clockwise movement (FIG. 13) of the handpiece 224 of, say, 90° has the result, through the agency of the connecting rods 221, 222 and operating crank arms 220 of swinging the hopper control eccentric part 217 a corresponding amount, with a consequent elevation of hopper unit 24' from the solid line position of FIG. 16 to the dotted line position. This may amount to only an elevation of, say, 1⅛ inches, but it is sufficient to enable the bag holders 20', 21' to forwardly and rearwardly clear beneath the raised hopper unit 24' in the translational movement of the holder structure 182 described above.

In its lowered position, the hopper unit 24' rests on the top of the bag holders through the agency of small, downwardly arcuate seats 230 welded to the hopper sides. These restrain the bag against downward drag under the impacting stroke of the ram unit. It is also contemplated that the hopper unit 214 may be stably sustained in its extreme upwardly retracted position by swinging the handle 224 somewhat more than 90° clockwise (FIG. 13), so as to place the eccentric operating parts 217 in a slightly overcenter position in relation to the axes of the operating crank rods 215. In this condition, small bottom lips 219' of the hopper brackets 219 prevent a tendency of the hopper unit 24' to raise on an upward ram stroke under the upward influence of the decompressing compacted material.

It is seen that the embodiment of FIGS. 13—19 represents, in particular reference to the hopper control structure, a considerable simplification of the earlier described embodiment, being based on a quite different principle of wholly mechanical operation, as distinguished from a combined fluid pressure and cable-pulley arrangements. It is also to be seen that the dolly-type bag holder mount and its dual type function toggle linkage control afford an alternative to the pivotally mounted bag holder concept of FIGS. 1—12, inclusive, which may in many instances be preferable to the latter for one reason or another.

What we claim is:

1. A compactor of the type described, comprising a frame structure, a reciprocable ram unit, a bodily translatable holding unit for disposable containers positioned in the line of action of said ram unit, and a hopper unit to guide material to be compacted into a container in said holding unit, said ram, holding and hopper units operating within said frame structure, said ram unit acting through said hopper unit, the compactor having provision to afford additional vertical clearance between said holding unit and said structure for the bodily translational movement of said holding unit to a position forwardly of the structure and relative to the path of action of said ram unit.

2. The compactor of claim 1, in which a rolling dolly-type support mounts said holding unit for said bodily translational movement.

3. A compactor of the type described, comprising a frame structure, a vertically operating ram unit, at least one holding unit for disposable containers, said holding unit being positioned beneath and in the line of action said ram unit, said ram and holding units operating within said frame structure, rolling dolly-type, floor-engaging means mounting said holding unit for bodily translational movement into and out of a position relative to the vertical path of the ram unit to receive the latter in a container in the holding unit, and means for operating said holding unit vertically in relation to said frame structure to permit the holding unit to be translationally moved horizontally relative to the structure for the removal of the container therefrom.

4. The compactor of claim 3, in which said holding unit has manually actable means for the vertical operation thereof.

5. A compactor of the type described, comprising a vertically operating ram unit, a holding unit for disposable containers, means mounting said holding unit for movement into and out of a position relative to the vertical path of the ram unit to receive the latter in a container in said holding unit, a hopper unit to guide material to be compacted into said container, and powered flexible cable and pulley means for operating said hopper unit vertically toward and away from said holding unit to permit the latter to be moved laterally for the removal of the container therefrom.

6. The compactor of claim 5, in which said movement of the holding unit is a pivotal one about a horizontal axis at 90° to a vertical plane of movement of the holding unit, said axis being located forwardly and downwardly adjacent the bottom of the holding unit.

7. The compactor of claim 5, in which said means for operating said hopper unit vertically comprises a fluid pressure actuated mechanism having flexible cable and pulley means operatively connecting it to the hopper unit for the vertical action of the latter.

8. A compactor of the type described, comprising a frame structure, a vertically operating ram unit operating under reversing fluid pressure, at least two holding units for disposable containers, said ram unit operating in and said holding units being positioned beneath said ram unit in different laterally translated positions of the latter, means to horizontally shift said ram unit between said positions, means to mount said holding units for bodily movement translationally in a horizontal direction into and out of the path of said ram unit in either shifted position of the latter, and means to elevate said holding units for clearance relative to said structure to permit said movement.

9. The compactor of claim 8, in which a rolling dolly-type support mounts said holding units for said bodily translational movement.

10. A compactor of the type described, comprising a vertically operating ram unit operating under reversing fluid pressure, at least two holding units for disposable containers, said holding units being positioned side-by-side beneath said ram unit, means mounting said holding units for movement into and out of a position relative to the vertical path of the ram unit to receive the latter in said containers, a hopper unit to guide material to be compacted into said containers, fluid pressure-actuated cable and pulley means for operating said hopper unit vertically toward and away from said holding unit to permit the latter to be moved laterally for the removal of containers therefrom, and means to shift said ram unit horizontally between laterally translated positions above the respective holding units.

11. The compactor of claim 10, in which said movement of the holding units is a pivotal one about a horizontal axis at 90° to a vertical plane of movement of the holding unit, said axis being located forwardly and downwardly adjacent the bottom of the holding unit.

12. A compactor of the type described, comprising a vertically operating ram unit, at least one holding unit for disposable containers, said holding unit being positioned beneath said ram unit, means mounting said holding unit for bodily translational movement into and out of a position relative to the vertical path of the ram unit to receive the latter in a container in the holding unit, a hopper unit to guide material to be compacted into said container, and means for operating said hopper unit vertically toward and away from said holding unit to permit the latter to be translationally moved for the removal of the container therefrom, said means for operating said hopper unit vertically comprising a manually actuated linkage operatively connected to the hopper unit.

13. The compactor of claim 12, in which said linkage comprises a rotatable crank pivotally mounted on a fixed support and engaging the hopper unit at an eccentric part of the crank.

14. A compactor of the type described, comprising a vertically operating ram unit, a holding unit for disposable containers positioned beneath said ram unit, and means mounting said holding unit for bodily translational movement into and out of alignment with the vertical path of the ram unit, comprising a bodily movable support for the holding unit, and means to shift said support vertically for clearance in the movement thereof relative to other parts of the compactor, comprising a manually operable, toggle-type linkage operatively connected between a manual operator and a part of the holding unit support through which the latter is shifted vertically.

15. The compactor of claim 14, and further comprising means operated by said linkage to releasably lock said holding unit and its support in a translated position relative to said ram unit.

16. The compactor of claim 14, and further comprising means operated by said linkage to releasably lock said holding unit and its support in a translated position relative to said ram unit.

17. A compactor of the type described, comprising a vertically operating ram unit, a holding unit for disposable containers positioned beneath said ram unit, and means mounting said holding unit for bodily translational movement into and out of alignment with the vertical path of the ram unit, comprising a bodily movable support for the holding unit, and means to shift said support vertically for clearance in the movement thereof relative to other parts of the compactor, said shifting means comprising a manually operable, toggle-type linkage operatively connected between a manual operator on the support and a part of the holding unit support through which the latter is shifted vertically.

18. The compactor of claim 17, and further comprising means operated by said linkage to releasably lock said holding unit and its support in a translated position relative to said ram unit.

19. A compactor of the type described, comprising a vertically acting ram unit having means to operate a compacting part thereof in a compacting stroke, and a holding unit in the path of the stroke adapted to receive containers for material to be compacted, said ram unit having means externally shielding said part thereof in the compacting stroke, and means internally of said shielding means to mechanically sustain said compacting part adjacent the top of said stroke.