

[54] REFUSE COMPACTING DEVICE

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[51] Int. Cl. B30b 11/22

[58] Field of Search..... 100/49, 179, 229 A, 269 R, 100/295, 52, 256, 43, 245, 41; 53/124 B

[56] References Cited

UNITED STATES PATENTS

3,103,876 9/1963 Ferranti 100/295 X

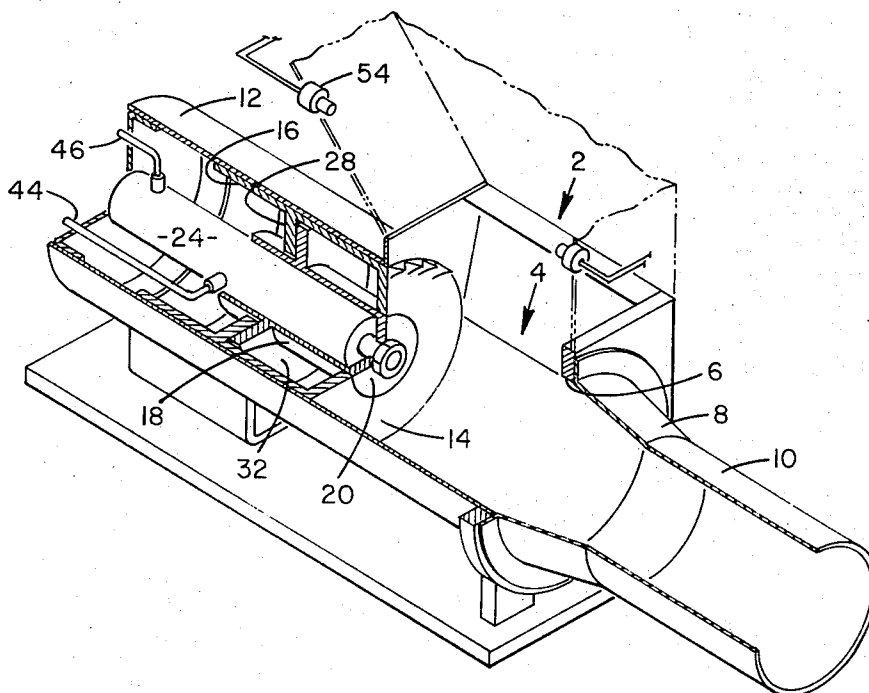
3,384,007 5/1968 Boje et al..... 100/295 X
3,603,245 9/1971 Pioch 100/269 X
3,621,775 11/1971 Dedio et al. 100/295
3,734,005 5/1973 Vogel..... 100/52

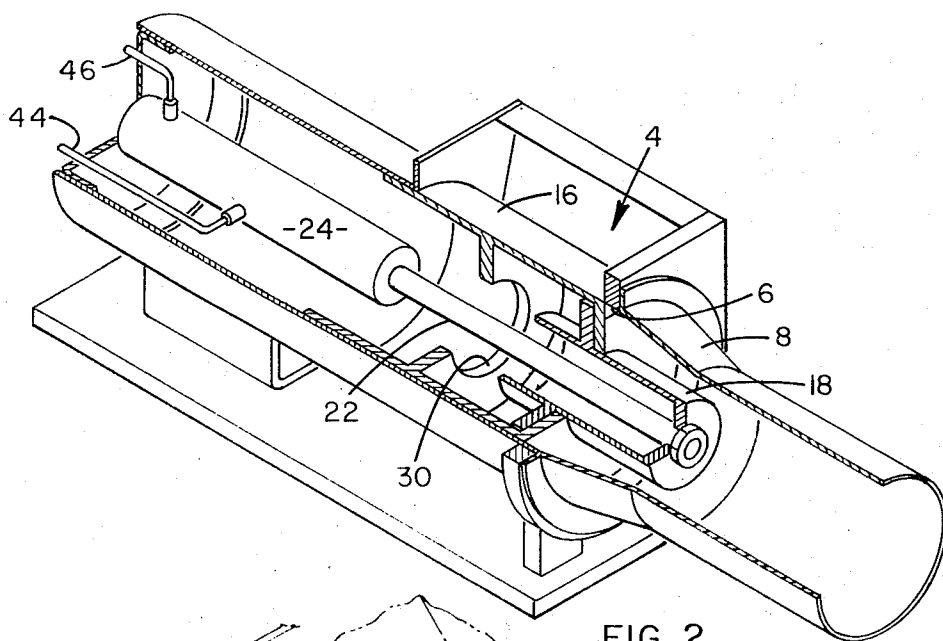
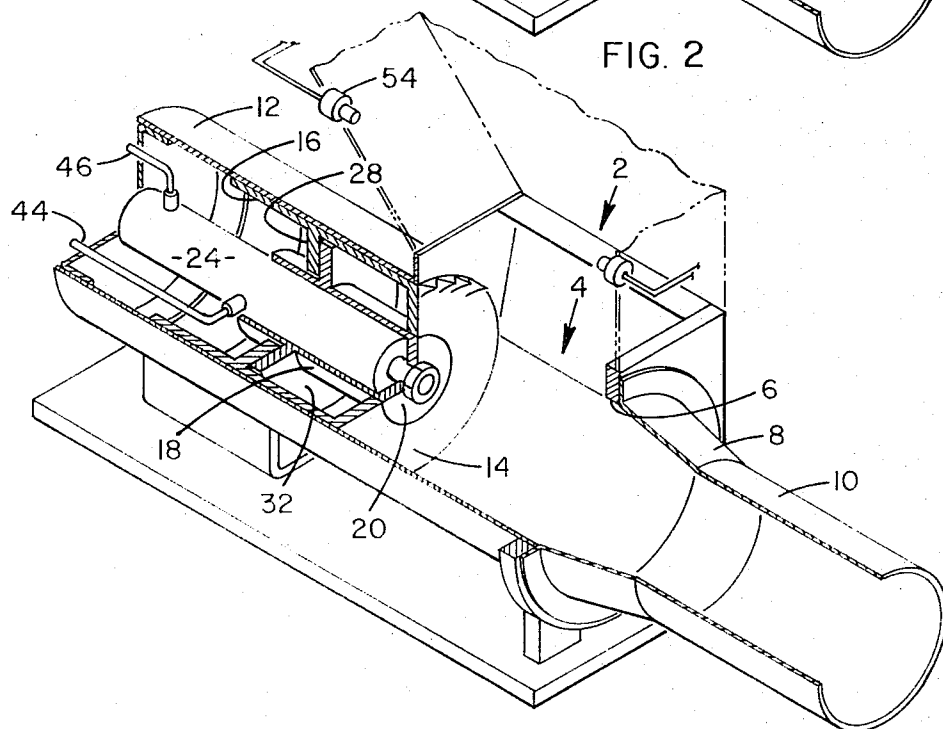
Primary Examiner—Billy J. Wilhite

[57] ABSTRACT

A ram and funnel type of refuse compacting device having a main compacting ram and a center mounted concentric auxiliary ram. The main ram is driven through the compaction cycle by the auxiliary ram. The auxiliary ram is driven forward of the main ram at the beginning of the compaction cycle and thereafter engages the main ram and drives it forward through the compaction chamber.

6 Claims, 7 Drawing Figures





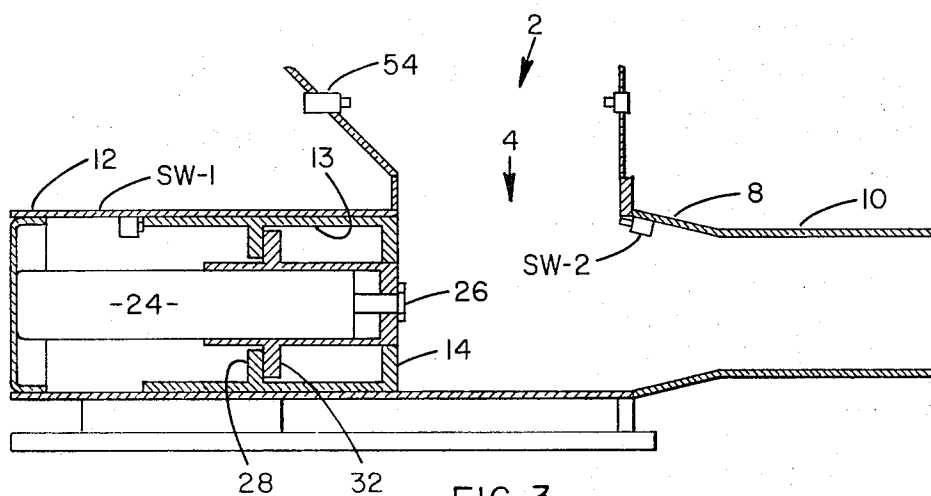


FIG. 3

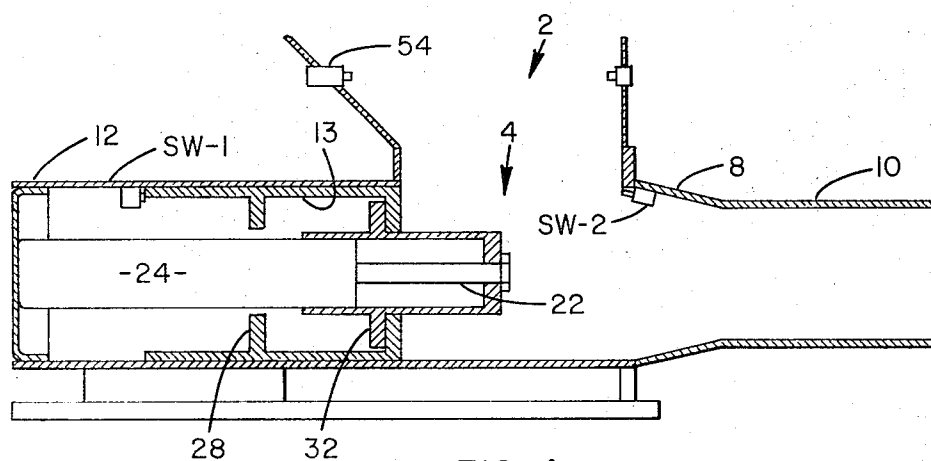


FIG. 4

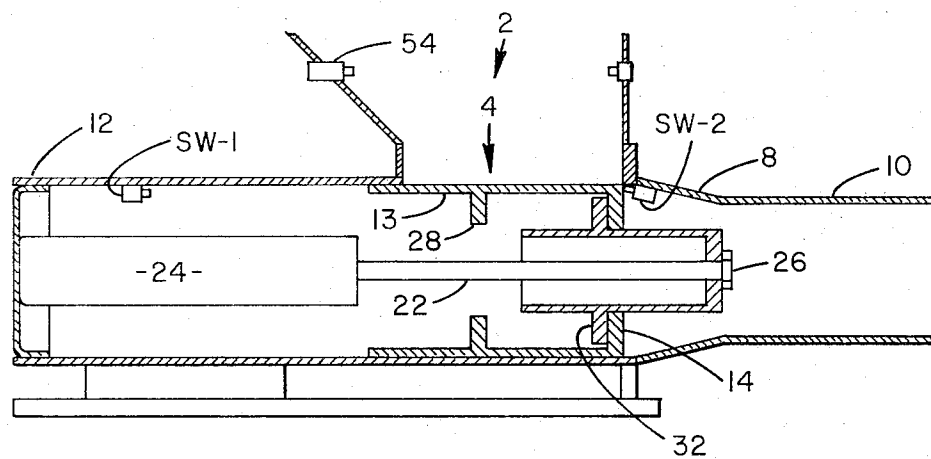


FIG. 5

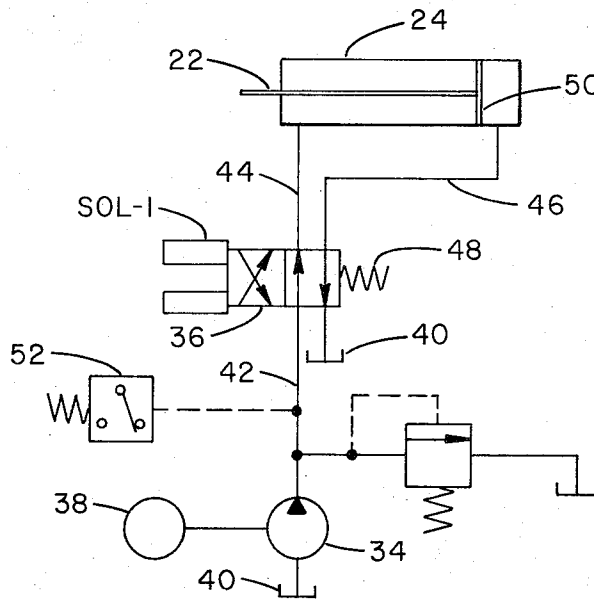


FIG. 6

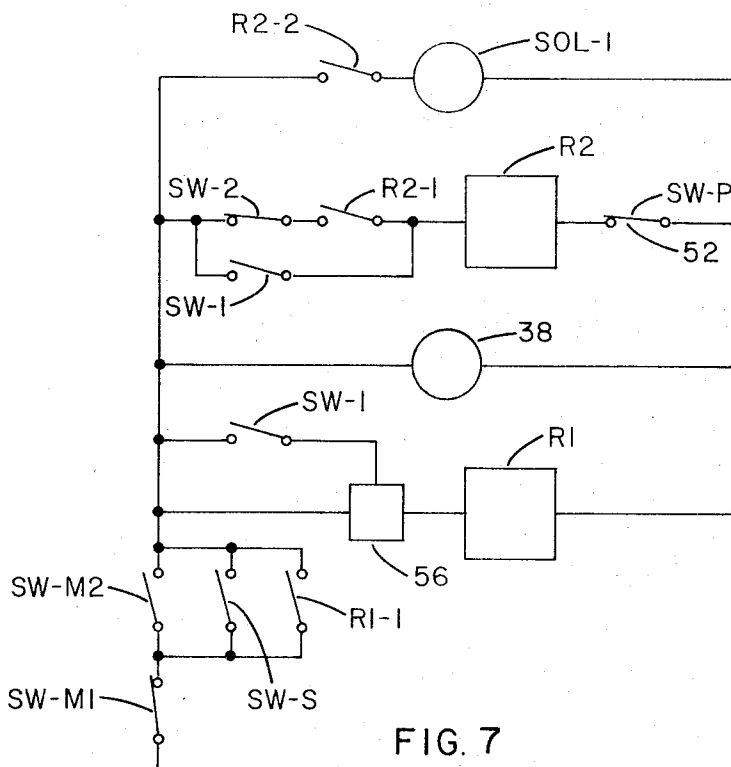


FIG. 7

REFUSE COMPACTING DEVICE

BACKGROUND OF THE INVENTION

This invention relates in general to refuse compacting devices and specifically, to ram and funnel type of refuse compacting devices.

Ram type refuse compacting devices generally fall into two categories. The first utilizes a ram to crush and compact refuse into a closed chamber wherein a bale of refuse is ejected from the chamber after compaction by forward movement of the ram into the chamber. The second type ejects a continuous mass of compacted refuse by moving a ram to force refuse into and through a funnel shaped conduit. The pressure of the ram forced the refuse through the funnel causing compaction and ejection through the smaller end of the funnel. A device of this type is disclosed in the Boje et al. U.S. Pat. No. 3,384,007, issued May 21, 1968. Machines of this type are utilized for intermittent, unattended operation. A common usage is in residential apartments where trash and waste are deposited by tenants into chutes which deposit the trash into a main bin which feeds the waste compactor. All types of normal waste material, including cartons and irregular shaped objects are deposited in the compactor which results in a non-uniform material requiring varying amounts of pressure for compaction and ejection. Occasionally material will jam, resulting in excessive pressure build-up ahead of the ram and causing the ram to stall or go through repeated cycling to break up the jam. In the prior art, devices such as the Boje et al. patent cited above, a smaller auxiliary ram concentrically located in the center of the main ram has been used. Upon occurrence of a jam, the small auxiliary ram is forced forward by a separate hydraulic system in an attempt to break up the jam ahead of the main ram by forcing smaller amounts of refuse into the funnel. Devices of this type have been successful, however, they increase the cost of the compactor unit, in that they require separate hydraulic systems and the necessary control systems. The Boje et al. U.S. Pat. No. 3,384,007, for example, utilizes three separate hydraulic cylinders with valving and control between the cylinders.

The present invention tends to break down large chunks of refuse prior to the compaction and force a portion of the precompact material forward toward the center of the funnel. By breaking down the larger material prior to compaction, the material is rendered more uniform and the flowability or compaction characteristics are enhanced. By forcing a portion of the precompact material forward, the material is partially compacted and aligned with the funnel so that it is less likely to jam as it is forced into the small end of the funnel.

SUMMARY OF THE INVENTION

It is an object of this invention, to improve ram and funnel type refuse compaction devices by reducing the complexity of the mechanical equipment and of the control and power systems.

Further objects of this invention are to reduce the number of jams occurring in refuse compaction devices, and to reduce or break down large masses of refuse prior to compaction;

it is also an object of this invention to provide a refuse compaction device with a jam preventing capabil-

ity that requires only one hydraulic cylinder in its operation.

These, and other objects of this invention, are attained by means of a hydraulic main ram head mounted in a funnel type compaction device and having a concentrically mounted auxiliary ram, both of which are operated from a single hydraulic cylinder. The main ram and the auxiliary ram are constructed so that the auxiliary ram advances ahead of the main ram prior to movement of the main ram. The auxiliary ram engages the main ram and carries the main ram forward through its compression stroke. At the end of the compression stroke the auxiliary ram is retracted into the main ram and then engages the main ram to withdraw the main ram through its return stroke.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be hereinafter more fully described with reference to the accompanying drawings in which:

FIG. 1 is an isometric view of a refuse compacting device with its ram in the precompaction position, and embodying the present invention. Portions are broken away to show the internal structure of the device;

FIG. 2 is an isometric view of a refuse compacting device with the ram in their fully extended position;

FIG. 3 is a schematic sectional view of a refuse compacting device embodying the present invention, with the main ram and auxiliary ram in the fully retracted position;

FIG. 4 is a schematic sectional view of a refuse compacting device embodying the present invention, with the main ram head in its retracted position and the auxiliary ram head in its extended position;

FIG. 5 is a schematic sectional view of a refuse compacting device embodying the present invention, with the main ram head and the auxiliary ram head in their fully extended positions;

FIG. 6 is a diagrammatic representation of a hydraulic system usable with the present invention; and

FIG. 7 is a diagrammatic representation of an electrical circuit usable with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1 and 2 of the drawings depict a refuse compacting device wherein a refuse hopper or loading chute 2, which is designed to receive and accumulate refuse prior to compaction, empties into a compaction chamber 4. Waste material in the chamber 4 is ejected through an exit opening 6 into a compaction funnel 8 and conduit 10. Refuse forced through the funnel 8 is compacted and emerges into a conduit 10. Continued compaction of material and ejection through funnel 8 causes the compacted material to be continually ejected from the end of the conduit 10. Material exiting conduit 10 can be captured in rigid containers or flexible bags.

A casing or shell 12 extends rearwardly of the compaction chamber 4 and the loading chute 2. Within the shell 12 there is mounted a main compaction head 14 mounted for sliding movement through the compaction chamber 4. The main head 14 has a cylindrically shaped body portion 16 extending rearwardly into the casing 12, as shown in FIG. 1. An auxiliary ram 18 having a head 20 is concentrically mounted in the center of the main head 14. The auxiliary ram 18 extends rear-

wardly from the face of the main ram and is mounted on a piston rod 22 of a hydraulic cylinder 24. The piston rod 22 is secured to the auxiliary ram 18 at the forward end of the ram. In the retracted position the face of the auxiliary ram 18 is flush within the face of the main ram head 14 to prevent refuse from depositing on the auxiliary ram and limiting the capacity of the chamber 4.

Within the body portion 16 of the main ram there is a rigid stop plate 28 with a circular center opening 30 sized to accommodate the auxiliary ram 18. The plate 28 is rigidly secured to the body 16 of the main ram. An annular ring 32 is secured to and extending outwardly from the auxiliary ram 18 between and in interfering relationship with the retracting plate 28 of the main compaction ram. The annular ring 32 is positioned on the auxiliary ram so that the auxiliary ram extends forward of the main ram before the ring 32 engages the main ram compaction head 14. Continued forward movement of the auxiliary ram will drive the main ram through the compaction chamber 4.

Operational positions of the auxiliary ram and main ram can be seen in the schematic sectional views of FIGS. 3, 4 and 5. In FIG. 3 the main ram and the auxiliary ram are shown in their retracted positions wherein the piston rod 22 is in its extreme rearwardly position within the hydraulic cylinder 24. The annular ring 32 is in engagement with the retracting plate 28; the auxiliary ram 18 is withdrawn inside the main ram 18 so that the face of the plug 26 is flush with the face of the main compaction ram head 14. Refuse from the loading hopper 2 falls by gravity into the compaction chamber 4 and is relatively loosely packed.

Upon operation of the hydraulic cylinder 24 the piston rod 22 moves forward carrying with it the auxiliary ram 18 to the position shown in FIG. 4. In this position the annular ring 32 engages the rear side of the main compaction ram head 14. The forward portion of the auxiliary ram 18 extends forwardly into the compaction chamber 4, forcing refuse material in the compaction chamber 4 forward towards the center of the funnel 8. The auxiliary ram head 20 will engage any large masses of refuse, such as cardboard cartons, and cause them to be broken or displaced forwardly. Continued forward movement of the piston rod 22 causes forward movement of the main ram 13 through engagement of the annular ring 32 and the main compaction head 14 until the position shown in FIG. 5 is reached. In this position the refuse is packed into the funnel by the main ram head and forced into the cylindrical tube by the auxiliary ram.

OPERATION

The operation of the compactor shown in FIGS. 1-5 will be described with reference to the hydraulic system and the electrical circuitry shown in FIGS. 6 and 7, respectively. The head end and the rod end of the hydraulic cylinder 24 are connected to a fluid pump 34 through a four-way hydraulic spool valve 36. The pump 34 is driven by a motor 38 and pumps fluid from a reservoir 40 through line 42 to the four-way valve 36. A hydraulic line 44 connects the four-way valve to the rod end of the hydraulic cylinder 24 and a hydraulic line 46 connects the four-way valve to the head end of the hydraulic cylinder 24.

A spring 48 holds the four-way valve in a straight through position wherein the pump 34 pumps fluid

through the line 42, through the four-way valve to the line 44 leading to the rod end of the cylinder 24. In this position fluid is free to move under the action of the piston head 50 through line 46, through the four-way valve 36 back to the reservoir 40. A solenoid sol-1 has its plunger connected to the four-way valve to actuate the valve to a position wherein fluid from the pump 34 will pass through the line 42 to the four-way valve, through the four-way valve to line 46 leading to the head end of the cylinder 24. Hydraulic fluid in the rod end of the cylinder 24 is free to move under the action of the piston 50 through the line 44, through the four-way valve 36 back to the reservoir 40. A pressure switch 52 is mounted in line 42 to respond to excess pressure in the system to disconnect solenoid sol-1, allowing the spring 48 to reverse the position of the four-way valve.

A light or sonic sensing switch 54 is mounted in the hopper 2 to detect the presence of refuse in the hopper and initiate operation of the compactor. The switch 54 has contacts SW-s mounted in the main power line to the compactor. When the light or sonic beam is broken, the contacts SW-s close, energizing the compacting circuit. A master switch SW-M-1 is also mounted in the main power line to the compactor so that the entire compactor may be shut down to prevent operation at any time. The master switch SW-M-1 must be closed prior to operation of the compactor. A manual switch SW-M-2 is mounted in the compactor circuit in parallel with the contacts SW-s of the sensing switch 54, to allow manual operation of the compactor. In the event there is insufficient refuse in the hopper 2 to actuate the sensing switch 54, the compactor may be operated by manually closing the switch SW-M-2.

Closing of the contacts of the sensing switch SW-s or the manual switch SW-M-2, energizes the circuit and provides power through a counter 56 to a relay R1. The relay R1 has a set of normally open contacts R1-1 which are in parallel with the contacts of the sensing switch SW-s and the manual switch SW-M-2 and which provide a holding circuit for the relay R1. Operation of the compactor allows the refuse in the hopper 2 to be depleted and the beam of switch 54 to be restored. The contacts SW-s are normally open, cutting off power to the compactor circuit. The holding circuit and the contacts R1-1 maintain power to the circuit throughout the cycle of operation. The counter 56 can be set to allow a predetermined number of cycles of operation prior to deenergizing relay R1 which, in turn, opens contacts R1-1 to shut down the compactor. The counter 56 is pulsed by a set of contacts to switch SW1. The switch SW1 is a limit switch located on the inside of the shell 12 at a position to be actuated by the return movement of the main ram 13. If, for example, it is determined that the hopper 2 and the compaction chamber 4 hold approximately five times the volume of the compaction chamber, then the counter would be set to operate five cycles each time the sensing switch 54 is interrupted. Each time that the main ram 13 returns to its retracted position it would actuate SW1 pulsing the counter 56.

Closing of the sensing switch SW-s also energizes the motor 38 and provides power to a second relay R2 through a second set of contacts to switch SW1. The line to relay R2 also has a set of normally closed contacts for a second limit switch SW2 mounted in parallel to the contacts of limit switch SW1. The limit

switch SW2 is mounted in the compaction chamber 4 in a position to be actuated by the main ram head at the end of the compaction stroke.

Relay R2 has two sets of contacts, the first set R2-1 being normally open and mounted in the line to relay R2 parallel to contacts of switch SW1. Contacts R2-1 provide a holding circuit for the relay R2. A second set of contacts R2-2 for the relay R2 are also normally open and control the power to the solenoid sol-1.

Prior to operation, main ram 13 is in the retracted position shown in FIGS. 1 and 3 and the switch SW1 is held in a closed position by contact with the main ram shell. When refuse is accumulated in the hopper 2 the circuit to the switch 54 is interrupted and the normally open contacts SW-s are closed, energizing relay R1 and providing the holding circuiting through contacts R1-1. The motor 38 is energized, driving pump 34 to provide high pressure fluid to the system from reservoir 40. With the switch SW1 in a closed position, the relay R2 is energized, closing the holding circuit through contacts R2-1 and the circuit to solenoid sol-1 through contacts R2-2. With the solenoid energized, the four-way valve 36 is moved to the position wherein high pressure hydraulic fluid is supplied to the head end of the hydraulic cylinder 24. Movement of the hydraulic cylinder 24 causes the auxiliary ram 18 to advance and engage the rear portion of the main ram head 14. Forward movement of the main ram 13 releases the switch SW1, allowing the contacts for SW1 to return to their normally open position. The solenoid sol-1 continues to be energized by means of power through contacts SW2 and R2-1 to relay R2 and through contacts R2-2 to the solenoid sol-1. When the main ram 13 advances through the compaction cycle to the position shown in FIG. 5 the switch Sw2 is actuated and the normally closed contacts SW2 are open, breaking the circuit to relay R2. De-energization of relay R2 allows the contacts R2-2 to open, de-energizing solenoid sol-1. The four-way valve 36 is then moved under the action of spring 48 to the position wherein high pressure fluid is supplied from the pump 34 to the rod end of the cylinder 24 through line 44. Pressure in the rod end of the cylinder 24 causes the piston head 50, the auxiliary ram 18 and the main ram 13 to move back towards the retracted position. Release of switch SW2 allows the contacts SW2 to revert to their normally closed position, however, the contacts R2-1 are now in an open position, since relay R2 has been de-energized. When the main ram is in the fully retracted position it actuates limit switch SW1, again pulsing the counter which, if the preset number of cycles has been completed, will de-energize relay R1, cutting off the entire circuit. However, if the counter has not reached the preset number, then the second set of contacts to the switch SW1 are also closed, re-energizing relay R2 and repeating the compaction cycle.

In the event that the full compaction cycle cannot be completed because of excess pressure ahead of the ram, then the fluid pressure in the system will increase until sufficient pressure is reached to actuate pressure switch 52. The pressure switch 52 is located in the electrical circuit to the relay R2 and when actuated, will open its normally closed contacts de-energizing relay R2 and solenoid sol-1. When this situation is reached, prior to the completion of the compaction cycle, the spring 48 moves the four-way valve 36 to the return stroke position, thus, the main ram 13 and the auxiliary

ram 18 will go back to the original retracted position and actuate switch SW1 to initiate a complete new cycle of operation. Having thus described the invention relative to the preferred embodiment disclosed, it is understood that various changes may be made by one skilled in the art without departing from the spirit and scope of the invention.

What I claim is:

1. A waste compacting device including:

a main compaction ram slidably mounted in a housing for reciprocating movement through a compaction chamber in the housing and having a compaction head for compacting waste material in the compaction chamber;

an auxiliary ram concentrically mounted in the main compaction ram and slidably movable in a reciprocating manner from a position inside the main compaction ram to a position ahead of the main compaction ram head;

fluid actuated power means to drive the auxiliary ram forward and rearward through the compaction chamber; and

means to engage the main compaction ram by the auxiliary ram after the auxiliary ram has moved to a position forward of the head of the main compaction ram when the auxiliary ram is moving in the forward direction and after the auxiliary ram has moved to a position inside the main ram when the auxiliary is moving in the rearward direction to thereby move the main compaction ram forward and rearward through the compaction chamber.

2. A waste compacting apparatus including:

a compaction chamber capable of receiving waste material to be compacted and having a funnel shaped discharge opening in one end;

a main compaction ram, having a compaction head slidably mounted for reciprocating movement through the compaction chamber towards and away from the funnel shaped discharge opening;

an auxiliary ram slidably mounted in the center of the main ram and extending through the main compaction head for movement relative to the main ram;

a cylinder having a fluid driven piston connected to the auxiliary ram;

means to supply fluid under pressure to the cylinder to drive the piston in both a forward and rearward direction to thereby drive the auxiliary ram in a reciprocating movement; and

means on the auxiliary ram to engage the main ram compaction head to couple the auxiliary ram to the main ram during forward travel of the auxiliary ram and stop means on the main ram positioned to be engaged by the auxiliary ram during its return movement thereby causing the main ram to be returned with the auxiliary ram, said means on the auxiliary ram being positioned so that the auxiliary ram moves relative to the main ram prior to engaging the main ram compaction head.

3. The apparatus of claim 2 wherein the engaging means on the auxiliary ram comprises:

a stop member secured to the body of the auxiliary ram between the stop means and the compaction head on the main ram; and

the distance between the stop means of the main ram and the main ram compaction head being sufficient to allow the auxiliary ram to extend forward of the

main ram when the auxiliary ram is driven in the forward direction, and for the auxiliary ram when the auxiliary ram is driven in the rearward direction.

4. The apparatus of claim 3 further including:
a control system to terminate forward movement of the auxiliary ram when the main ram has traversed the compaction chamber; and
means to reverse the direction of movement of the auxiliary ram on occurrence of a predetermined pressure build-up ahead of the main ram.

5. In a waste compacting device of the type wherein a compaction chamber is positioned in a housing to receive waste from supply hopper for compaction by forcing through a funnel shaped outlet in the compaction chamber and a main compacting ram is mounted in the housing for reciprocating motion through the compaction chamber to force waste material through the funnel shaped outlet, an auxiliary ram is concentrically mounted in the center of the main ram for reciprocating movement relative to the main ram and to the compaction chamber, the improvement comprising:

a hydraulic cylinder connected to the auxiliary ram to drive the auxiliary ram forward into the compaction chamber;
engaging means, on the auxiliary ram, to engage the main ram in driving relationship with the auxiliary

ram;
the engaging means being positioned on the auxiliary ram so that the auxiliary ram travels forward into the compaction chamber prior to engaging the main ram and so that the continued movement of the auxiliary ram will carry the main ram through the compaction chamber;

means to reverse the movement of the auxiliary ram when the main ram has completed its forward movement; and

means mounted on the main ram to contact the engaging means on the auxiliary ram when the auxiliary ram is moving in the reverse direction to return the main ram back through the compaction chamber.

6. A method of compacting refuse material, including:

the steps of supplying refuse material to be compacted to a compaction chamber;
driving a small high-pressure ram device into the refuse in the compaction chamber; and
forcing the refuse material through a funnel shaped opening in the compaction chamber by means of a larger ram device driven by the small ram device through the compaction chamber.

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