

May 21, 1968

D. Q. BOJE ETAL
WASTE COMPACTING DEVICE

3,384,007

Filed Aug. 9, 1967

5 Sheets-Sheet 1

FIG. 1

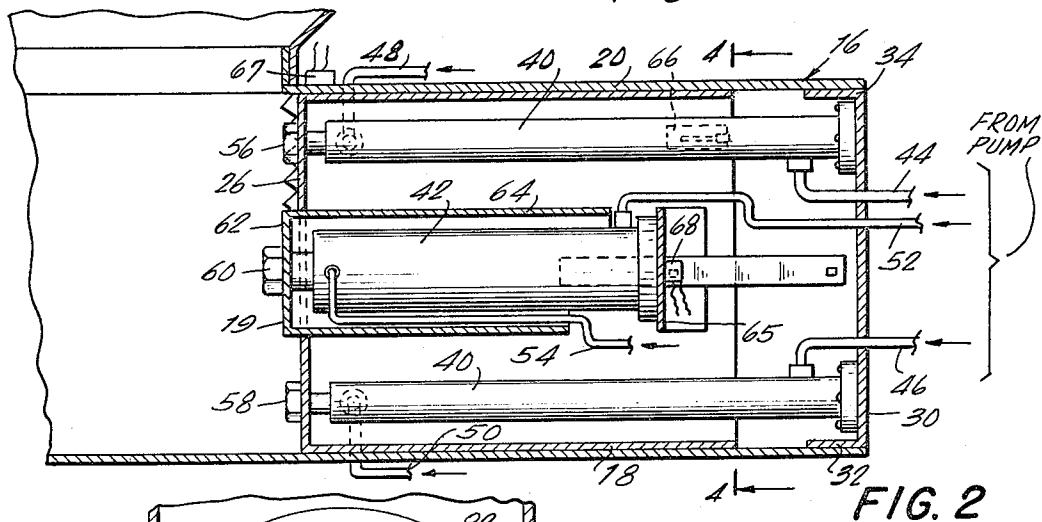
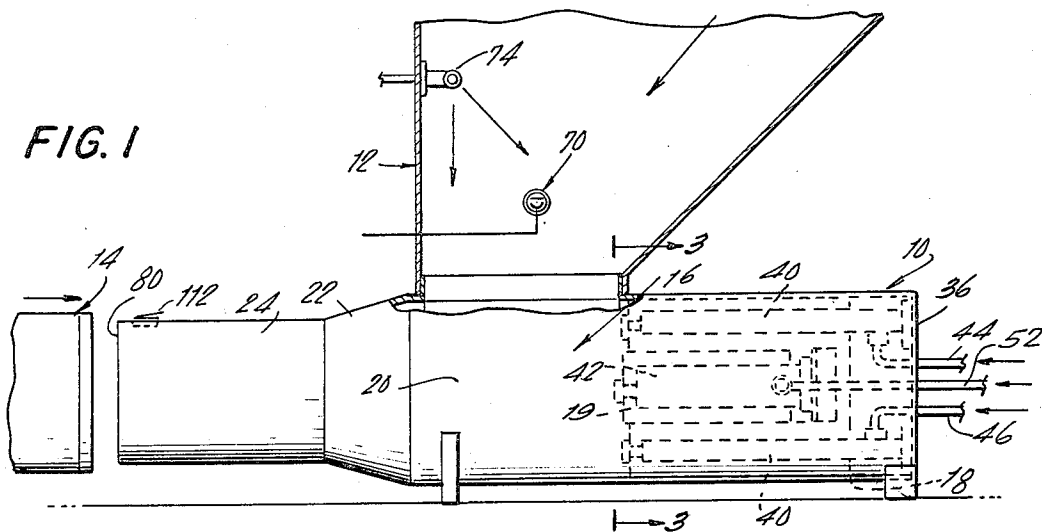


FIG. 2

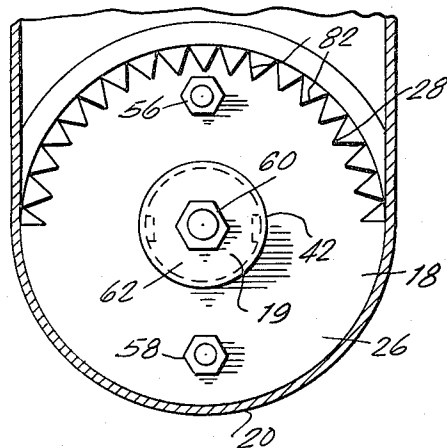


FIG. 3

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5 Sheets-Sheet 2

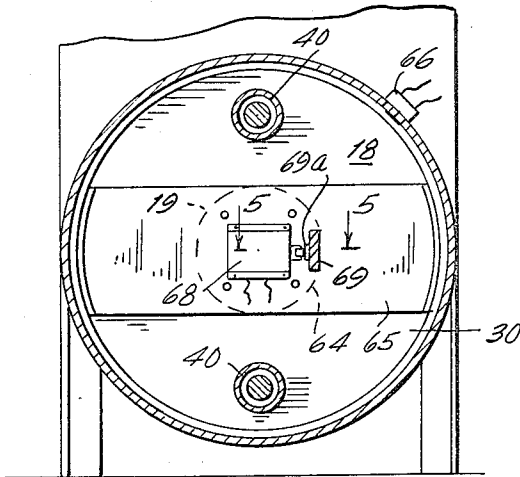


FIG. 4

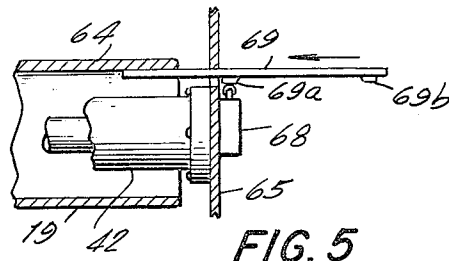


FIG. 5

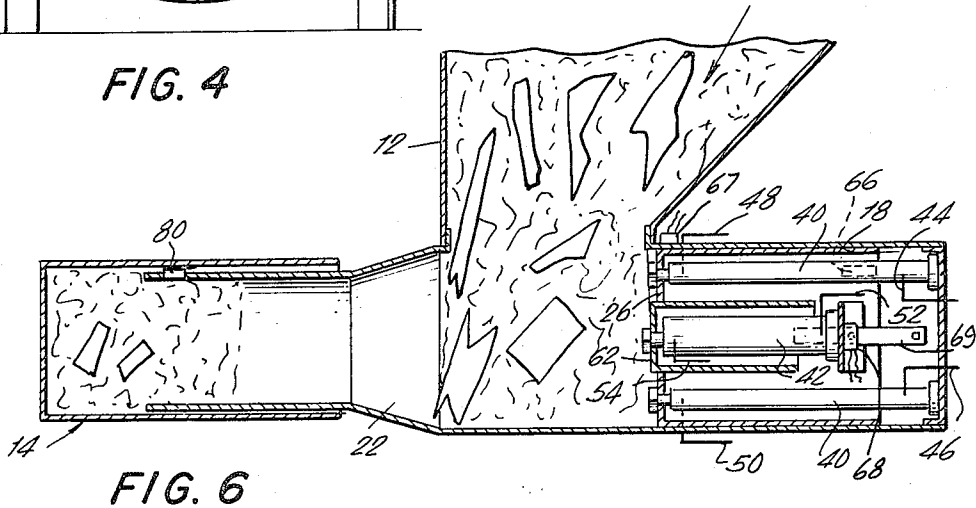


FIG. 6

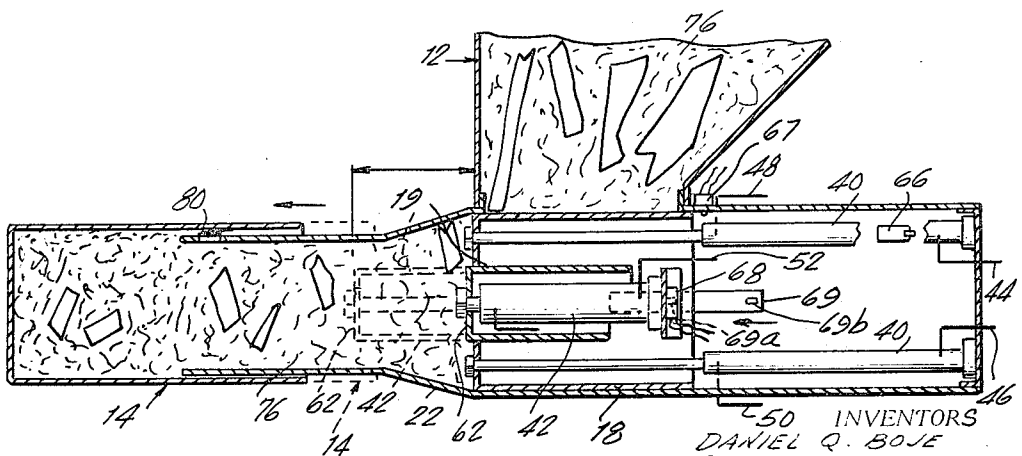


FIG. 7

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5 Sheets-Sheet 3

FIG. 8

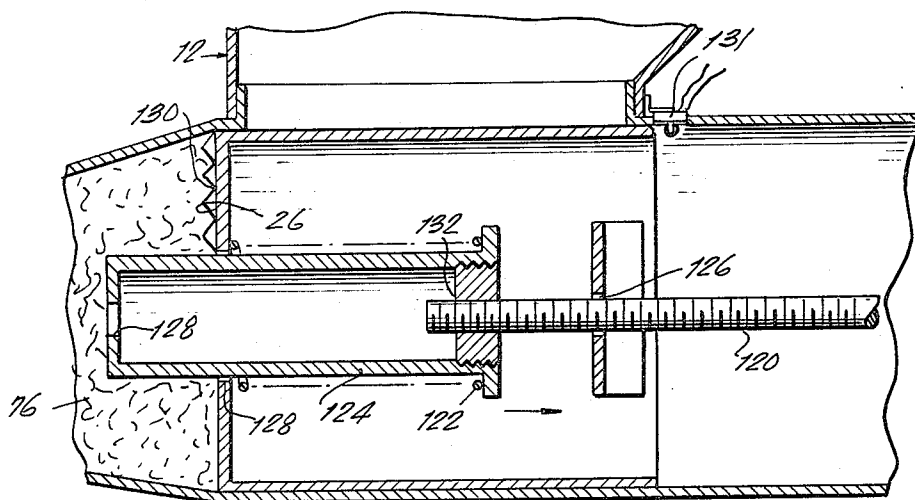
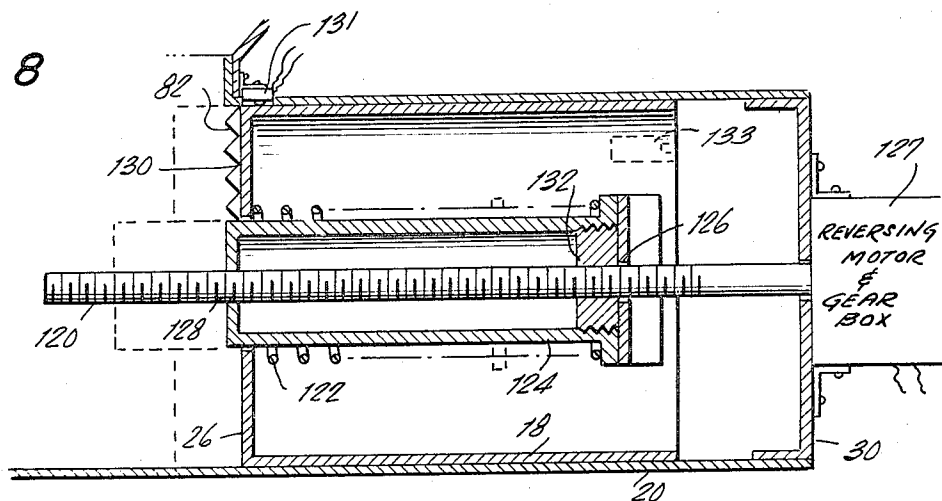


FIG. 9

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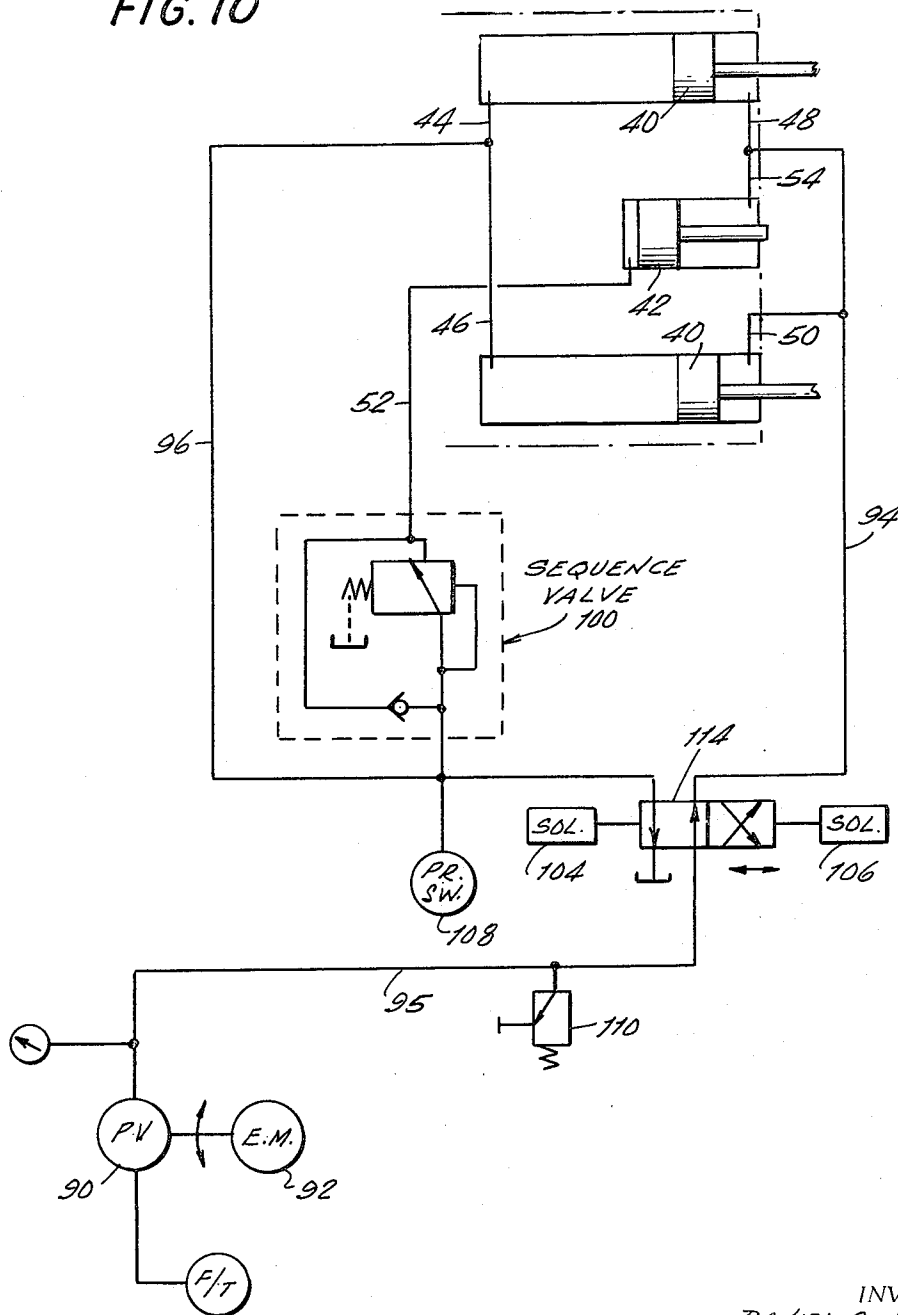
3,384,007

WASTE COMPACTING DEVICE

Filed Aug. 9, 1967

5 Sheets-Sheet 4

FIG. 10



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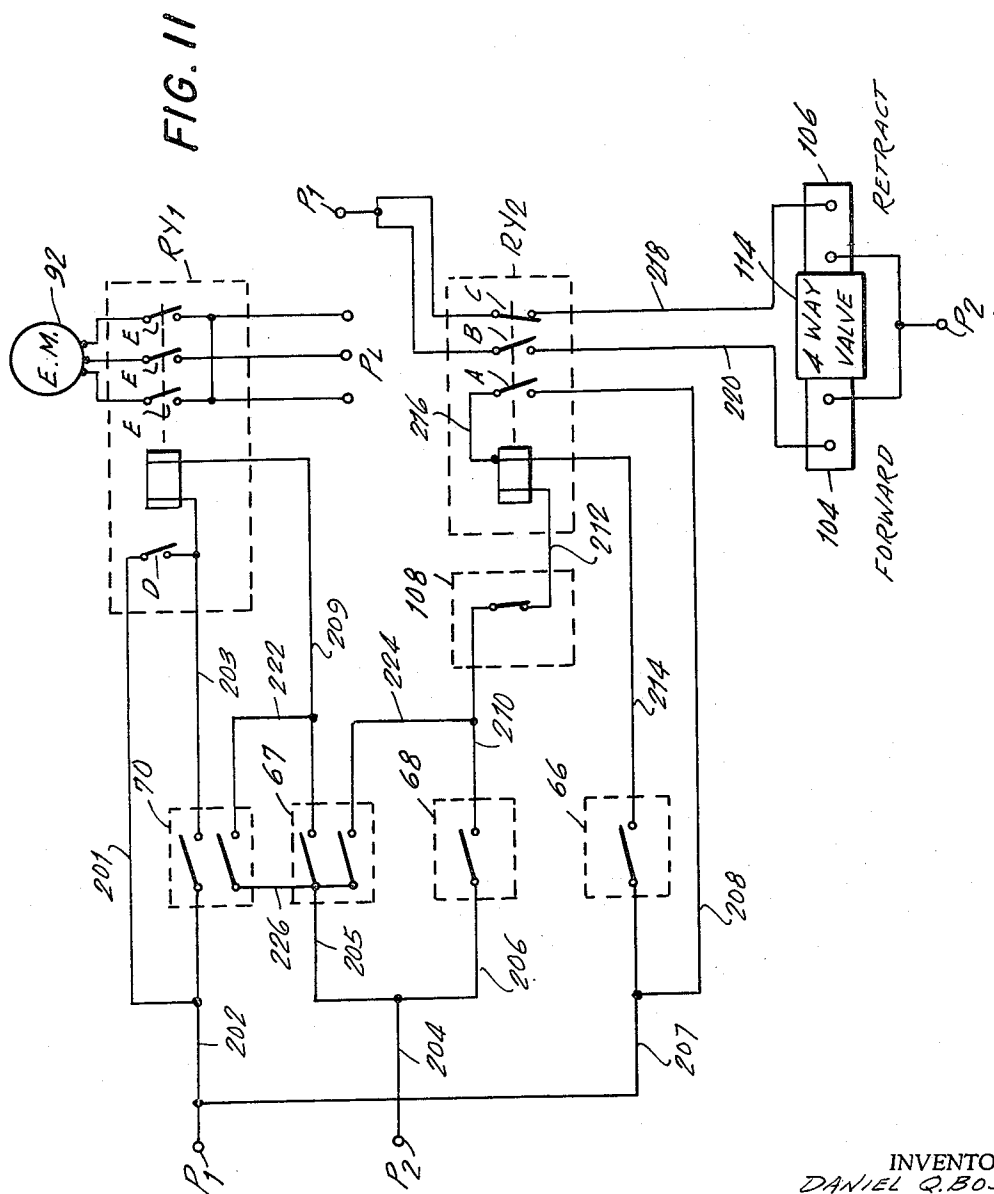
D. Q. BOJE ETAL

3,384,007

WASTE COMPACTING DEVICE

Filed Aug. 9, 1967

5 Sheets-Sheet 5



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1

3,384,007

WASTE COMPACTING DEVICE

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Continuation-in-part of application Ser. No. 588,050, Oct. 20, 1966. This application Aug. 9, 1967, Ser. No. 659,472

10 Claims. (Cl. 100—49)

ABSTRACT OF THE DISCLOSURE

This invention is concerned with providing an improved waste compacting device in which concentrically adapted compactors are so coordinated that continual reciprocating compacting action is allowed to proceed.

CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a continuation-in-part of my copending U.S. application Ser. No. 588,050, filed Oct. 20, 1966.

BACKGROUND OF THE INVENTION

(1) *Field of the invention.*—This invention relates generally to a waste compacting device. More particularly, this invention relates to an improved waste compacting device in which uninterrupted compacting action is provided.

(2) *Description of the prior art.*—Various waste compacting devices are known. For example, in my copending application, identified above, there is described a waste compacting device in which a ram is forcibly reciprocated toward and away from a funnel provided in the housing therefor to compact waste loaded into the housing against the inner surface of the funnel. However, it is a problem in said compactor that when it has been in operation for a period of time, a back pressure in the waste builds up resultingly arresting the compacting action of the ram and thereby preventing the further compacting of waste materials through the elongated housing therefor.

SUMMARY OF THE INVENTION

It is, therefore, among one of the principal objectives of this invention to provide an improved compacting device wherein the compacting action of the device is essentially uninterrupted and operating at lower pressure levels.

In accordance with the invention an improved waste compacting device has been devised in which multiple or concentrically arranged ram means are provided whose compacting action is so coordinated that continual reciprocating compacting of waste is allowed to proceed; the first ram means reciprocably proceeding until a predetermined adjustable back pressure build-up in the waste material is reached, whereupon a second ram means is automatically actuated. The action of the said second ram means relieving said back pressure in the mass of material, thereby allowing the first ram means to reciprocably proceed anew when said back pressure has been reduced to a preselected level, and so forth.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be hereinafter more fully described with reference to the accompanying drawings, in which: FIGURE 1 is a fragmented side view of the inventive device;

FIGURE 2 is an enlarged cross-sectional view;

FIGURE 3 is a sectional view taken along line 3—3 of

2

FIG. 1 in the direction of the arrows in front of the numerals;

FIG. 4 is a sectional view taken along line 4—4 of FIG. 2 in the direction of the arrows in front of the numerals;

FIGURE 5 is a sectional view, in fragmentary form, taken along line 5—5 of FIG. 4 in the direction of the arrows;

FIGURE 6 is a view similar to FIG. 1, in cross-section, showing the actual operation of the device with a waste can partially filled, and the ram means in the retracted position;

FIGURE 7 is a view similar to FIG. 6, showing the operation of the second ram means after the first ram means has been arrested;

FIGURE 8 is a view in cross-section of another embodiment of the invention;

FIGURE 9 is a view in cross-section, partially fragmented, showing the actual operation of the embodiment of FIG. 8;

FIGURE 10 is a diagram illustrating the operation of the device; and

FIGURE 11 is an electrical circuit diagram.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the figures of the drawings, for purposes of illustration, FIGS. 1 and 2 depict a waste compacting device designated generally by the numeral 10 with a loading chute assembly 12, to which it is connected, and a disposal receptacle 14 for receiving compacted waste matter. The waste compacting device 10 includes an elongated housing 16 and a reciprocably moving first ram 18 slidably mounted within said housing. Said housing 16 comprises in turn an elongated horizontal portion 20, in which said ram 18 is slidably housed, a tapered portion 22 at the end opposite said ram, said tapered portion 22 joining shorter horizontal portion 24 of said housing 16. The housing 16 is preferably annular in shape although other configurations may be employed, and may be an integral unit making up parts 16, 22 and 24, or may be composed of detachably mounted parts 16, 22 and 24. The movable ram 18 conforms to the configuration of the housing and in this case is also annular in shape and of circular cross-section, constructed in piston-like form. Turning now to FIGS. 2—5, the first ram 18 comprises a head wall 26, a circular side wall 28 and rear wall 30. Side wall 28 is not integrally connected to rear wall 30, so that forward motion may be accomplished when the hydraulic cylinder driving means are actuated as described below. Rear wall 30 has at each end integrally connected thereto right angle flanges 32 and 34 which are received inside housing 16 at the rear end 36 thereof. Within said ram 18 are located first driving means or primary hydraulic cylinders 40. Preferably in concentric inner relation with said primary cylinders 40 is a second driving means or auxiliary hydraulic cylinder 42 which actuates the second or auxiliary ram means 19. Said second ram means 19 is also preferably of circular cross-section when that general configuration is employed and constructed in piston-like form being comprised of a head wall 62, a circular side wall 64 and a rear wall 65 which is not connected to said side wall. Rear wall 65 is fixedly secured, as by welding to the side wall 28 of the first ram means 18 and thus mounts the second driving means comprised of hydraulic cylinder 42. It will thus be seen that the first ram means may be reciprocated with respect to the housing and that the second or auxiliary ram means may be reciprocated simultaneously with the first ram as well as with respect thereto.

The first hydraulic cylinder means 40 are suitably connected to forward flow hydraulic fluid by means of for-

ward flow lines 44 and 46 which are connected to a suitable pump 90 (see FIG. 10), which supplies the hydraulic fluid needed to drive the pistons of said hydraulic cylinders forward. Return lines 43 and 50 are provided for the return or retractive movement of the pistons of said hydraulic cylinders. Likewise, hydraulic cylinder 42 has a forward flow line 52 and a return line 54 for the purpose of forward and retractive movement of the piston thereof. The piston rods of hydraulic cylinders 40 and 42 are secured to the head wall by means of bolts 56, 58 and 60, respectively. Since the bases of primary hydraulic cylinders 40 are fixedly secured to the housing by means of rear wall 30 the actuation of the piston rods will cause the first ram means to be reciprocated with respect to the housing. The base of the auxiliary driving means comprised of hydraulic cylinder 42 is fixedly secured to the side wall of the first ram means 18 by rear wall 65. It will therefore be carried by and travel with said first or primary ram means. It is however adapted to reciprocate the second or auxiliary ram means 19 with respect to said primary or first ram means 18 upon actuation of the piston of said second or auxiliary hydraulic cylinder. In the fully retracted position of both ram means a continuous head wall is thus provided for compacting the waste material. The arrangement is such that both ram means may thus be simultaneously reciprocated presenting a common head wall between forward and retracted positions, or under appropriate circumstances the inner or auxiliary ram means 19 may be advanced with respect thereto. As stated, ram 19 being slidably movable within housing 20 and concentrically within ram 18, can be said to have its own head wall 62, which however, is located at times in a generally common plane with head wall 26.

A limit switch 68 is mounted on rear wall 65 for the purpose of controlling the movement of ram 19. Limit switches 66 and 67 are provided for controlling the movement of the first ram means 18. The function of these switches will be hereinafter described. A sonic beam and switch arrangement 70 (FIG. 1) is provided for the chute whose function is to initially activate the ram means and commence the compacting action when waste is deposited or present in the chute 12 as sensed by the interruption of the beam. A light beam arrangement with suitable detection means to actuate a switch may also be employed. There are also provided deodorizing and insecticide sprays which may be applied to the waste by means of spray inlet 74.

As may be seen from FIG. 10, there is provided a hydraulic system comprised of suitably interconnected pump means 90 (P.V.) operated by a motor 92 (E.M.) and a filter (F/t) and a safety relief valve 110 all of conventional type. A four-way valve 114 is operated by means of solenoids 104 and 106 and controls the forward and reverse movement of the hydraulic cylinder pistons and consequently the movement of the rams. Sequence valve 100 of conventional type is also provided for periodically operating cylinder 42 as required. Pressure operated switch 108 (P.R. SW) is provided for reversing the flow if pressure exceeds operating limits.

Referring now to FIGS. 10 and 11, it will be seen that the interruption of the sonic or light control beam closes switch 70 thus providing a path from P1, through line 202, the upper contact of switch 70, line 203, the coil of RY1 and lines 209 and 222, the lower contact of switch 70, lines 226, 205 and 204 to P2. Relay RY1 is thus actuated closing contacts D and E thereof. Contacts D and E thus closed permit power to be fed from lines PL to the electric motor 92 (E.M.) which operates pump 90 (P.V.). This initiates the retractive movement of ram 18 which carries with it ram 19. As seen in FIG. 10, hydraulic fluid is now being fed from the pump through line 95, four-way valve 114 and lines 94, 48 and 50. The fluid under pressure in line 54 leading to cylinder 42 retains the ram in telescoped relation within ram 18 during the retractive movement of the latter. It will be noted that

contact C of relay RY2 is closed since that relay is in rest position and that consequently solenoid 106 of valve 114 is connected across P1 and P2. The four-way valve is therefore in right hand position for retractive movement of the cylinders and rams.

It will be noted that RY1 is provided with a holding contact D which shunts the upper contact of switch 70 so that once actuated, relay RY1 will be maintained in activated condition under certain circumstances as when switch 70 opens in the course of a ram stroke due for example to the exhaustion of material in the chute.

At the retractive movement of ram 18 is initiated and the ram begins to move to the right, the tail end of the ram contacts the operating lever of switch 67 closing both contacts thereof. Retractive movement of the rams continues uninterrupted, the upper contact of said switch providing an alternate path feeding one side of the coil of RY1 through lines 209, 205 and 204 of P2. The retractive movement will thus be completed even if switch 70 is opened in the course thereof.

In the course of the retractive movement of the rams, the space under the chute is vacated by the rams permitting the waste to drop and fill the space in front of the rams for the purpose of compaction, as in FIGURE 6. As the rams approach the limit of the retractive movement namely the position shown in FIG. 6, the tail end of ram 18 contacts switch 66 closing the contacts thereof. The closing of switch 66 provides current to the coil of RY2 through the following path; P1 to line 207, switch 66 and line 214 to the coil, through line 212 through switch 108, lines 210 and 224, the lower contact of switch 67 which is now closed and lines 205 and 204 to P2.

Since contact A of RY2 is now closed, a holding circuit shunting switch 66 is now established through line 216, 208 and 207 to P1. It will now be apparent that the positions of the contacts B and C have been reversed and consequently the positions of solenoids 104 and 106 are similarly reversed thus causing the four-way valve 114 to reverse the fluid flow and thus the direction of movement of the rams. The forward or compacting stroke of the apparatus is thus initiated. The flow of hydraulic fluid is from valve 114 through lines 96, 44 and 46 to cylinders 40. Ram 19 is carried forward by ram 18 while the piston of cylinder 42 remains in the position illustrated in FIG. 10. As the forward movement commences, switch 66 is cleared and its contact opens. This does not effect the continuance of the forward movement of the rams since the holding circuit provided by contact A of RY2 shunts switch 66. Nor is the forward movement interrupted if switch 70 is opened in the absence of any further waste in the chute since RY1 is provided with a holding circuit through contact D. The forward stroke of the rams must therefore be completed before the operation of the apparatus comes to a halt.

The forward movement of the rams compacts the waste ahead of them and forces it into the tapered portion 22 of housing 16. When the limit of the compacting stroke is reached the tail of ram 18 clears switch 67 which now opens.

Power from P2 to the coil of RY2 is thus interrupted and that relay returns to its rest position shown in FIG. 11 thereby reversing the four-way valve solenoids and causing the rams to retract in the manner heretofore indicated and thus the apparatus is caused to re-cycle in a continuous manner so long as the chute sensing switch remains closed due to the pressure of waste therein. A point will however be reached when the chute has emptied and switch 70 is opened in the course of operation of the apparatus. Under these conditions, the completion of a compacting stroke will find both switch 67 and 70 open and consequently relay RY1 will be released, opening the contacts to motor 92 and causing the apparatus to shut down until switch 70 again ac-

tuates RY1 due to the introduction of waste material into the chute. A manually operable override switch shunting switch 70 may of course be provided to permit the apparatus to operate with the chute in empty condition.

From the foregoing it will be apparent that, in operation, the rams will be simultaneously retracted and returned to the forward position, and repeatedly automatically recycled in a continuous manner. The waste material is thus progressively compacted by the rams and expelled from the mouth of the apparatus whence it may be deposited in a waste can 14 or the like placed at the extreme end 80 of housing 16 in overlying relation to portion 24 thereof.

As this process continues with each forward stroke, back pressure builds up in the waste material and consequently in the hydraulic lines feeding main cylinders 40 and the rate of the forward movement of the rams is reduced due to the resistance of the compacted waste material. The rise in pressure of the hydraulic fluid is sensed by sequence valve 100 which is of conventional type. As a preselected back pressure is reached during a compacting stroke, sequence valve 100 is caused to be actuated to the position wherein the highly pressured hydraulic fluid is now fed into the secondary or auxiliary cylinder 42 of ram 19 through line 52. This causes the auxiliary ram 19 to be projected from and to advance ahead of ram 18. In order to prevent the interruption of the forward stroke of the auxiliary ram before it has been fully projected from main ram 18, a cam-operated switch arrangement is provided.

Referring to FIGS. 2 and 4 and particularly FIG. 5, it will be noted that side wall 64 of auxiliary ram 19 has affixed thereto a cam bar 69 which is provided with spaced bands 69a and 69b adapted to bear upon the switch actuating roller of switch 68. In initial position when the auxiliary ram 19 is fully telescoped into ram 18 the switch roller is retained in depressed condition and the switch is open. However, as soon as the sequence valve 100 is activated, the cam bar moves forward with ram 19 as it is driven into the compacted mass of waste material ahead of ram 18. The arm of switch 68 drops off band 69a and its contacts close thus shunting contacts of switches 67 and 70 to P2. The circuits are therefore held in position for forward or compacting movement until both the main and auxiliary rams have reached the forward limit of the compacting stroke. At this point switch 67 will be opened in the manner heretofore indicated and switch 68 will be opened by abutment with band 69b of cam bar 69. The consequent release of relay RY2 will cause a reversal of both rams and ram 19 will again telescope into ram 18, remaining in that position subject to the action of the sequence valve.

As the auxiliary cylinder is driven into the center of the compacted mass of waste material, the back pressure of that mass is reduced or relieved and the main ram can then continue forward to the full limit of its forward or compacting stroke as shown in FIGURE 7, the position of the auxiliary ram being that indicated by the broken lines. Since switches 67 and 68 are again actuated at this point it will be seen that the flow of hydraulic fluid will be reversed and that the auxiliary ram will recede into the main ram which will also retract until the position shown in FIG. 2 and the space ahead of the rams will refill with waste as long as waste remains in the chute. The apparatus will then continue to recycle and progressively compact the material until a point is reached wherein the back pressure developed in the compacted mass exceeds the capability of the main ram and the pressure is relieved by the auxiliary ram to permit the compacting operation to proceed on a continuous basis and without interruption. If at any point the back pressure of the waste mass exceeds the capability of both rams to move forward, a pressure build-up will result and reach a preselected level, at which point the pressure

build-up is sensed by pressure switch 110 causing it to open and release relay RY2, thus reversing the direction of movement of both rams. The rams will thus retract and recycle through a partial compacting stroke until the pressure presented by the mass of waste is relieved and the limit of forward movement of the rams is reached permitting normal operation to be resumed.

It will thus be seen that the reciprocating action and hence the compacting action is substantially uninterrupted and consequently the compactor operates in a substantially continuous manner. When the supply of waste material in the chute has been exhausted the sonic beam or similar sensing device opens switch 70 but the rams will not come to rest until a cycle has completed and the position shown in FIGS. 1 and 2 is achieved. Since waste material such as garbage will still fill portions 22 and 24 of the housing this space is now sealed off preventing the escape of odors or an otherwise unsanitary condition. Waste material dumped into the chute will be supported on the side wall 28 of the main ram until a sufficient quantity has been deposited to interrupt the sensing device 70 at which point the operation of the apparatus is initiated and the retraction of the rams permits the waste to drop into compacting position.

Saw-teeth 82 are provided on the peripheral edge of head wall 26 so that debris may be sheared away thereby. An interlock switch 112 is provided on the outer wall portion 24 of housing 16, which, when a waste container 14 is placed thereon permits the overall operation of the apparatus and prevents the operation thereof in the absence of a receptacle in garbage receiving position. This switch also shuts off the apparatus when a can has been filled and thus automatically slides off the housing. An override switch (not shown) may advantageously be provided on an operating panel of the apparatus to bypass switch 112 and thus permit the operation of the apparatus even in the absence of any container disposed on the housing. This arrangement is useful when it is desired to load waste into a different type of container such as may be disposed at the mouth or front end portion 24 of the housing or at any other location. In such event a chute leading thereto may be provided for guiding the compacted waste as it is expelled from the apparatus. It will also be understood that the apparatus may be air operated without departing from the spirit and scope of the invention.

Turning now to another embodiment of the invention which is shown in FIGS. 8 and 9, there is seen a first or main ram 118 within which a second or auxiliary ram 124 is telescopically received for reciprocating movement. The main ram 118 is mounted for reciprocation within a housing similar to that heretofore described. Auxiliary ram 124 is surrounded by a coil spring 122 one end of which is seated on a flange at the base of the ram; the other end of the spring bearing against the back of the head wall 130 of the main ram. Thus when the auxiliary ram is moved forward it will tend to compress the spring until the tension thereon exceeds the resistance of the waste material encountered by the main ram. At this point the main ram is moved forward thus compacting the waste. When the back pressure of the compacted waste material exceeds the capability of the main ram, the auxiliary ram moves forward to and penetrates the mass to relieve the pressure and to permit compaction to proceed. A threaded drive shaft 120 is disposed within the auxiliary ram 124, the rear end of the shaft being coupled to a reversing motor and gear box 127 mounted on the rear wall 30 of the housing. The drive shaft passes through an aperture 126 in a bracket carried by the main ram 118 and through a threaded bore 132 provided in the base of the auxiliary ram. The forward end of the drive shaft extends through an aperture in the head wall of the auxiliary ram. Upon rotation of the drive shaft the threaded engagement thereof with bore 132 in the base of the auxiliary ram causes it to move forward,

compressing the spring and driving the main ram forward in a leap frog manner. When the auxiliary ram 124 is arrested by the mass, and the spring 122 is compressed and piles up against the back of the head wall 130 of the main ram 118, the main ram 118 drives forward into the mass, the auxiliary ram 124 withdrawing into the main rams 11 (FIG. 9) in the direction of the arrow in FIG. 9. The limiting switches 131 and 133 are actuated sequentially, reversing the drive motor and drawing the rams back to the rest position.

The predetermined back pressure that will arrest the compacting action of the device described in its embodiments above will vary from waste material to waste material, e.g. waste paper, garbage, industrial material or wastes, etc.

Having thus described the fundamental novel features of the invention as applied to specific embodiments, it is to be understood that various changes may be made by those skilled in the art without departing from the spirit and scope thereof.

We claim:

1. A waste compacting device comprising a first compacting means and second compacting means in a housing therefor, the first compacting means reciprocally proceeding until detained by the back pressure generated by the waste material being compacted, the detention of the first compacting means automatically actuating the second compacting means, the action of the said second compacting means substantially releasing said back pressure, thereby allowing the said first compacting means to reciprocally proceed.

2. A waste compacting device according to claim 1, wherein said housing is generally annular shaped, said first compacting means being slidably movable in said housing also being of a generally annular shape, said second compacting means being in inner concentric relation with said first compacting means.

3. A waste compacting device according to claim 1, wherein said first and second compacting means each includes a compacting ram and drive means therefor.

4. A waste compacting apparatus according to claim 3, wherein said drive means comprise fluid actuated cylinders operatively connected for reciprocating movement with an associated compacting ram.

5. The device according to claim 4, including switch means associated with said compacting rams for remotely signalling said rams to move forwardly and rearwardly and valve means automatically actuable by the rate of

movement of said first compacting means to initiate a movement of said second compacting means.

6. A waste compacting device according to claim 1, wherein said first compacting means includes a compacting ram provided with a head wall for contacting waste material to be acted upon and first drive means operatively connected therewith for imparting reciprocating movement thereto, said second compacting means includes a compacting ram provided with a head wall for contacting waste material to be acted upon and second drive means operatively connected therewith to impart reciprocating movement thereto, said second ram means being telescopically received within said first ram means and arranged for periodic concurrent compacting movement therewith.

7. A waste compacting device according to claim 6, including means for additionally actuating said second compacting means when the continued compacting movement of said first compacting means is restrained by the compacted material beyond a preselected back pressure level, said second compacting means being projected in advance of said first compacting means to relieve said restraint so that compacting movement of said first compacting means may be continued.

8. A waste compacting device according to claim 7, wherein means are provided for reversing the movement of both compacting means during the course of a compacting stroke when a predetermined level of back pressure developed by the mass being compacted is exceeded.

9. A waste compacting device according to claim 7, wherein means for additionally actuating said second compacting means includes a sequence valve.

10. A waste compacting device according to claim 1, wherein said first and second compacting means comprise mechanical drive means.

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BILLY J. WILHITE, *Primary Examiner*.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,384,007

May 21, 1968

Daniel Q. Boje et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, lines 21 to 24, cancel

**CROSS-REFERENCES TO RELATED
APPLICATIONS**

This application is a continuation-in-part of my copending U.S. application Ser. No. 588,050, filed Oct. 20, 1966.

Signed and sealed this 7th day of April 1970.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.

Commissioner of Patents