Dec. 6, 1966 R. J. PIOCH 3,289,572

REFUSE LOADING AND COMPACTING APPARATUS

Filed Aug. 24, 1965 5 Sheets-Sheet 1

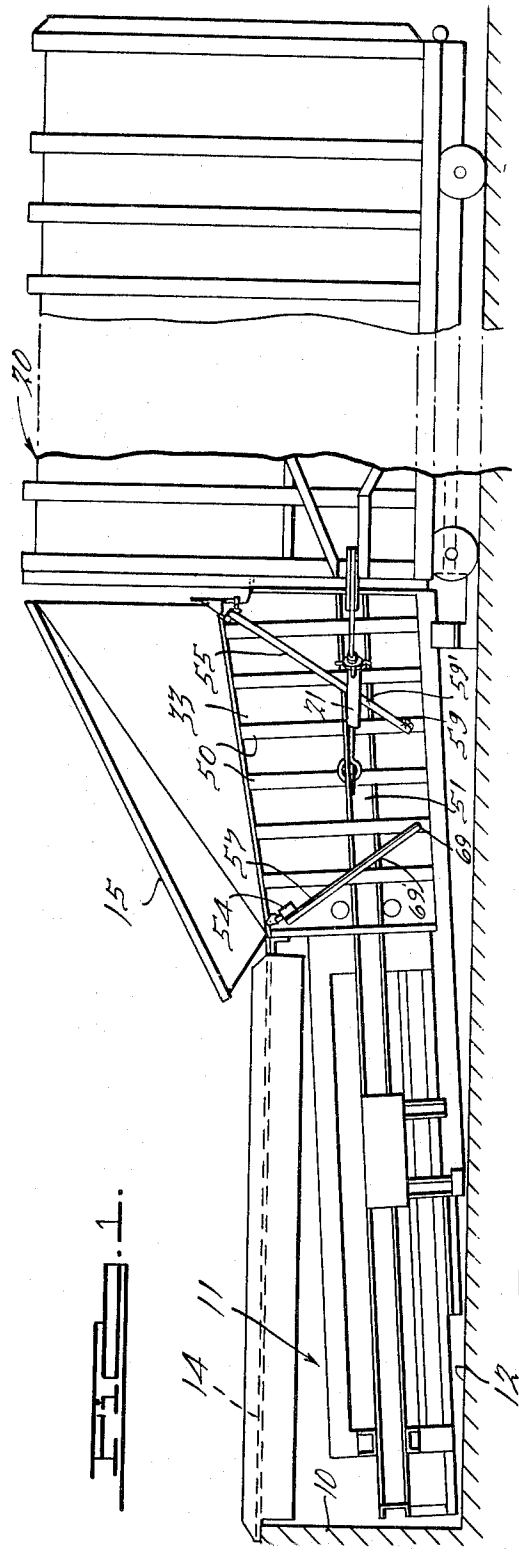


FIG. 1.

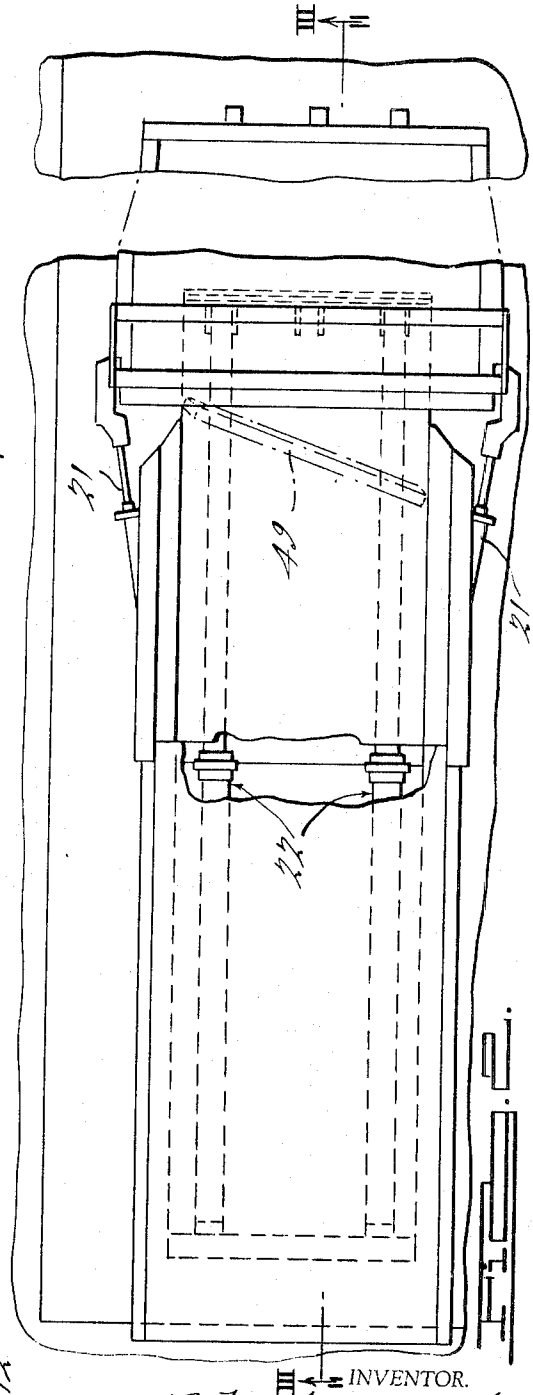


FIG. 2.

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Filed Aug. 24, 1965 5 Sheets-Sheet 2

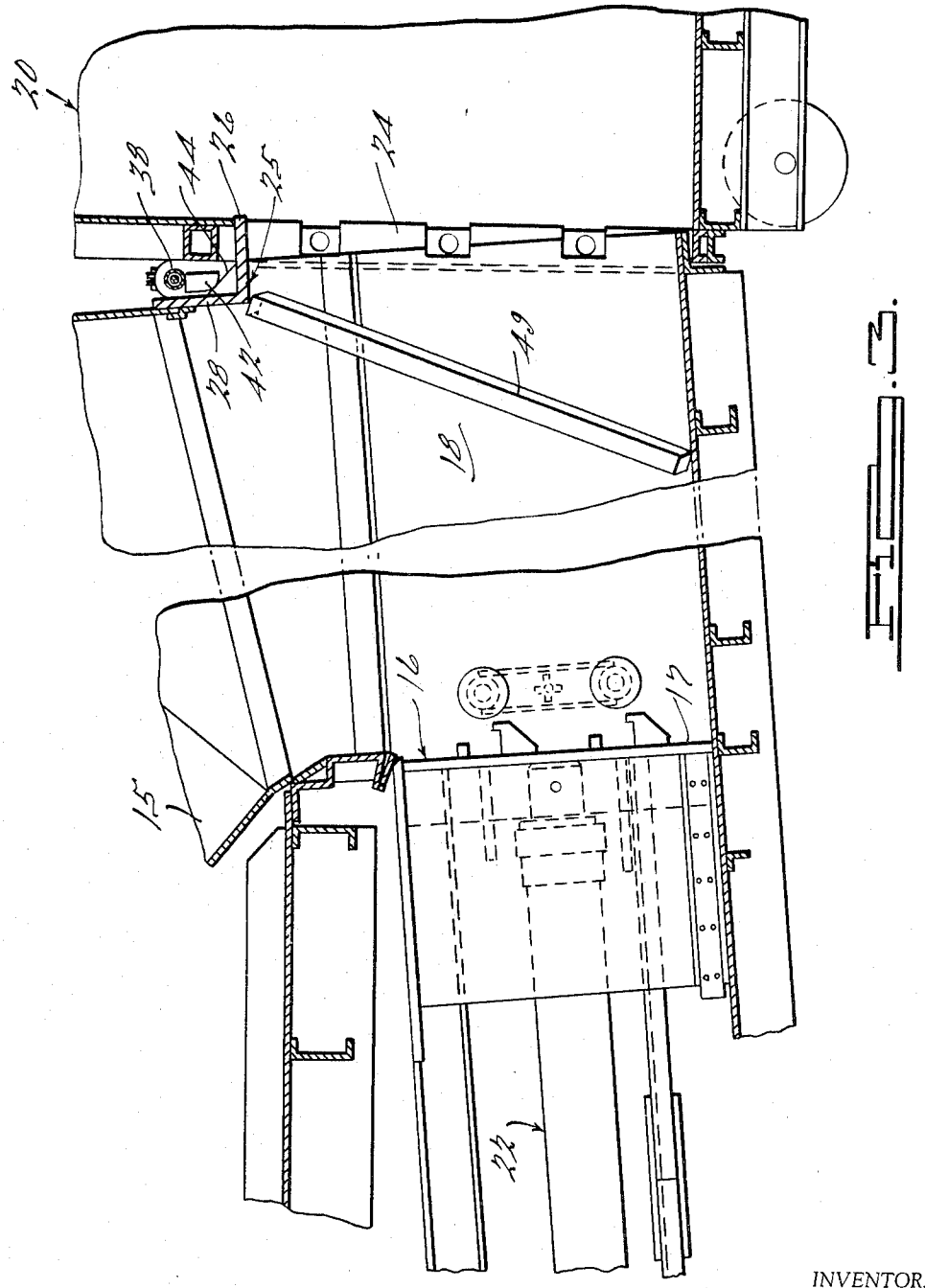


Fig. 2.

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REFUSE LOADING AND COMPACTING APPARATUS

Filed Aug. 24, 1965 5 Sheets-Sheet 3

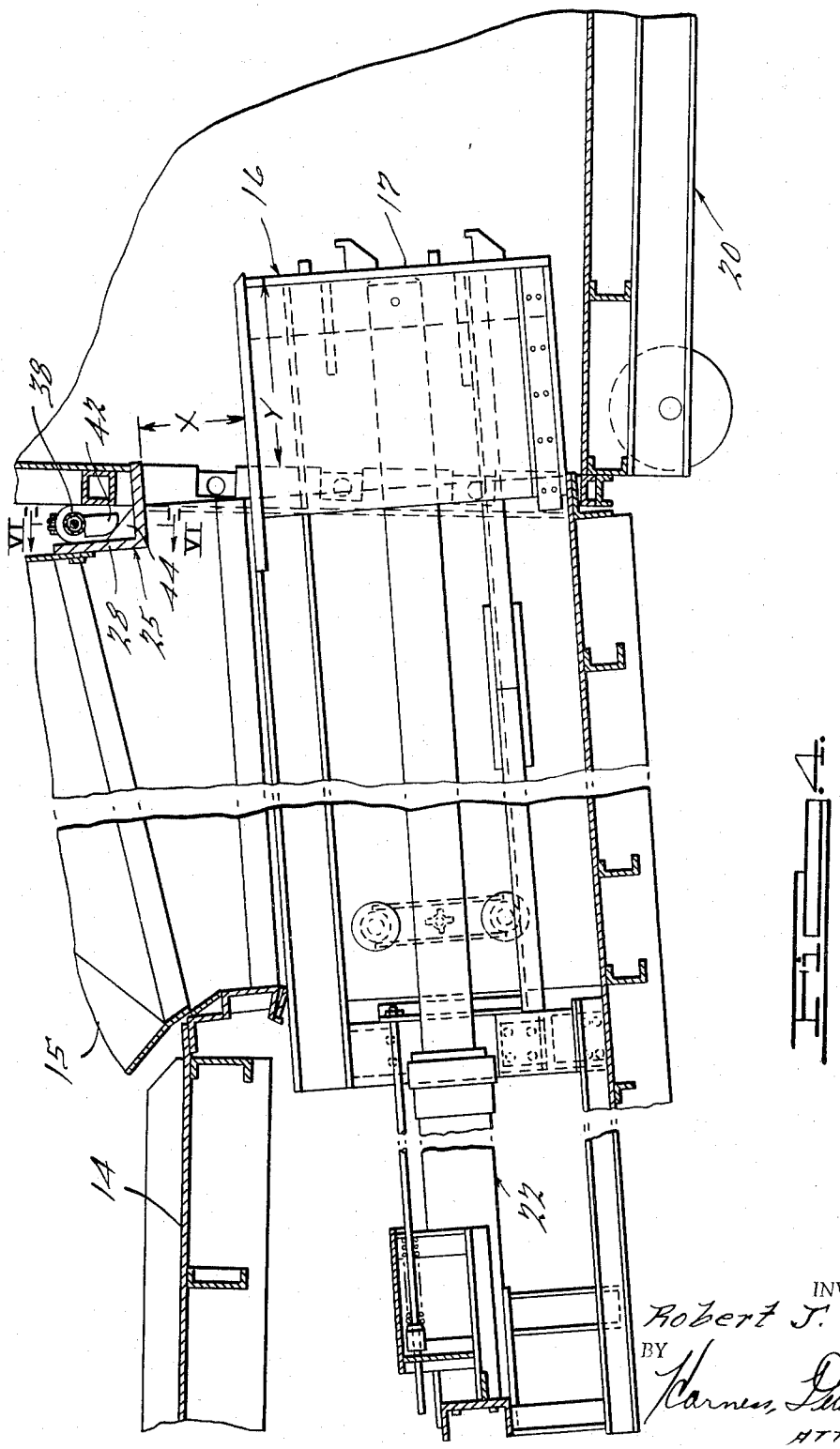


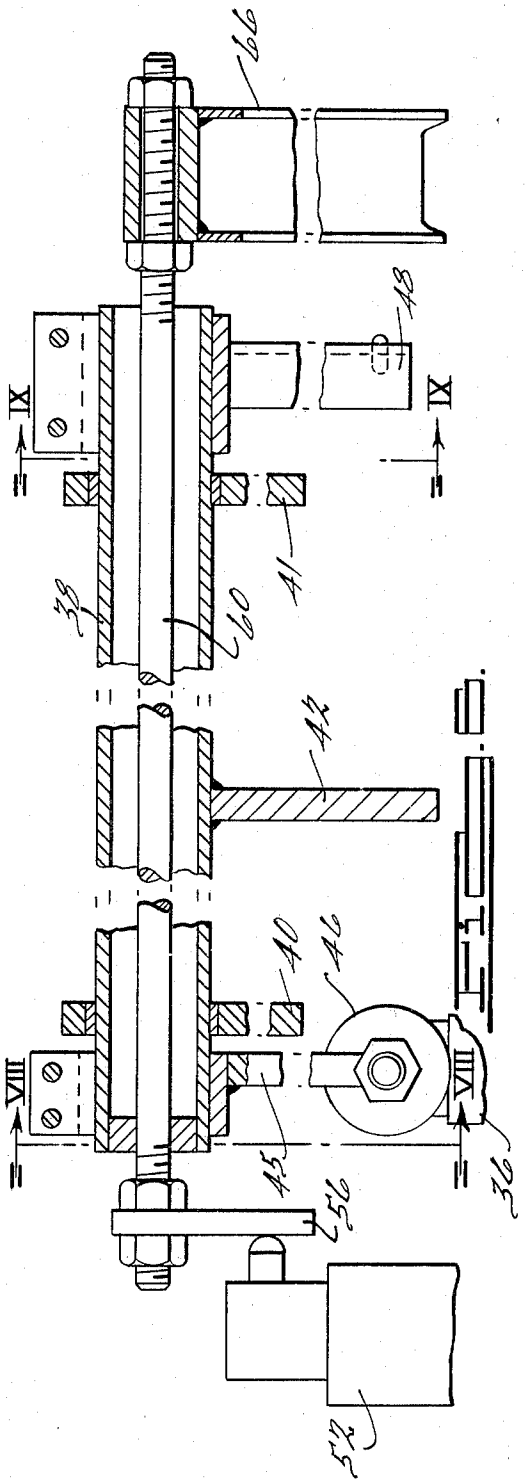
FIG. 4

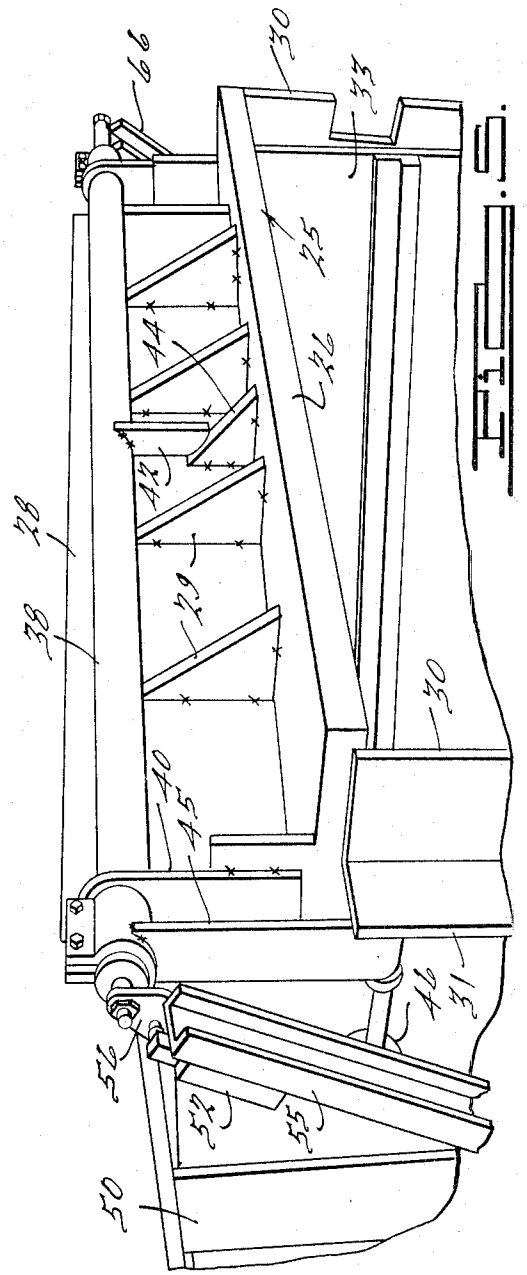
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REFUSE LOADING AND COMPACTING APPARATUS

Filed Aug. 24, 1965 5 Sheets-Sheet 4





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REFUSE LOADING AND COMPACTING APPARATUS

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FIG. 7.

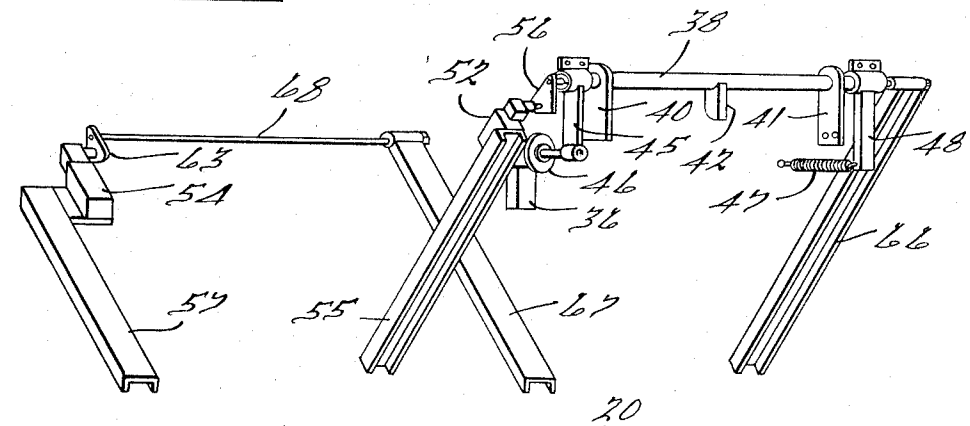
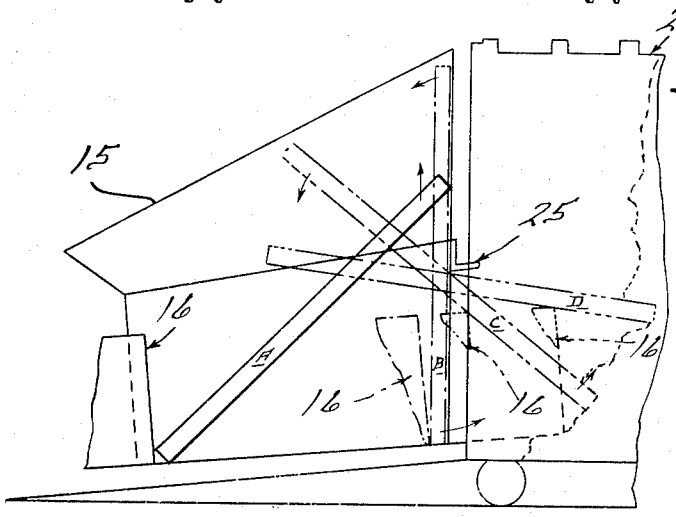
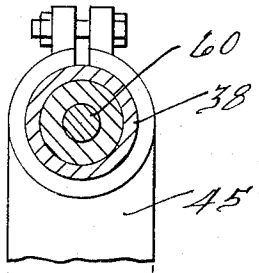


FIG. 10.





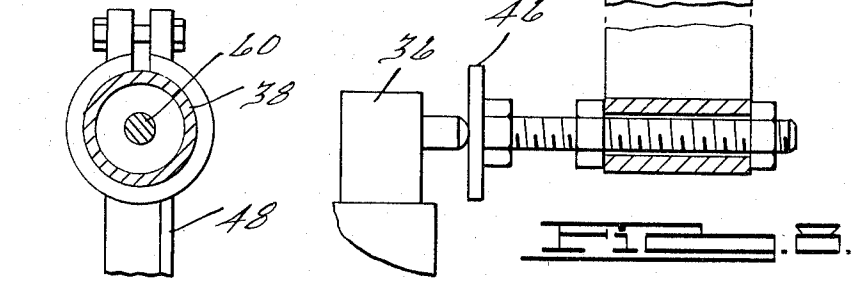
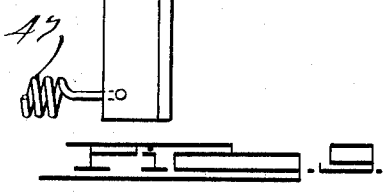


FIG. 8.

FIG. 9.



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United States Patent Office

3,289,572

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REFUSE LOADING AND COMPACTING APPARATUS

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Filed Aug. 24, 1965, Ser. No. 482,080

10 Claims. (Cl. 100—53)

The present invention relates to compacting and containerizing apparatus for loose bulk material, and particularly for compacting and containerizing trash to facilitate hauling and disposal thereof with minimal equipment and labor. A principal object of the invention is to provide improved apparatus of the indicated character adapted to handle a wide variety of materials differing in density, size, moisture content and other characteristics, such as are encountered in general trash which may be collected from household sources, as well as industrial wastes.

In order to reduce the volume of the material to as great an extent as is practicable and reduce to a minimum the size, weight and cost of the vehicle employed to transport the compacted material to its destination, and also reduce the labor involved to a minimum, I prefer to employ a permanently installed stationary compaction system consisting of a power-driven ram which is so designed and arranged that it is capable of pressure-filling with compacted material standardized reinforced containers which may be coupled thereto for loading and which are interchangeable so that, after loading, a container filled with compacted material may be uncoupled and hauled away to a disposal destination and another empty container substituted for loading. Apparatus of the character indicated is disclosed in my co-pending application, Serial No. 294,607, filed July 12, 1963, now Patent No. 3,250,414 which issued May 10, 1966.

The handling of general trash with apparatus of the indicated character presents problems resulting from the widely variant character and dimensions of the material which must be handled. Discarded furniture, bed springs, pieces of pipe, broken concrete, cement blocks, and other articles of wood, metal, cardboard, as well as vegetable waste, glass, and virtually everything used in household and industrial activities may be thrown into such machines. The compaction chamber, into which the material is thrown, may have a capacity of the order of two to six cubic yards. The container to be loaded may have a capacity of the order of fifteen to forty cubic yards. Frequently, due to the nature of the material, the so-called "compaction" may consist primarily of forcing together, and reducing the spacing between, parts of material which is not in itself materially compressible. In other instances the material may be highly compressible. In my preferred construction, the ram is of rectangular cross section, with a flat top. When the ram is withdrawn so that the compacting chamber is adapted to be loaded from above through its hopper top or other suitable loading system, the material falls down to a position in front of the ram, and the ram is then powered forwardly, pushing the material into and compacting it within the container. Until the container has been filled sufficiently so that the ram can exert substantial pressure behind previously-loaded material, the compaction pressure may not rise to a high value (although this varies with the frictional characteristics, compressibility, weight, moisture content, etc. of the material). As soon as substantial resistance is encountered, however, further loading progressively compresses the material in the container, up to the compaction pressure which the ram is capable of exerting, which may be of the order of 90,000 pounds. In some apparatus of this general character which has been employed in the past, the ram fits quite accurately in the charging opening through which the material is

forced into the container. With such constructions if, when the ram is powered forwardly, any material is located between the ram and the top edge of the charging opening, it is necessary for the ram to shear or completely crush the material before the ram can complete its stroke. I avoid attempting to shear or crush such material. Instead, as shown in my aforementioned copending application, I leave a substantial clearance space between the top of the ram and the header bar which defines the top of the charging opening. Such clearance is great enough so that no trash which is apt to be encountered must be sheared or completely crushed in order to permit the ram to move forwardly to the limit of its stroke. If the components were constructed heavily enough to actually crush or shear all such rigid materials as might be encountered, it would not only be necessary to provide great power, with a correspondingly heavy and expensive construction of the ram, compaction chamber and header bar, but the power generated would be so great that it would also be necessary to construct the transportable container in a correspondingly heavy manner. Constructing a container of the proper size strongly enough for such pressures would be impractical; that is, the power would be great enough to burst or bulge the container, unless the construction of the container were so heavy as to render it impractical to transport over the roads.

A further difficulty results from the fact that relatively long pieces of pipe, posts or heavy timbers are sometimes encountered which during loading may lie diagonally over or against the nose of the ram, and may at the forward end be wedged against or into previously loaded material, or against a wall of the container so that as the ram moves forwardly it tends to exert a sliding and camming action or a lifting action on the pipe or beam, or a toggle-like pivoting action, and thereby force the beam either laterally or upwardly, or both, with great force. In fact under any of several such situations a pipe, beam or the like may be lifted against the header, or driven into a side wall of the container, or of the compaction chamber, with a force which may greatly exceed the driving force of the ram itself. High and highly localized forces of the order of 250,000 p.s.i. can be generated in such manner, and under such conditions the walls of the compaction chamber or of the container, or the header which protects the upper edge of the charging opening, or the frame of the machine, may be strained beyond the elastic limit and thereby permanently damaged.

The present invention aims to provide an improved construction of the indicated class which is capable of handling a wide variety of materials in large volume and of exerting great pressure thereupon, but which reduces the tendency of long rigid or tangled or interconnected objects to become wedged or angularly positioned so as to cause the machine to develop unduly high and localized forces of the character referred to above, and which also incorporates improved means for safeguarding the machine and preventing damage if such a piece of material does attain a dangerous position.

A further object is to provide such a mechanism having its parts arranged in such manner that the material is more efficiently projected into the container.

Other objects and advantages will be apparent upon consideration of the present disclosure in its entirety.

In the drawings:

FIGURE 1 is a side elevational view, partly broken away, of compaction apparatus and an associated container adapted to be loaded thereby, illustrating a preferred embodiment of my invention;

FIG. 2 is a plan view of the same, also partly broken away;

FIG. 3 is a fragmentary vertical longitudinal sectional view on a larger scale and centrally broken away, taken substantially on the line III—III of FIG. 2 and looking in the direction of the arrows, showing the ram retracted;

FIG. 4 is a view similar to FIG. 3 showing the ram projected;

FIG. 5 is a perspective view of the upper front portion of the compaction unit with the container removed and the ram retracted;

FIG. 6 is a longitudinal sectional view taken substantially on the line VI—VI of FIG. 4 and looking in the direction of the arrows, central portions being broken away;

FIG. 7 is a somewhat diagrammatic perspective view of the safety switch system and actuating means therefor;

FIG. 8 is a fragmentary detailed elevational view of the actuating means for the header bar safety switch;

FIG. 9 is a sectional detail on the line IX—IX of FIG. 6 and looking in the direction of the arrows; and

FIG. 10 is a fragmentary diagrammatic view corresponding to a central longitudinal vertical section of principal components of the apparatus showing progressive positions assumed by the parts and by a large incompressible beam which has been loaded into the hopper.

Referring now to the drawings, reference character **10** designates a shipping dock and reference character **12** designates a floor adjacent the dock, these parts being shown as representative of an environment where my invention might be installed and used. A platform **14** which forms a part of the compaction unit generally designated **11** constitutes in effect a walkway extension jutting from the dock **10** and extending forwardly therefrom over the floor **12** to provide access to the loading station. A hopper **15** at the loading station opens into the ram chamber **18** of the compaction unit. Platform **14** also acts as a cover for the ram and for the actuating means therefor. The compaction chamber **18** is directly beneath the hopper **15** and the material to be compacted falls into chamber **18** and is ejected therefrom by the ram **16**. The container into which the material is forced by the ram is generally designated **20**. The general construction and arrangement of these parts may correspond to the disclosure of my aforementioned copending application. As more particularly disclosed therein, the ram is adapted to be projected and retracted by hydraulic means such as the hydraulic cylinder and piston assembly generally designated **22**.

The container **20** has a rear charging opening **24** of rectangular cross section and of a width which is only slightly greater than that of the ram, and the ram and the closely fitted side walls of the ram chamber **18** fit closely at the sides into the opening **24** and substantially fill such opening in a lateral direction when the container is coupled to the compactor **11** by the releasable fastening means **21**. The opening **24** is substantially higher than the vertical dimension of the ram **16**, however, and the header bar **25** at the forward portion of the compaction chamber which protects the upper margin of the opening **24** and in effect defines the top of such opening will be seen to be spaced above the ram by a distance shown at "X" in FIG. 4. The header **25** consists of a generally horizontal bottom plate **26** and a generally vertical back plate **28**, these parts being rigidly attached to each other and to the ram chamber structure as by welding and by gussets **29**. The forward corners of the side walls **33** of the ram chamber structure are defined by vertical angle irons which include vertical longitudinal flanges **30** which project forwardly into and lie closely against the sides of the charging opening **24** in the container and laterally extending rear flanges **31** which limit the extent to which the container overfits upon the ram chamber of the compactor.

When the ram is fully retracted, as shown in FIG. 3, its front wall **17** forms a rear wall for the compaction chamber **18**. When fully projected, as shown in FIG. 4, the front wall **17** of the ram preferably extends a substantial distance into the container **20**. In a preferred device constructed as illustrated the ram is 60 inches wide and 30 inches high. The clearance between ram and header, designated by the dimension X of FIGURE 4, is 10 inches, and when the ram is fully projected it extends into the container approximately 15 inches. By such substantial projection of the ram into the container several benefits are achieved. Long material, such as pipes, poles, lengths of wood, partly broken parts of boxes, furniture or other large members which may lie angularly across the top of the ram and which may be tangled or wedged together with material lying on top of the projected ram, will, by virtue of this arrangement, be lifted to a horizontal position, if they cannot be moved forwardly by the forward movement of the ram. The long forward movement of the ram also tends to separate the material in the container from any remaining outside on top of the ram after the ram is fully projected and so helps to clear the unit. Unless a pole, pipe or other overlying part is very long, it will fall down, into a position in front of the ram, when the ram is next retracted, so that upon the next forward stroke it is pushed into the container. Such lifting and separating of angularly disposed material, most of which is of course much shorter than the occasional very long member contemplated in the discussion just concluded, also tends to dislodge and loosen any material behind the header bar **25** and above the ram.

I have found that with an overclearance between ram and header bar (dimension X, FIG. 4) of ten inches, which is sufficient to eliminate the problem of high shearing forces with virtually all objects which might be encountered, there is a tendency for some types of material overlying the ram to hang up and fail to fall down in a position in front of the ram, so that it cannot be forced into the container in the intended fashion, under certain conditions when the container is nearly full, if the forward travel of the ram is not carried to a position such that the face **17** of the ram extends into the container a distance at least equal to the overclearance X. Preferably, the penetration of the ram (dimension Y, FIG. 4) is of the order of 150% of the clearance X.

In FIG. 10, I have represented in dot-dash lines at A, B, C and D four successive positions which a long, heavy beam or pipe **35** might assume during forward travel of the ram. This would, of course, constitute an unusal and extreme use of the machine but might nevertheless be encountered, particularly in view of the frequent operation of these machines by unskilled labor. It will be seen that as, and after, position C is reached, the forward movement of the ram exerts a strong rocking and camming force tending to lift the member **35**. Due to the space between the top of the ram and the header bar **25**, and the long travel of the ram (inwardly to the D position), this action does not generate a force which might bow the header bar to such extent as to deform it beyond its elastic limit. It will be understood that the position such a troublesome or large piece might assume could vary greatly. As shown at position C, its forward end might become caught or wedged into material already in the container. The subsequent forward movement of the ram toward position D exerts a rocking couple on the piece **35** tending to lift its front end. If the piece is very strong, this will lift the material in the container to permit the piece to assume a more nearly horizontal position across the top of the ram, such as is shown at D. Unless it is very strong, however, the piece will break or bend if it catches in a load which is already partly packed, rather than remaining straight or unbroken while moving from C to D as illustrated. In either event, it will drop down upon the next retraction of the ram and thereafter be pushed into the container by the face of the ram on the next stroke.

In the unlikely event that a very strong piece of such excessive length should be held down at its forward end so tightly, by a very tight or wedged load that a force of undesirable magnitude might be transmitted to the header bar 25, damage to the machine is prevented by a limit switch 36, secured to the outside of the compaction chamber near and somewhat below one end of the header bar 25. A transverse tubular shaft 38 is journaled in brackets 40, 41 mounted on the header bar, and extends parallel to and above the bottom flange 26 of the header bar in a position to be accommodated in the space between the rear of the container 20 and the upright flange 28 of the header bar, as best shown in FIGS. 3 and 4. A follower 42 is rigidly attached to a central portion of the shaft 38 and extends downwardly to a position to engage the inclined upper surface of a cam element 44 which is formed as a gusset plate welded to the internal corner of the header bar flanges. The rounded cam-engaging surface of the follower 42 will rock the shaft 38 in its journals if the header bar is bowed either upwardly or forwardly. An arm 45 fast upon a projecting end portion of shaft 38 carries a pad 46 which normally holds the switch closed by overengaging and maintaining depressed a spring-biased actuating plunger which, as is well known in the art, is an operative part of the mechanism of switches of the type used in this character of service and which are biased open. A spring 47 acting through an arm 48 attached to the shaft 38 yieldably holds the follower 42 against the cam 44 with a force exceeding that of the biasing spring of the switch and accordingly urges the pad 46 to a position which normally holds the switch closed. In event the shaft is rocked beyond a predetermined angle representative of an undesired degree of bowing of the header bar, however, the pad 46 moves away from the switch plunger, permitting the switch to open. The circuitry of the ram control system is such that opening the switch stops the ram and may also reverse it, as brought out in my aforementioned copending application. It will be appreciated that the details of the switching means and circuitry are not per se a part of this invention and are conventional and well known in character.

It will be understood that where rigid elongated elements such as rods, pipes or poles are thrown into the ram chamber in a random orientation, such members or other stiff parts may enter the chamber at angles such that they project against the sides and may catch against the other parts and tend to wedge either in the ram chamber or in the container, or partly in each, at angles such that the forward movement of the ram will cause a strong camming action or toggle effect so that a very high lateral bowing force may be exerted against a side wall of the ram chamber. The position such a wedged piece could assume is illustrated by way of example at 49 in FIGS. 2 and 3. This is also a rare occurrence, but protection against damage in such an eventuality is highly desirable.

Any undue lateral bowing of the side walls of the ram chamber due to such lateral forces is sensed and employed to actuate additional safety switches which stop the ram before the occurrence of an amount of deformation which would cause damage to the structure.

The plate steel side walls 33 of the ram chamber are reinforced by stiff external vertical I beam stud braces as 50 to which the side wall plates 33 are welded, a series of the stud members 50 being provided at suitably longitudinally spaced intervals. The sidewalls are also braced by a stiff longitudinal channel 51. A pair of safety switches 52, 54 are provided so mounted as to be operable to stop the ram in event of undue outward bulging of either side of the ram chamber. Switch 52 is carried near the upper front of the ram chamber by an inclined arm 55 which extends angularly upwardly and forwardly from a low position spaced from the front a distance equal to about one-third the length of the chamber and across the outer surfaces of a plurality of the studs 50 on one side of the ram chamber. At its lower end the arm 55 is rigidly welded to the outer flange of one of the studs 50, at the position designated 59. At a position 59' spaced above weld position 59 arm 55 is welded to longitudinal channel brace 51. From weld position 59' to its upper extremity the arm 55 is unsupported. At its free upper extremity arm 55 carries a switch 52. By virtue of this arrangement it will be seen that if the studs 50 or channel 51 bow outwardly, the arm 55 will also move outwardly carrying with it the switch 52. Under normal conditions the switch 52 is held by the arm 55 in a position such that its plunger engages and is depressed by a pad 56 to hold the switch closed; but, if the switch moves bodily outwardly with the upper end of arm 55 in the manner described, the plunger is projected under the spring action of the switch, thereby opening the switch, which (through circuitry requring no description) has the effect of immediately stopping and reversing the ram.

The pad 56 is rigidly attached to a shaft 60, which is slidably supported in the shaft 38 and projects through shaft 38 and from the opposite end of such shaft, shaft 60 being attached at its farther end, beyond the tubular shaft 38, to an arm 66 which corresponds and is parallel to the arm 55 on the other side of the ram chamber, and is similarly secured to and extends angularly upwardly and forwardly across the upright stud braces 50 upon the opposite side. Thus, if the opposite side of the chamber is bowed, shaft 60 is pulled toward such opposite side, thereby moving the pad 56 away from the plunger of the switch 52 and causing the switch to open.

The previously mentioned safety switch 54 is supported near the upper rear of the ram chamber on the same side as and similarly to switch 52, upon the inclined switch-carrying arm 57, which is attached near its lower end at corresponding weld positions 69, 69'. Since the ram chamber is of substantial length in the preferred embodiment disclosed, greater responsiveness to bulging of rear portions of the ram chamber is thereby afforded; but, in smaller units, wherein the ram chamber is shorter in a fore-and-aft direction, I have successfully dispensed with such rear sensing means. Arm 57 normally holds the switch 54 in a position such that it is held closed by the engagement of its plunger with a pad 63 attached to a shaft 68 which is supported in a transversely slidable manner in the upper rear of the ram chamber structure, and which is rigidly attached at its opposite end to an arm 67 on the opposite side of the compaction chamber and corresponding to the arm 57. It will be seen that outward movement of either or both of the arms 57, 67 will cause the switch 54 to be actuated toward open position.

It will be understood that the circuitry and connections of the safety switches are subject to variation and the details of such electrical connections form no part of my present invention. Although they are described as being arranged to be normally closed and to be opened in event of an unwanted degree of distortion, this will be recognized as a matter of preference of the designer. I prefer this arrangement because, as will be appreciated, in event of any loosening or other accidental damage of the portions of the switch actuating elements themselves, this also will tend to assure that forward ram movement will be stopped.

While one commercially practical embodiment of the invention has been described and illustrated herein somewhat in detail, it will be understood that various changes may be made as may come within the purview of the accompanying claims.

What is claimed is:

1. Apparatus for containerizing and compacting waste material or the like including a ram housing comprising spaced parallel side walls, a header bar interconnecting upper front corner portions of said side walls, a ram mov-

able through said housing from a retracted position spaced from the header bar to a projected position under said header bar whereby material in said housing may be forced therefrom into a desired receiver, and means for sensing bending of the header bar including a shaft extending parallel to and rotatable with respect to the header bar, said sensing means adapted to modify the actuation of the ram when said bar is bent and cam and follower elements carried by intermediate portions of the header bar and shaft and effective to rock the shaft in response to bowing of the header bar.

2. Apparatus as defined in claim 1 in which the header bar is of substantially right-angular cross section having a generally upright back web and a bottom web extending forwardly from the back web, the cam element defining a gusset connecting said webs.

3. Apparatus as defined in claim 1 in which the header bar is of substantially right-angular cross section having a generally upright back web and a bottom web extending forwardly from the back web, the shaft being arranged in the included angle between said webs, the cam element defining a gusset connecting said webs and the follower comprising an arm secured to the shaft and engaging a surface of said cam inclined with respect to both of said webs.

4. In combination with apparatus as defined in claim 1, means for sensing bulging of a side wall including a rigid arm lying outside and bearing against at least portions of said side wall, means attaching a portion of the arm to the sidewall, another portion of the arm being unattached to the sidewall, and means responsive to rotation of the shaft and to relative movement between the sidewall and said unattached portion of the arm for modifying the actuation of the ram.

5. Apparatus as defined in claim 4 in which the header bar is substantially right-angular cross section having a generally upright back web and a bottom web extending forwardly from the back web, the shaft being arranged in the included angle between said webs, the cam element defining a gusset connecting said webs and the follower comprising an arm secured to the shaft and engaging a surface of said cam inclined with respect to both of said webs.

6. Apparatus as defined in claim 5 wherein said shaft is hollow, at least two of said side arms being provided, one on each sidewall, and means for sensing relative movement between said side arms including an element extending through said hollow shaft.

7. Apparatus as defined in claim 5 wherein at least two of said side arms are provided, one on each sidewall, and means responsive to relative movement between said side arms and to rotation of said shaft for modifying the actuation of the ram.

8. Apparatus for containerizing and compacting waste material or the like including a ram housing comprising spaced parallel side walls, a ram movable through the space between said side walls to force material from said space to a desired receiver, means for actuating the ram, means for sensing bulging of a side wall including a rigid side arm lying outside and bearing against at least portions of said sidewall, means attaching a portion of the arm to the side wall, another portion of the arm being unattached to the sidewall, and means responsive to relative movement between the sidewall and said unattached portion of the arm for modifying the actuation of the ram.

9. Apparatus as defined in claim 8 wherein said walls are flat, rigid vertical and horizontal stiffening members overlying the outsides of said walls, said side arm being secured adjacent one end only and having unsecured portions overlying and bearing against at least one of said stiffening members.

10. Apparatus as defined in claim 9 wherein said side arm is inclined with respect both to the horizontal and vertical stiffening members.

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