United States Patent

[11] 3,541,949

[72] Inventor **Milton Clar**
Bethesda, Maryland

[21] Appl. No. **727,845**
[22] Filed **May 9, 1968**
[45] Patented **Nov. 24, 1970**

[73] Assignee **Auto Pak Company**
Bladensburg, Maryland
a corporation of the District of Columbia

---

[54] APPARATUS FOR COMPACTING MATERIAL INTO DRUMS OR BAGS

30 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **100/49,** 53/124; 91/414; 92/61; 100/52, 100/229, 100/98, 100/269, 100/295; 141/73

[51] **Int. Cl.** **B30b 15/14**

[50] **Field of Search** ..... 107/14P; 18/12P; 141/73; 100/98, 295, 41, 49, 52, 229, 240, 245, 269, 150; 91/411(A), 414; 53/124; 92/61, 161, 146, 117

[56] **References Cited**

UNITED STATES PATENTS

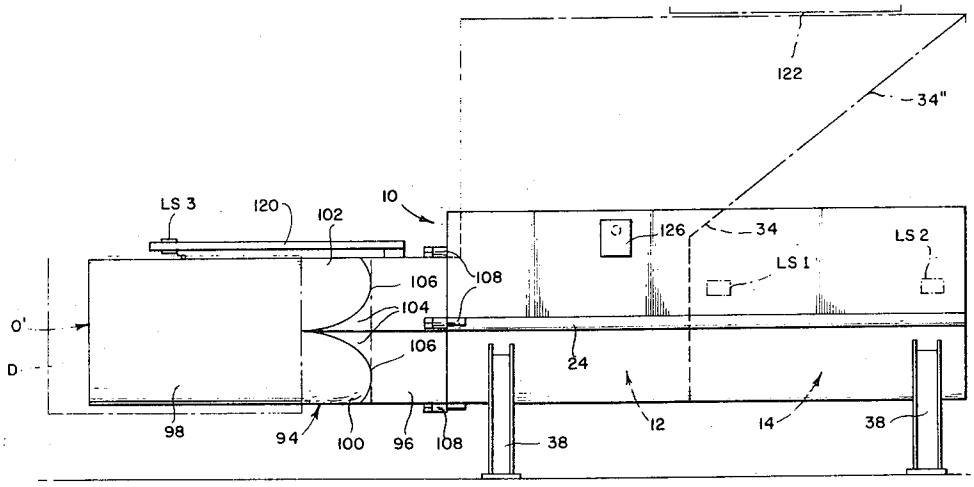
2,622,748	12/1952	Feidert	100/269UX
2,821,264	1/1958	Ulinski	92/61X
3,006,272	10/1961	Brady	100/98X
3,065,586	11/1962	Ghiringhelli	53/124
3,222,853	12/1965	Michael	100/98X
3,229,618	1/1966	O'Connor	100/98X
3,231,107	1/1966	Clar	100/229X
3,327,620	6/1967	Cole	100/52
3,368,478	2/1968	Clar	100/50
3,384,007	5/1968	Boje et al.	100/49

FOREIGN PATENTS

723,335	8/1942	Germany	18/12

Primary Examiner—Billy J. Wilhite
Attorney—Shapiro and Shapiro

ABSTRACT: Compaction apparatus having a material receiver chamber of polygonal cross section with an inlet opening at the top and a polygonal outlet opening at the front. A compaction blade of polygonal cross section moves through the chamber and forces material through the outlet opening into a snout having, in succession, a portion of polygonal cross section, a tapered transition portion, and a portion of circular cross section of reduced cross-sectional area. A receptacle received over the snout is moved along the snout as material is supplied thereto. The blade has cutting teeth which cooperate with a shear bar and is hydraulically actuated by a photoelectric control system.



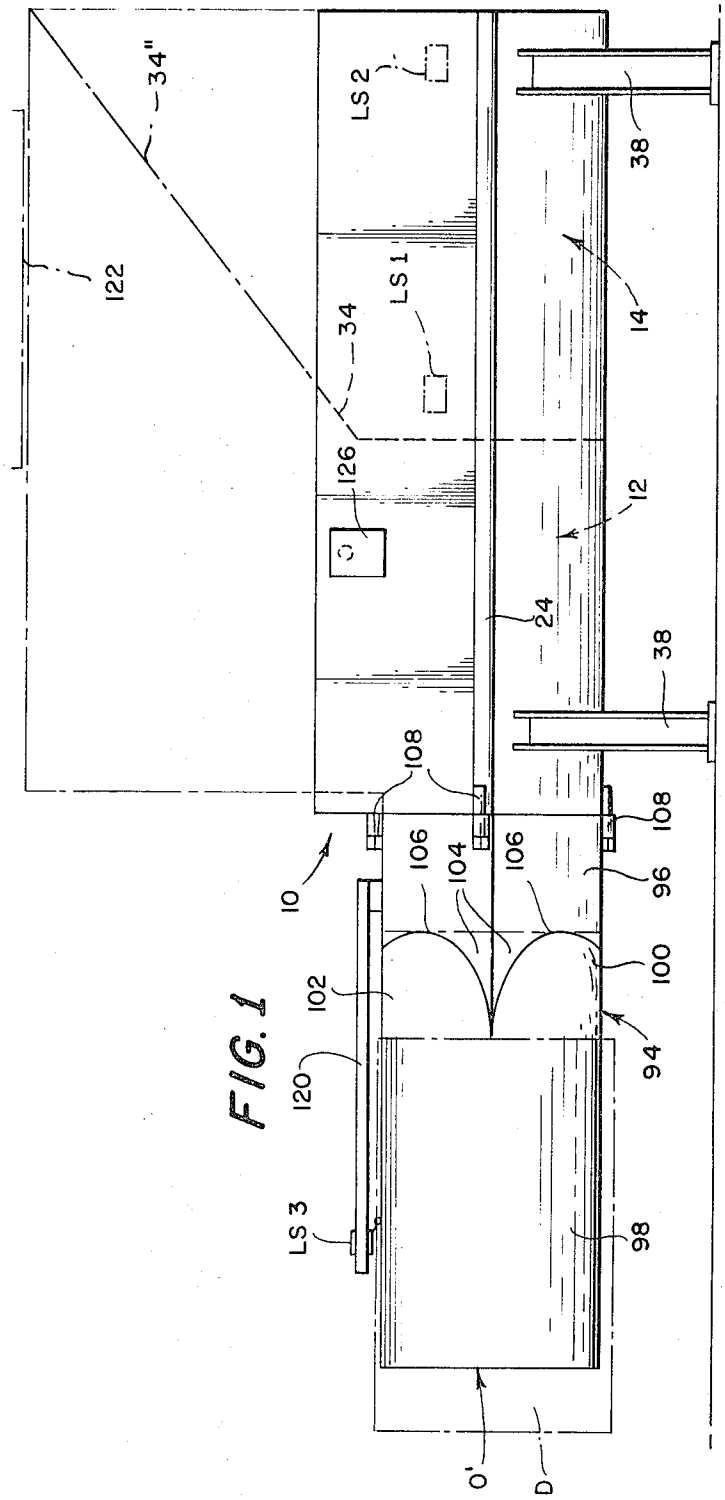


FIG. 1

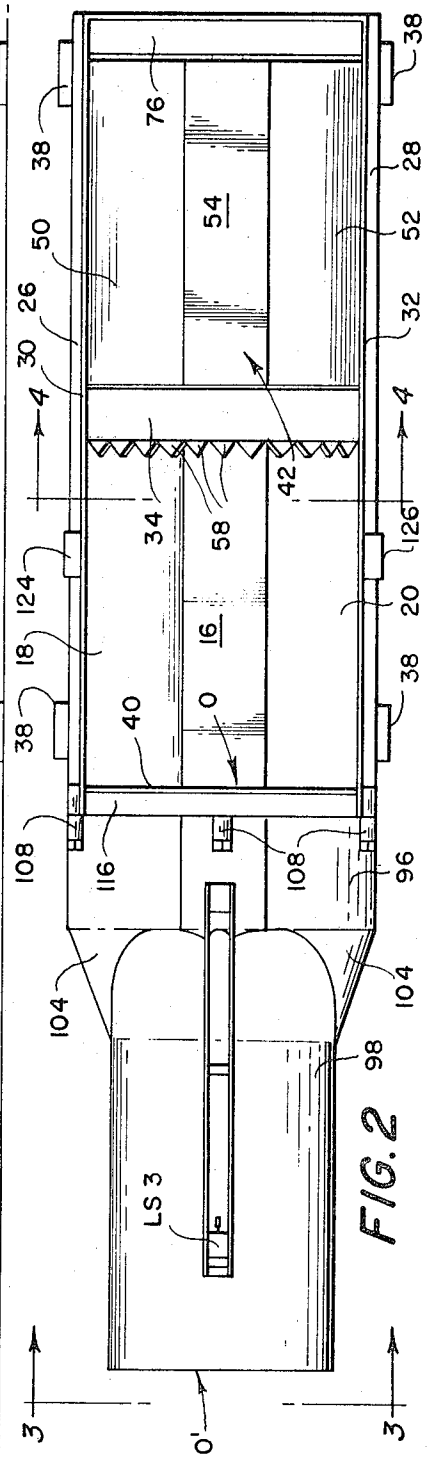


FIG. 2

INVENTOR
MILTON CLAR

BY Shapiro and Shapiro

ATTORNEYS

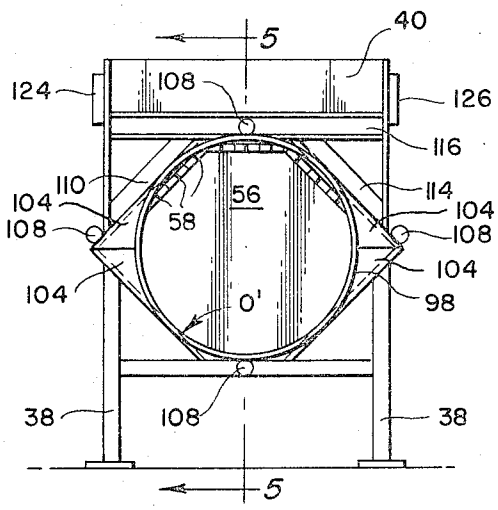


FIG. 3

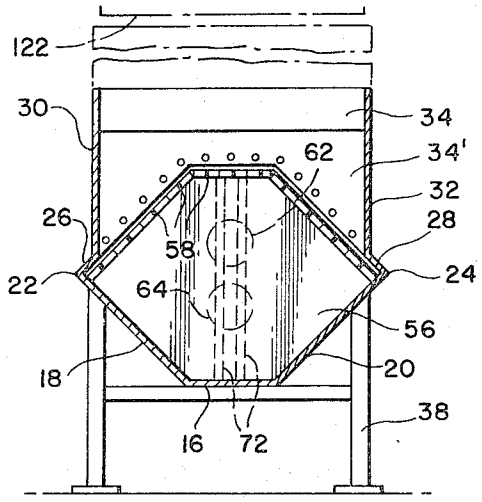


FIG. 4

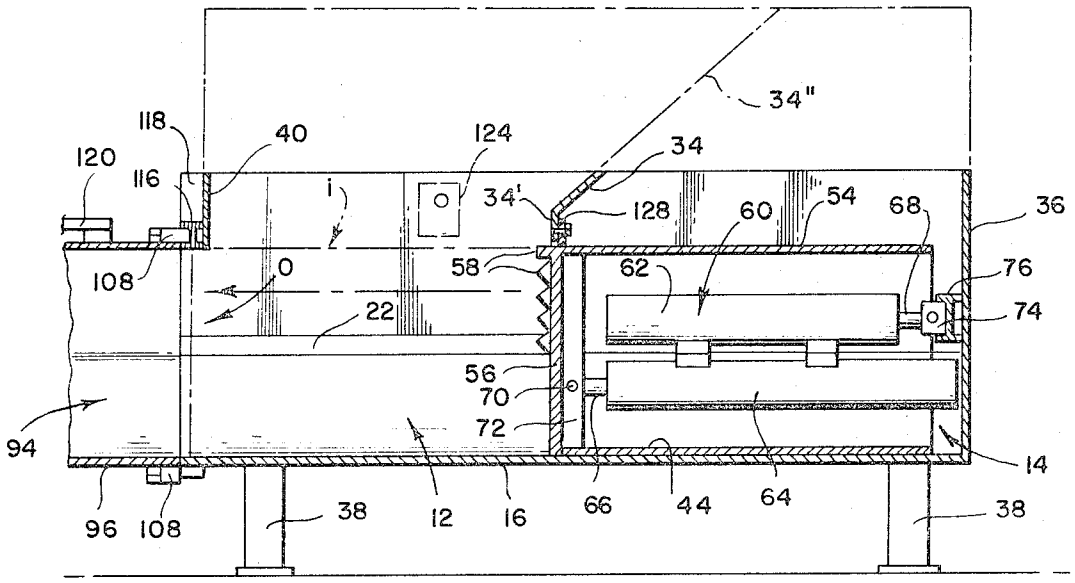


FIG. 5

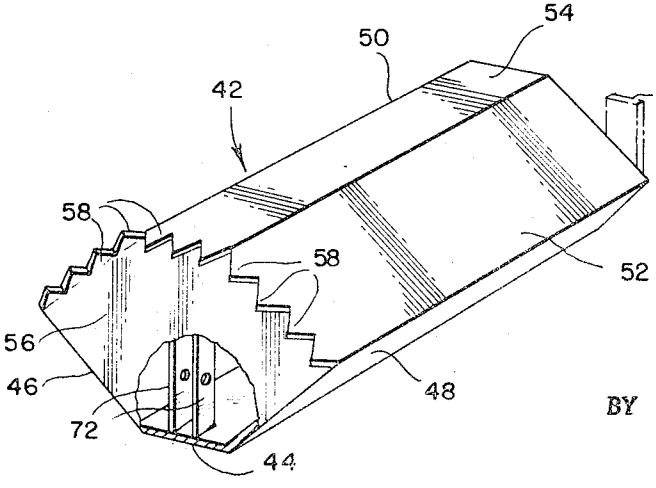


FIG. 6

INVENTOR
MILTON CLAR

BY Shapiro and Shapiro

ATTORNEYS

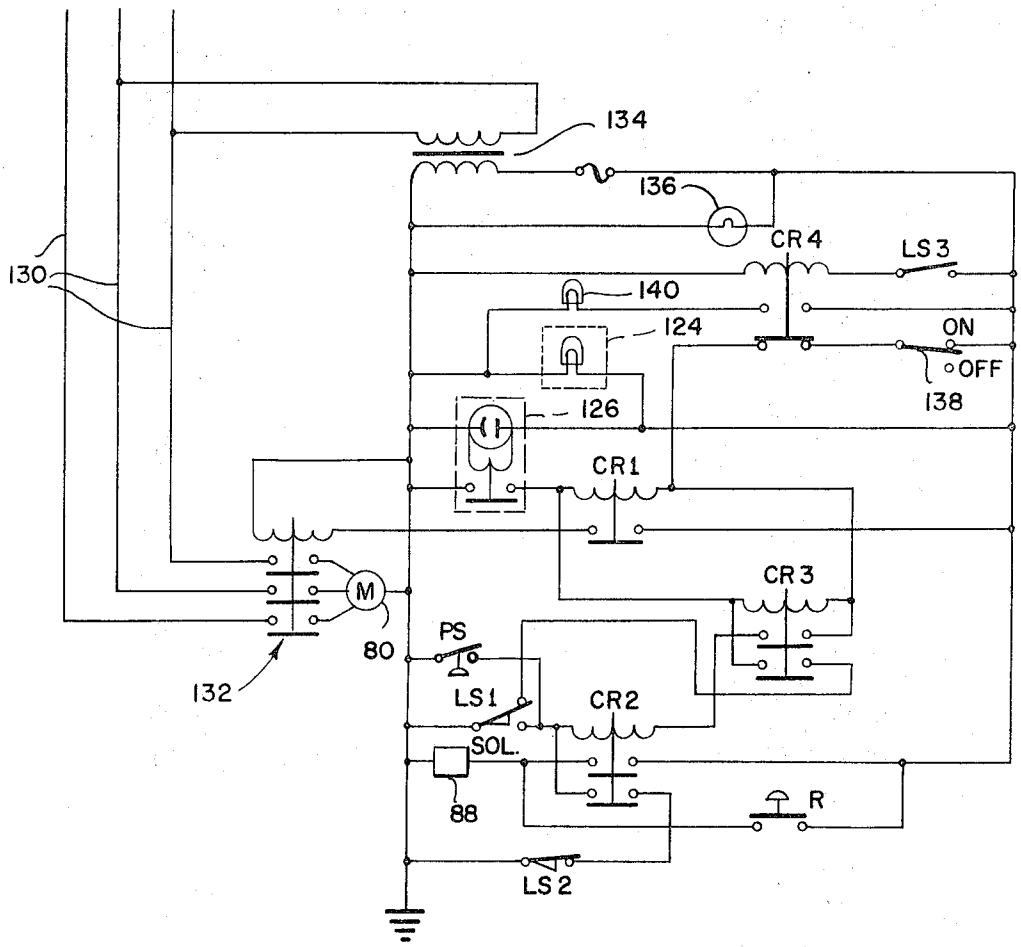


FIG. 7

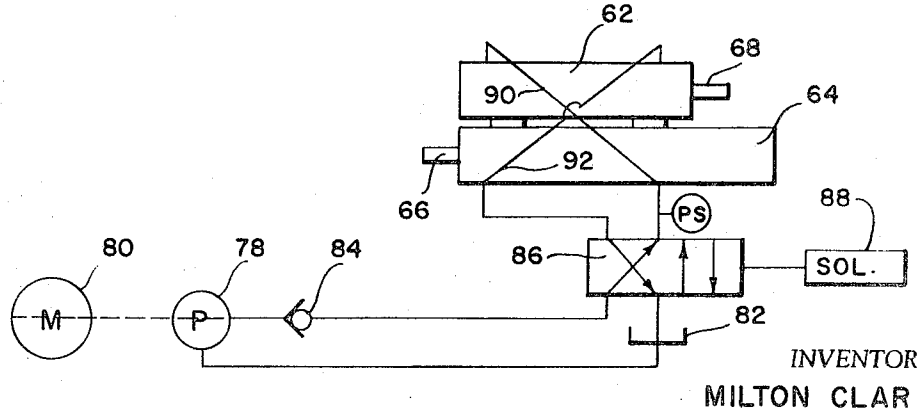


FIG. 8

INVENTOR
MILTON CLAR

BY Shapiro and Shapiro

ATTORNEYS

APPARATUS FOR COMPACTING MATERIAL INTO DRUMS OR BAGS

BACKGROUND OF THE INVENTION

This invention relates to compaction apparatus for refuse or the like and is more particularly concerned with apparatus for supplying compacted trash to barrels, drums, or bags, for example.

In a system heretofore proposed by the applicant, and now in commercial use, trash generated in high-rise apartment buildings is disposed of by the provision of stationary compaction apparatus in the basement beneath a chute, in association with containers of the order of 2 cubic yards, for example, into which the trash is packed and which are adapted to be separated from the compaction apparatus, rolled from the building, and emptied into the body of a self-loading vehicle. Such a system, described and claimed in the applicant's prior U.S. Pat. No. 3,231,107, serves this purpose admirably but requires the use of containers specially adapted to the self-loading vehicle. A need has also existed for the disposal of trash where the use of specialized containers is undesirable or impractical, as for example, where self-loading trash trucks are not readily available, where the volume of the trash generated in the building does not justify service by self-loading vehicles, or merely where it is desired to have wider freedom of choice of trash haulers. Prior attempts to solve this problem have been deficient in one respect or another. In the case of balers, which have been tried for this purpose, the apparatus employed has been complex and/or unwieldy.

The concept of precompaction of trash, that is, compaction prior to entry in a storage receptacle, has been employed in an attempt to solve the problem. A prior compaction apparatus has used a circular-cylinder material receiver chamber through which a blade of circular cross section moves to force the trash through a circular outlet opening and into a tapered snout of circular cross section which reduces the volume of the trash. As will be pointed out more fully hereinafter, such apparatus cannot be employed practically in association with the large diameter trash chutes employed in high-rise apartment buildings and in association with conventional containers.

BRIEF SUMMARY OF THE INVENTION

It is accordingly a principal object of the present invention to provide improved compaction apparatus.

A further object of the invention is to provide improved apparatus employing the principal of precompaction and in which optimum compaction is obtained in conjunction with conventional large-diameter chutes and conventional receptacles.

Another object of the invention is to provide compaction apparatus incorporating improved means for breaking and removing obstructions in the material receiver chamber.

Still another object of the invention is to provide improved compaction apparatus with a unique hydraulic drive mechanism permitting a longer blade stroke without increasing the overall length of the housing.

A still further object of the invention is to provide an improved actuating circuit for compaction apparatus and the like.

Briefly stated, the present invention employs a material receiver chamber with an inlet opening at one side thereof and an outlet opening at one end thereof through which material is moved by a blade into a volume-reducing snout. The outlet opening from the receiver chamber is noncircular and has an area less than the area of a circle with diameter equal to the width of the outlet opening. The snout has a preferably circular outlet opening of substantially less area than the area of the outlet opening of the receiver chamber and includes a tapered transition section. A container placed upon the snout receives the compacted material and moves along the snout as the container is filled. The compaction blade has cutting members which cooperate with a shear bar for breaking up large pieces of material in the receiver chamber and is driven by a unique ram supplied by a photoelectrically controlled hydraulic system.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, advantages, and features of the invention and the manner in which the same are accomplished will become more readily apparent upon consideration of the following detailed description of the invention taken in conjunction with the accompanying drawings, which illustrate a preferred and exemplary embodiment, and wherein:

FIG. 1 is a side elevation view of compaction apparatus in accordance with the invention, illustrating in phantom lines the association of the apparatus with a receptacle and a chute;

FIG. 2 is a top plan view of the apparatus of FIG. 1;

FIG. 3 is a front elevation view taken along line 3–3 of FIG. 2 with a portion of the apparatus deleted for clarity of illustration;

FIG. 4 is a transverse sectional view taken along line 4–4 of FIG. 2 and illustrating in phantom lines the association of the compaction apparatus with the chute;

FIG. 5 is a longitudinal sectional view taken along line 5–5 of FIG. 3 and illustrating the hydraulic ram mechanism;

FIG. 6 is a perspective view, partially cut away, of a compaction blade constructed in accordance with the invention;

FIG. 7 is a schematic diagram of an electrical circuit employed in the invention; and

FIG. 8 is a schematic diagram of a hydraulic circuit employed in the invention.

Referring to the drawings, the compaction apparatus of the present invention comprises a housing **10** having a material receiver chamber **12** at the forward end of the housing and a machinery compartment **14** at the rearward end of the housing. The housing has a lower portion defined by a bottom wall **16** (see FIG. 4) and a pair of sidewalls **18** and **20** which diverge upwardly and outwardly from the bottom wall to the side extremities **22** and **24** of the housing. The housing is provided with a pair of upwardly and inwardly converging longitudinal lips **26** and **28** which merge with substantially vertical side walls **30** and **32**. These sidewalls may be somewhat upwardly divergent to define the sides of a hopper. The machinery compartment **14** (FIG. 5) is separated from the material receiver compartment **12** by an upwardly and rearwardly inclined wall **34** extending between the side walls **30** and **32** of the housing and defining the rear wall of the hopper. The machinery compartment may have a rear wall **36** or may be open at the rear. Legs **38** are provided to support the housing above the level of the floor.

The front wall **40** of the housing (and hopper) and the depending vertical portion **34a** of wall **34** cooperate with the lower portion of the housing in defining polygonal openings (the front wall opening being designated O) for the passage of a compaction blade **42** of corresponding polygonal cross section (see FIG. 6). The blade is formed as a hollow polygonal box having a bottom wall **44** and upwardly diverging side walls **46** and **48** which rest upon corresponding walls **16**, **18** and **20** of the housing. Upwardly converging side walls **50** and **52** of the blade and a top wall **54** complete the blade side wall structure. The front wall **56** of the blade constitutes the packing surface of the blade, the opposite end of the blade being open as shown in FIG. 5.

The blade is constrained against upward movement by the lips **26** and **28** of the housing which mate with corresponding portions of walls **50** and **52** of the blade. Along the forward edges of walls **50**, **52** and **54**, the blade is provided with cutting members in the form of triangular teeth **58** which project forwardly from the front wall **56** of the blade. The blade is supported in the housing for reciprocative movement between a retracted position shown in FIG. 5, at which the front wall **58** may be substantially alined with the opening in wall **34**, and an extended position (indicated in phantom lines in FIG. 5) at which the front wall of the blade projects forwardly beyond the front wall **40** of the housing.

Reciprocative movement of the blade is obtained by the use of a hydraulic system which includes a dual hydraulic ram 60 including a pair of hydraulic cylinders 62 and 64 fixed to each other side-by-side, one above the other. The cylinders have oppositely extending piston rods 66 and 68, rod 66 extending forwardly and being connected to the blade as by a pin 70 passing through a pair of spaced vertical plates 72 which embrace the end of the piston rod 66 and are fixed behind the front wall 56 of the blade. Piston rod 68 extends rearwardly and is similarly coupled at 74 to a transverse frame member 76 of the housing, which may be an I-beam extending between and fixed to the side walls of the housing. The general arrangement of the hydraulic ram and its connection to the blade and the frame member is similar to that disclosed in the applicant's U.S. Pat. No. 3,368,478. However, in accordance with the present invention, cylinder 64 is elongated so as to extend rearwardly beneath the frame member 76 as shown in FIG. 5. This provides a substantial addition to the ram stroke without increasing the overall length of the compaction apparatus, thereby permitting greater extension of the blade than has heretofore been possible in such a compact configuration.

As shown in FIG. 8, the hydraulic system also includes a pump 78 driven by an electric motor 80, the pump drawing hydraulic fluid from a sump or reservoir 82 and forcing it through a check valve 84 to a two-way reversing valve 86, which is biased to a rest position by a spring (not shown) and moved to its opposite position by a solenoid 88. The hydraulic fluid lines 90 and 92 interconnect the cylinders 62 and 64 so that the piston rods 66 and 68 tend to be driven in opposite directions. Since rod 68 is fixed, cylinders 62 and 64 are moved as a unit in the same direction as the movement of rod 66. Operation of the hydraulic system will be described later in conjunction with the electrical control circuit shown in FIG. 7.

In accordance with the invention as shown in FIGS. 1 and 2, the housing 10 is provided with a volume-reducing snout 94 which extends forwardly from the opening O in the front wall of the housing. The snout preferably comprises three portions, namely, a rear or entry portion 96 adjacent to the front wall 40 of the housing having a substantially constant polygonal cross section which matches and extends from the opening O in the front wall, a forward or exit portion 98 of substantially constant circular cross section and an intermediate tapered transitional portion 100 which connects portions 96 and 98. As shown, the cross-sectional area of the forward portion 98 is substantially less than the cross-sectional area of the rearward portion 96 of the snout, and the cross-sectional area of the transitional portion 100 is continually reduced to match the forward and rearward portions of the snout (see FIG. 2). Although in some instances the transitional portion may taper in both a vertical plane and a horizontal plane, in the preferred form of the invention illustrated the taper is principally in the horizontal plane, since the height of the snout is approximately the same from one end to the other. The sides of the transitional section may comprise alternating curved sections 102 and pyramidal sections 104, the curved sections having nodes 106 at the junction with the rear portion 96 of the snout. Such transitional sections per se are well known in the sheet-metal art, for example. In general it is desired that the transition take place as smoothly as practical.

The snout may be attached to the housing by means of four fasteners 108, one each at the top and bottom walls and the side extremities of the rear portion 96 of the snout. The fasteners may include bolts welded to the housing 10 and extending into sleeves welded to the snout and fixed thereto by nuts.

The upper edge portions of the opening O at the front of the housing are preferably strengthened by angle or I-beam pieces 110, 114 and 116 welded to the housing (see FIG. 3) and constituting a shear bar for cooperation with the teeth 58 of the blade. A stiffening member, such as the I-beam 116, may be welded to the front wall of the housing and have its ends welded to side extensions 118 (FIG. 5) of the housing for stiffening the front wall structure.

As shown in FIGS. 1 and 2, an arm 120 extends forwardly cantilever-fashion from the rear portion 96 of the snout and supports a switch LS3 adjacent to its forward end. The arm is spaced from the upper surface of the forward portion of the snout sufficiently to permit a receptacle D, such as a drum, to be placed over the snout, as will be described hereinafter, and to engage the depending actuating arm of the switch.

In accordance with the preferred form of the invention, the compaction apparatus is actuated automatically in response to the presence of material, such as trash, at the inlet opening *i* (FIG. 5) at the top side of the receiver chamber 12. The apparatus of the invention may be located in the basement of multistory apartment building beneath the lower end of a chute 122 shown in phantom lines in FIG. 1, the housing being extended upwardly as indicated by the phantom lines to provide an enclosure or hopper into which the material to be compacted may fall. Wall 34 is extended as indicated by line 34'' to constitute a deflection plate for the material which falls through the chute from the upper levels of the apartment house under the influence of gravity. Reference is made to the applicant's U.S. Pat. No. 3,231,107 for a description of the arrangement of stationary compaction apparatus in a high-rise apartment house.

In the preferred form of the apparatus of the invention the blade normally rests in its extended or forward position and blocks the inlet opening *i* at the top of the receiver chamber. Material dropping from the chute thus comes to rest upon the top side of the blade where it may interrupt a light beam projected from a light source 124, located above the blade at one side of the housing, to a photoelectric relay 126, similarly located at the opposite side of the housing, small holes being provided in the housing sidewalls for passage of a light beam. As will be described hereinafter, when the light beam is interrupted, the blade is moved rearwardly to the fully retracted position illustrated in FIG. 5, and the material resting upon the blade drops into the receiver chamber 12, the blade then moving forwardly to force the material through the outlet opening O at the front of the receiver chamber. Suitable wiper elements 128, such as canvas or rubber strips, may be secured to wall portion 34' around the upper edges of the opening therein to wipe the blade and prevent material from being carried into the machinery compartment 14 as the blade moves rearwardly.

Movement of the blade is controlled by the electric circuit illustrated in FIG. 7. The pump motor 80 may be supplied from 208 volt three-phase supply lines 130 through a motor starter relay 132. 115 volt a.c. for the remainder of the circuit is provided by a transformer 134 connected across two of the three-phase lines, ground for one side of the 115 volt system and for the motor M being connected to one side of the secondary winding of transformer 134.

The light source 124 and photoelectric relay 126 are supplied from transformer 134 as shown, an indicator lamp 136 being provided to show that the system is energized. The motor starter relay 132 is controlled by relay CR1, which closes a circuit for energizing the motor starter relay when the light beam from source 124 is interrupted so as to close the contacts of relay 126, thereby completing a circuit through the coil of relay CR1 and the on–off switch 138. Actuation of relay 126 also completes a circuit for relay CR3, which closes two sets of contacts, the upper contacts illustrated extending an energization circuit to relay CR2 and the lower contacts illustrated providing a holding circuit for relays CR1 and CR3 through the upper contact of a limit switch LS1 having a switch blade which is held closed upon its upper contact by the compaction blade and is permitted to move to its lower contact when the blade is in its forward or rest position. Energization of relay CR2 closes its two sets of contacts, the upper set completing an actuating circuit for solenoid 88 of the two-way control valve, and the lower contacts completing a holding circuit for relay CR2 through limit switch LS2, which is normally closed and which is opened by the compaction blade when the blade reaches its fully retracted position. Limit

switches LS1 and LS2 may be positioned on a side wall of the housing as indicated in phantom lines in FIG. 1 and may have actuating arms which project through openings in the side wall to engage the blade cam C. A manual reverse switch R shunts the upper contacts of upper relay CR2 and thus permits energization of solenoid 88 independently of the relay. A pressure switch PS shunts the lower contacts of limit switch LS1 for a purpose to be described hereinafter. Switch LS3, previously described in connection with the snout, controls relay CR4 for energizing an indicator lamp 140 to indicate that the container or receptacle is full, and to interrupt operation of the compaction apparatus, as will also be described hereinafter.

In a typical cycle of operation, material from the chute 122 comes to rest upon the top of the compaction blade 42, which as indicated above is normally extended, and interrupts the light beam from source 124. Photoelectric relay 126 is actuated, closing motor starter relay 132 and energizing pump motor 80. In its extended position of the blade an actuating cam C (indicated in phantom lines in FIG. 6) fixed to the rear of the blade engages the actuating lever of switch LS1 and closes it upon its lower contact. Actuation of photoelectric relay 126 not only energizes relay CR1 to energize the motor starter relay 132 but also energizes relay CR3, which closes its contacts and energizes relay CR2 through limit switch LS1. Relay CR2 closes its contacts, energizing solenoid 88 and providing a self-holding circuit through limit switch LS2 and the closed upper contacts of relay CR3. Energization of solenoid 88 places the control valve 86 in a position which causes the compaction blade 42 to move rearwardly, releasing the blade of switch LS1 and permitting it to close normally upon its upper contact and providing a holding circuit for relays CR1 and CR3 through the closed lower contacts of the latter. As the blade moves rearwardly, the material on top of the blade falls into the receiver chamber 12, removing the interruption of the light beam and permitting photoelectric relay 126 to open its contacts. Relays CR1 and CR3 remain closed, however, by virtue of the holding circuit just mentioned. When the blade reaches its fully retracted position, the cam at the rear of the blade engages the actuating arm of limit switch LS2, opening this switch and breaking the holding circuit for relay CR2, which becomes deenergized and thus deenergizes solenoid 88. The control valve 86 is returned to its "forward" position by its spring bias, causing reversal of the hydraulic fluid path to the cylinders 62 and 64 and thereby moving the compaction blade forwardly and forcing the material in chamber 12 into the snout 94. The blade moves forwardly until the actuating lever switch LS1 is again engaged by the cam to move the blade of the switch from its upper contact to its lower contact. This movement of switch LS1 immediately opens the holding circuits for relays CR1 and CR3, deenergizing these relays and the motor starter relay 132. The apparatus thus comes to rest.

In the event that the compaction blade encounters a large obstruction as it moves forwardly sufficient to cause the hydraulic pressure in the hydraulic lines supplying fluid to the cylinders 62 and 64 to rise to a predetermined level required to actuate the pressure switch PS, the pressure switch will close, energizing relay CR2 and solenoid 88, so as to reverse the movement of the blade. Such movement of the blade will reduce the hydraulic pressure below the level required to hold switch PS closed and will permit the pressure switch to open, whereupon the blade will again move forward and engage the obstruction. The blade will thus move back and forth, causing the teeth 58 to engage the obstruction repetitively and, by cooperation with the shear bar 110, 114, 116, to break the obstruction if possible and force the pieces into the snout.

The material forced into the rear portion 96 of the snout will be greatly reduced in volume when it encounters the transition section 100 and will be squeezed into the forward section 98. When sufficient compacted material accumulates in the snout, the snout will fill up, and compacted material will extrude through outlet opening O' into the receptacle D. As more and more compacted material is forced into the receptacle, the receptacle, which is closed at its left end (bottom) in FIG. 1 and is free to move on the snout, will move forwardly along the snout under the compressive force of the compaction blade until the actuating lever of limit switch LS3 is released. The consequent closing of this limit switch will energize relay CR4 and indicator lamp 140 to indicate that the receptacle is filled and should be removed and replaced by an empty receptacle. The lower contacts of CR4 will open and interrupt the operating circuit through switch 138. If desired, the indicator 140 may be employed without the apparatus cutoff feature.

Either a drum-type receptacle, such as a 55 gallon metal oil drum, or a bag-type receptacle, such a bag of heavy paper or plastic material, may be employed. The receptacle is preferably placed upon the snout until its major portion (at least 50 percent) overlaps the snout. The receptacle need not fit the snout snugly, because it need not partake significantly in the compaction of the material received therein. An oil drum manually placed upon the snout until its bottom is a few inches from outlet O' will move forwardly when filled until it tips and the bottom-side corner engages the floor, whereupon the drum may be manually removed from the snout and replaced by another.

Apparatus heretofore proposed to compact material supplied from a chute and to feed the compacted material to a receptacle employs a blade which moves the material from a receiver chamber and through a tapered snout. However, such apparatus relies upon circular cross-sectional geometry exclusively. (Rudimentary noncircular tapered compaction apparatus has been employed in packaging Christmas trees, for example, but is not suitable for handling trash supplied as in the environment of the present invention.) The applicant has discovered that an optimum relationship exists between the cross-sectional area of the opening at the front of the receiver chamber (the entry to the snout), the cross-sectional area at the discharge outlet of the snout, the amount of compaction obtained, and the force required to drive the compaction blade, and that in practice the relationship can not be fulfilled with circular geometry compaction apparatus in association with large diameter chutes and conventional containers.

Optimum operation, with compaction of the order of 7 to 1 (volume reduction) for ordinary dry trash is obtained when the area of the discharge opening of the snout is approximately 78 percent of the area of the outlet from the receiver chamber. If this percentage increases appreciably, the compaction ratio decreases, and if the percentage decreases appreciably, the increased compaction is not justified by the great increase in energy required to do the compacting. If the receiver chamber is a cylinder of circular cross section with a circular outlet opening, the diameter of the receiver chamber must be sufficient to accommodate the large diameter chutes which must be employed in apartment buildings, for example, for adequate handling of conventionally disposed items such as large cardboard boxes and bundles of newspaper. Typically the chute may have a 24 inch or a 30 inch diameter or width. If the diameter of the receiver chamber is commensurately large, as is necessary to prevent clogging at the inlet opening of the receiver chamber, the diameter of the outlet of the snout must also be quite large. Otherwise, the back pressure upon the packing blade becomes enormous and the amount of energy required to compact the material becomes impractically large. If a large enough snout outlet diameter is employed to prevent these conditions, the cross-sectional area of conventional receptacles is too small to fit the snout. Hence, unconventional and expensive receptacles must be employed, and such receptacles are so large that they become unwieldy, making it very difficult to handle them manually when filled.

The present invention overcomes the foregoing problems by providing apparatus with a receiver chamber wide enough to accommodate a large diameter chute, such as a 24 inch diameter or 30 inch diameter chute, and which yet permits the use of a relatively small diameter snout outlet commensurate with conventional receptacles, such as 55 gallon oil drums and

paper bags of similar size. The polygonal cross section of the receiver chamber has its widest dimension disposed horizontally, (see FIG. 4) so as to accommodate the width of the chute. If a receiver chamber of circular cross section with diameter equal to the width of the receiver chamber of the invention were employed, the diameter of the outlet of the snout would have to be much too large to meet the practical considerations set forth above. The cross-sectional area of the outlet of the receiver chamber of the invention is, however, substantially less than the cross-sectional area of a circle with diameter corresponding to the width of the receiver chamber, and thus the cross-sectional area of the snout outlet may be made small enough to fit conventional receptacles without exceeding practical criteria for efficient compaction in terms of the amount of volume reduction obtained for a given energy input.

In the form of the invention illustrated the polygonal configuration of the outlet opening O of the receiver chamber may be constructed by arranging the upwardly diverging lower edges and the downwardly diverging upper edges of the opening to form right-angular corners where the upper and lower edges meet at the side extremities 22 and 24. If the lower edges defined by walls 18 and 20 were extended downwardly so as to intersect and if the corresponding upper edges of opening O were extended upwardly so as to intersect, the geometric FIG. thus constructed would be a square, or more accurately a diamond. Such a configuration of the outlet O would require substantial tapering of the snout transition in a vertical plane as well as in a horizontal plane, and although this is possible, excellent performance appears to be obtained with all types of trash when the diamond configuration is truncated by cutting off the top and bottom corners. In the illustrated form of the invention this is accomplished by making the top and bottom edges of the outlet opening O horizontal and approximately flush with the upper and lower extremities of the circular opening O′ of the snout, the horizontal diameter of which is alined with the side extremities 22 and 24 of the housing. The outlet opening O′ of the snout is thus inscribed within the confines of the polygonal outlet opening O of the receiver chamber, with the forwardly projected edges of this outlet opening approximately tangent to the circular outlet opening of the snout as indicated in FIG. 3.

The apparatus of the invention advantageously provides greatly reduced volume of compacted material, of the order of 7 to 1 or better, in conventional receptacles, which can be handled manually, and yet requires very little space for its installation and operation. Typically, for a 30 inch chute, the length of the housing may be about 74 inches, the length of the snout 46 inches, the height of the housing 45 inches (plus extensions to the chute) and the width of the housing 30½ inches. The length of the rearward section of the snout may be about 10 inches, the length of the transition section about 10 inches, and the length of the forward section 26 inches.

While a preferred embodiment of the invention has been shown and described, it will be apparent to those skilled in the art that changes can be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the appended claims. For example, while a circular snout outlet is highly preferred, for use with conventional drums, in some instances a different shape outlet may be employed while maintaining the optimum relationship of snout entry to outlet cross-sectional areas and while providing sufficient material receiver chamber width. Similarly, these criteria may be met in some instances without requiring a polygonal receiver chamber outlet opening. In some instances it may be desirable to provide an appreciable space between the upper surfaces of the compaction blade and the corresponding edges of the receiver chamber outlet opening. Accordingly, the foregoing embodiment is to be considered illustrative, rather than restrictive of the invention, and those modifications which come within the meaning and range of equivalents of the claims are to be included therein.

I claim:

1. Compaction apparatus comprising a material receiver chamber having a polygonal outlet opening at one end thereof with a tubular snout projecting from said opening, said snout having a first portion of polygonal cross section adjacent to said opening, a second portion of cross-sectional area substantially less than the cross-sectional area of said first portion, and a transitional portion connecting said first and second portions, and a compaction blade supported for movement in said material receiver chamber toward and away from said snout, said snout being freely exposed along a substantial part of its length and adapted to receive a tubular container thereon over said second portion.

2. The compaction apparatus of claim 1, said compaction blade being of polygonal cross section and arranged to reciprocate through said material receiver chamber, said chamber having an opening at one side thereof for the reception of material.

3. The compaction apparatus of claim 1, said receiver chamber having a lower portion defined at least in part by walls which diverge outwardly and upwardly toward the side extremities of said chamber, said polygonal outlet opening having substantially greater width than height and having edges substantially alined with the said walls of said chamber, said first portion of said snout having a cross section similar to the shape of said outlet opening, said second portion of said snout having a substantially more rounded cross section, said transitional portion being tapered, said compaction blade having a cross section substantially similar to the cross section of said outlet opening.

4. Compaction apparatus comprising a tubular snout having an entry portion with cross section wider than high, an exit portion of cross-sectional area less than that of the entry portion, and a tapered transitional portion connecting said entry and exit portions, and means for compacting material in said snout through said entry portion, said snout being freely exposed along a substantial part of its length and adapted to receive a tubular receptacle placed over the exit portion of said snout through one end of the receptacle with the snout extending along a major portion of said receptacle and with the receptacle being free to move along said snout, the opposite end of said receptacle being closed, whereby material is compacted in said snout and forced into said receptacle, causing said receptacle to move along said snout as it fills.

5. The apparatus of claim 4, wherein said receptacle is a drum.

6. The apparatus of claim 4, wherein said receptacle is a flexible bag.

7. The apparatus of claim 4, wherein said entry portion has polygonal cross section and said exit portion has round cross section.

8. The apparatus of claim 4, further comprising signalling means for indicating when the said receptacle has been moved along the said snout a predetermined distance.

9. The apparatus of claim 4, further comprising means for interrupting the operation of said compacting means when said receptacle has been moved along the said snout a predetermined distance.

10. Compaction apparatus comprising a material receiver chamber of polygonal cross section with corners at the side extremities thereof and a lower portion comprising walls diverging upwardly and outwardly to said corners, said chamber having a material inlet opening at one side thereof and having a polygonal outlet opening at one end thereof, a tubular snout having a circular outlet opening spaced from the first-mentioned outlet opening and having means including a tapered portion for connecting said openings, the second-mentioned outlet opening having substantially less area than the first-mentioned outlet opening, and a compaction blade movable in said chamber for forcing material through the first-mentioned outlet opening.

11. Compaction apparatus comprising a material receiver chamber having a material inlet opening at one side thereof and an outlet opening at one end thereof, and a tubular snout

extending from said outlet opening and having an outlet opening spaced from the first-mentioned outlet opening, the second-mentioned outlet opening being substantially circular and the first-mentioned outlet opening being noncircular and having an area substantially greater than that of the second-mentioned outlet opening but substantially less than the area of a circle with a diameter constituted by the width of the first-mentioned outlet opening.

12. The apparatus of claim 11, wherein the ratio of the width of the first-mentioned outlet opening to the width of the second-mentioned outlet opening is about 3 to 2.

13. Compaction apparatus comprising a material receiver chamber having an inlet opening at one side thereof and an outlet opening at one end thereof, the horizontal width of said outlet opening being substantially greater than its height, a tubular snout projecting from said outlet opening and having an outlet opening spaced from the first-mentioned outlet opening, the area of the second-mentioned outlet opening being substantially less than the area of the first-mentioned outlet opening and said snout being exposed along a substantial part of its length to permit a container to be slipped thereon longitudinally over said second-mentioned outlet opening.

14. The apparatus of claim 13, the area of the second-mentioned outlet opening being no less than about 78 percent of the area of the first-mentioned outlet opening.

15. The apparatus of claim 13, wherein the second-mentioned outlet opening is substantially circular with a diameter of about 20 inches and the first-mentioned outlet opening has a width of about 30 inches.

16. The apparatus of claim 13, wherein the second-mentioned outlet opening is circular and has a diameter of about 18 inches and wherein the first-mentioned outlet opening has a width of about 24 inches.

17. The apparatus of claim 13, wherein the ratio of the width to height of the first-mentioned outlet opening is substantially 3 to 2.

18. The apparatus of claim 13, wherein the first-mentioned outlet opening, has corners at its side extremities.

19. Compaction apparatus comprising a material receiver chamber having an inlet opening at one side thereof and an outlet opening at one end thereof, said chamber and said outlet opening having a lower portion with walls diverging upwardly and outwardly to the side extremities of said chamber, said outlet opening being substantially wider than high, a compaction blade supported for reciprocation through said chamber toward and away from said outlet opening, said blade having a lower portion with walls substantially complementing the walls of said chamber, and a tubular snout projecting from said outlet opening, said snout having an outlet opening of area substantially less than that of the first-mentioned outlet opening and being exposed along a substantial part of its length to permit a container to be slipped longitudinally thereon over the outlet opening of said snout.

20. The apparatus of claim 19, said chamber having an additional opening at the end opposite to the said outlet opening, said additional opening and said outlet opening having edges complementing the walls of the said blade and said blade being supported for movement through said outlet opening and said additional opening.

21. The apparatus of claim 19, said blade having an upper portion with walls diverging downwardly and outwardly to the said side extremities of said chamber.

22. The apparatus of claim 19, said outlet opening having upper edge portions extending from one side extremity of said chamber to the other and provided with a shear bar, said edge portions corresponding substantially to the upper portion of the cross section of said blade, said blade having shearing teeth extending from one extremity of the upper portion thereof toward said edge portions of said outlet opening.

23. Compaction apparatus comprising a material receiver chamber having an inlet opening at one side thereof and an outlet opening at one end thereof, said chamber and said outlet opening having a lower portion with walls diverging upwardly and outwardly to the side extremities of said chamber, said outlet opening being substantially wider than high, and a compaction blade supported for reciprocation through said chamber toward and away from said outlet opening, said blade having a lower portion with walls substantially complementing the walls of said chamber, said chamber having lip portions converging upwardly and inwardly from said side extremities and mating with corresponding walls of the said upper portion of said blade for constraining upward movement of said blade.

24. Compaction apparatus comprising a material receiver chamber, a compaction blade supported for movement through said chamber from a retracted position to an extended position, and means for moving said blade through said chamber, the last-mentioned means comprising a pair of hydraulic cylinders fixed to each other in side-by-side relationship one above the other and having piston rods extending from opposite ends thereof, one of said rods being connected to said blade and the other of said rods being connected to a fixed frame member extending transversely with respect to the movement of said blade, the cylinder having the first-mentioned rod being substantially longer than the other cylinder and extending past the said transverse frame member, whereby an extra long stroke of said blade is provided without increasing the overall length of said apparatus.

25. Compaction apparatus having a material receiver chamber with an inlet opening at one side thereof and an outlet opening at one end thereof, a compaction blade movable in said chamber toward and away from said outlet opening, a hydraulic system for moving said blade and including a ram for moving said blade, a fluid supply pump driven by an electric motor, means for energizing said motor in response to material supplied to said chamber at said inlet opening, an electrically-operated valve which, when actuated, directs fluid from said pump to said ram to cause said blade to move away from said outlet opening, first limit switch means having a first position when said blade is located adjacent to said outlet opening and a second position when said blade is located away from said outlet opening, a circuit including said limit switch means in said second position for maintaining said motor energized, a circuit including said limit switch means in said first position for energizing said valve, and a circuit including second limit switch means for maintaining said valve energized, the last-mentioned limit switch means having means for opening it when said blade is fully retracted from said outlet opening.

26. The apparatus of claim 25, further comprising switch means responsive to the hydraulic pressure of said system for shunting the first position of said first-mentioned limit switch means when said blade is moving toward said outlet opening and the hydraulic pressure in said system reaches a predetermined level.

27. The apparatus of claim 4, wherein said transitional portion comprises a pair of snout sections at opposite sides of said snout which converge toward the center of said snout horizontally and each of which includes surfaces which converge vertically.

28. Compaction apparatus comprising a tubular snout having an inlet opening of polygonal cross section and an outlet opening of circular cross section, said snout having means including a tapered transitional section for joining the inlet opening to the outlet opening, a projection of the circular outlet opening upon the polygonal inlet opening having the circle defined by said projection tangent with the edges of the polygonal inlet opening.

29. The apparatus of claim 28, wherein said polygonal inlet opening is hexagonal.

30. The apparatus of claim 29, wherein said polygonal inlet opening is located at the front of a material receiver chamber having a compaction blade therein for moving material through said inlet opening, said opening being wider than high.