

[54] CONTROL CIRCUIT FOR TRASH COMPACTOR

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[51] Int. Cl. H02b 1/24

[58] Field of Search 307/112, 149, 119, 120; 318/207 A, 207 C

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[57] ABSTRACT

Initial movement of the ram of a trash compactor actuates a switch which prepares a circuit for reverse flow of current through the start windings of an electric drive motor after a centrifugal switch incorporated therein has opened. When compaction of the trash has slowed the motor to a predetermined speed, the centrifugal switch recloses and the ram is automatically reversed. Other switches and means for controlling the ram's movement, as well as for safety purposes, are also disclosed, together with details of the structure of the trash compactor generally, the ram and the mounting of the container in which the trash is compacted.

3 Claims, 11 Drawing Figures

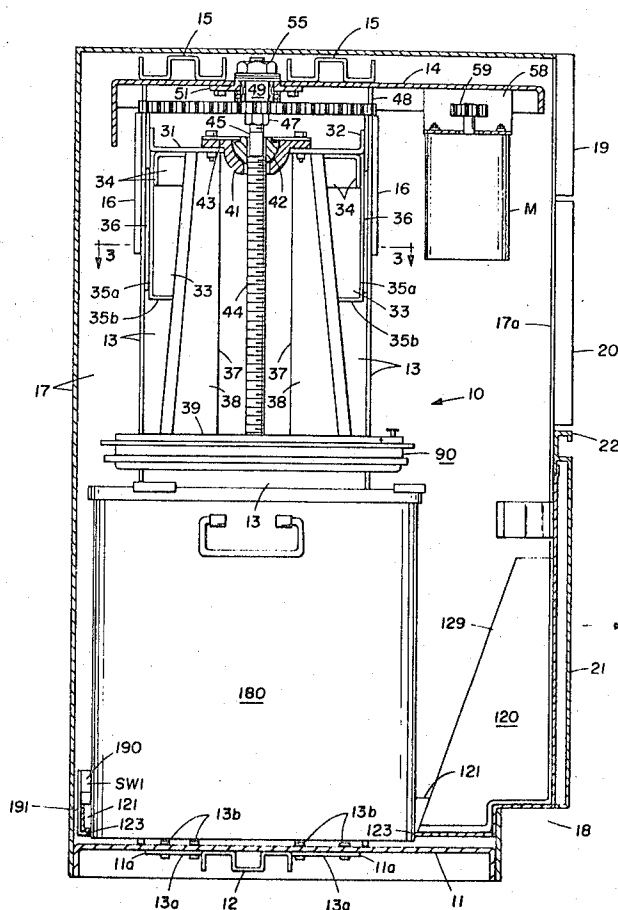


FIG 1

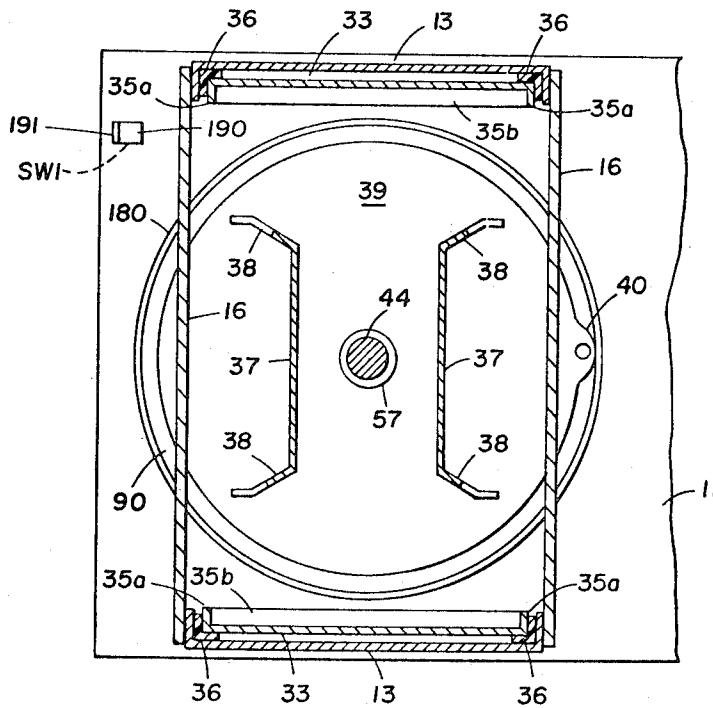
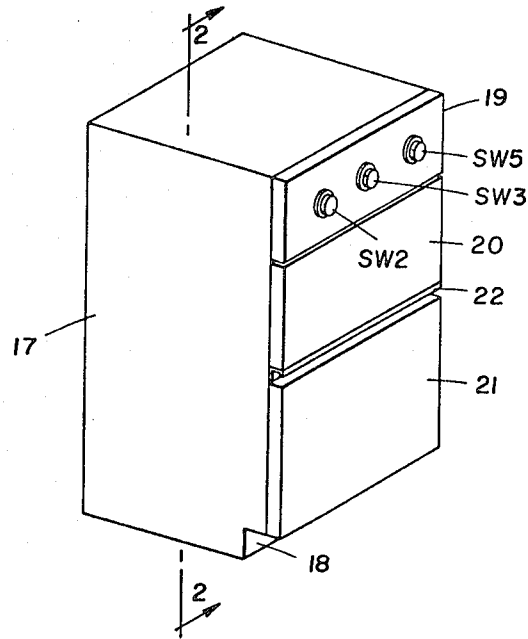
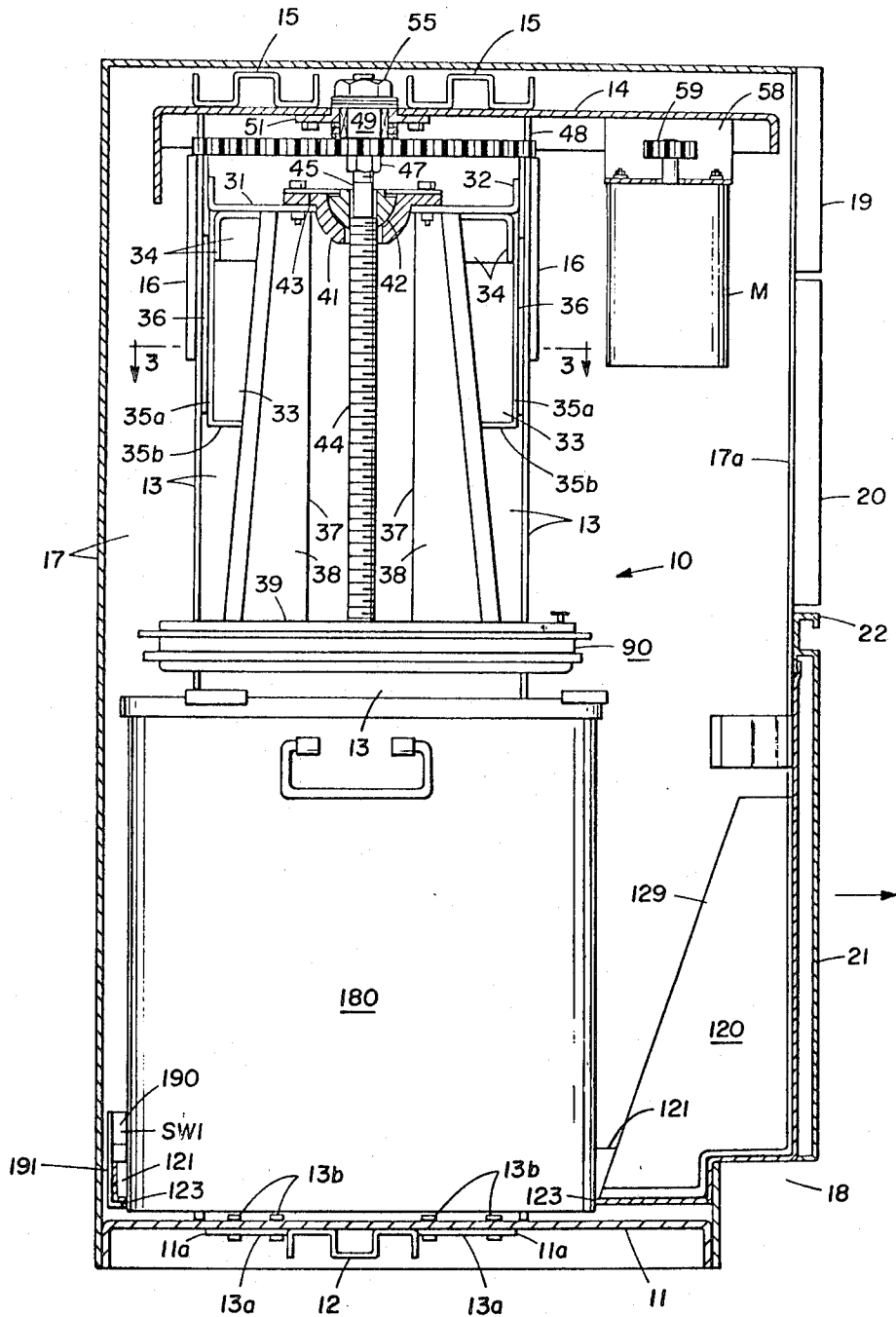


FIG 3

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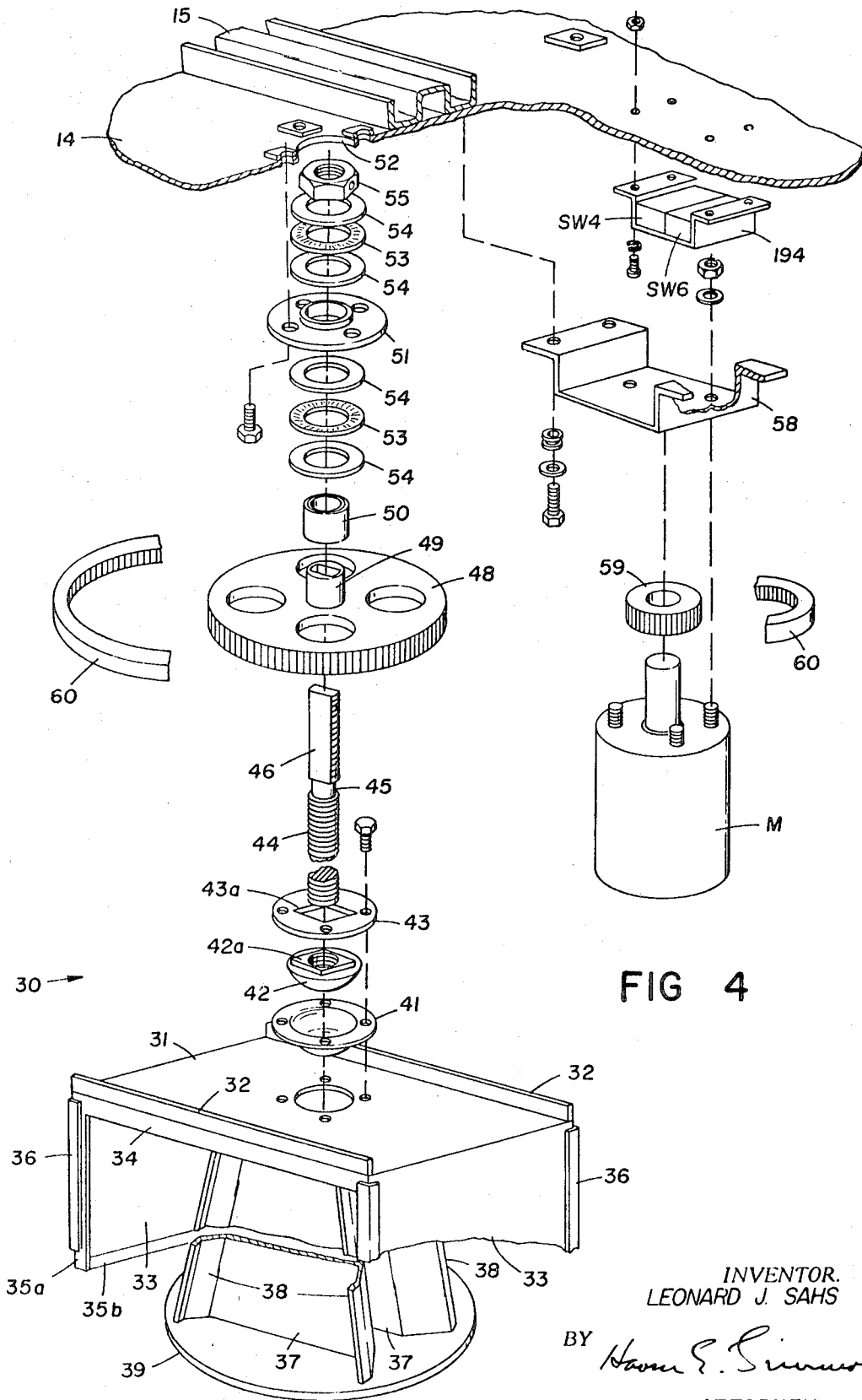


FIG 4

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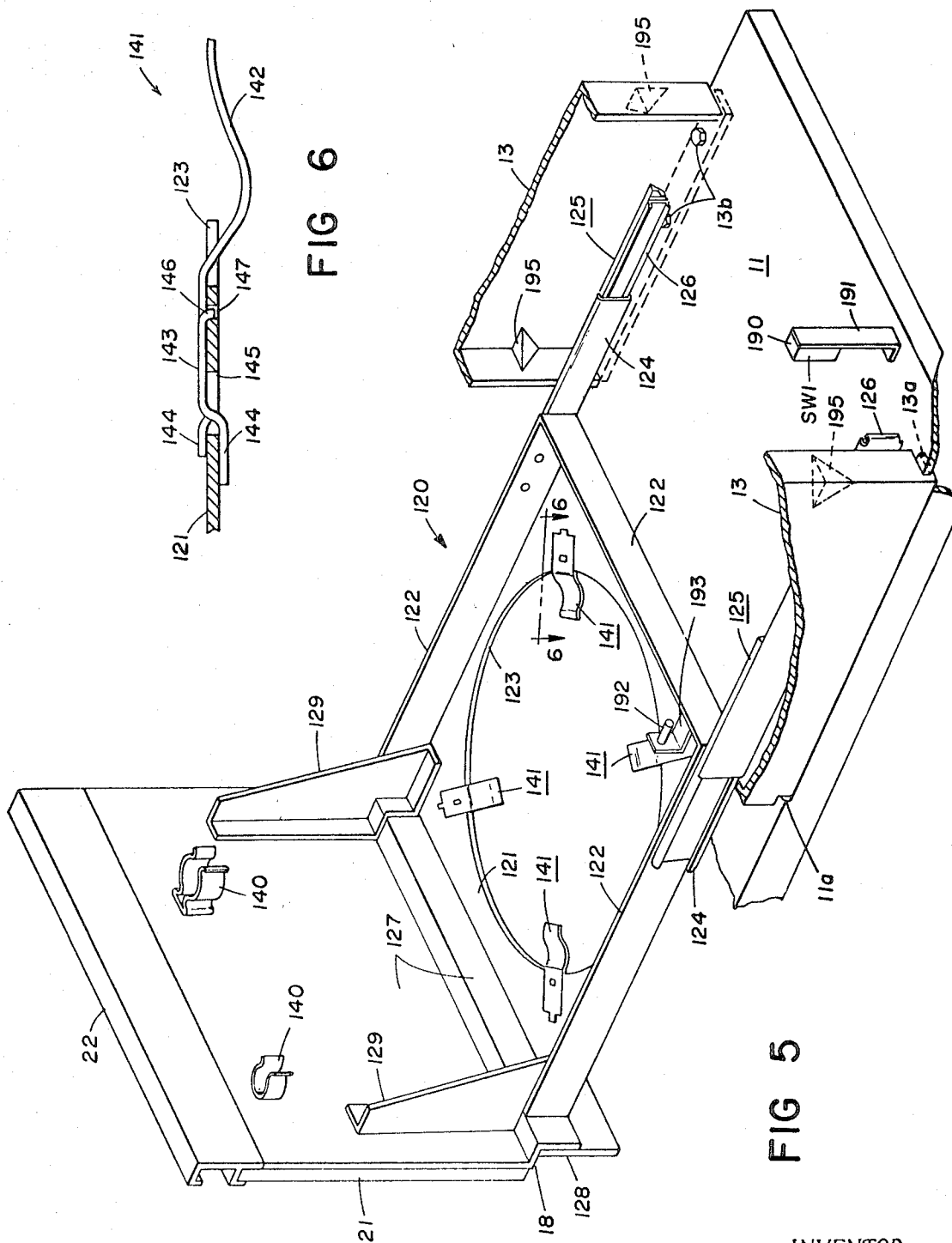


FIG 6

FIG 5

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FIG 7A

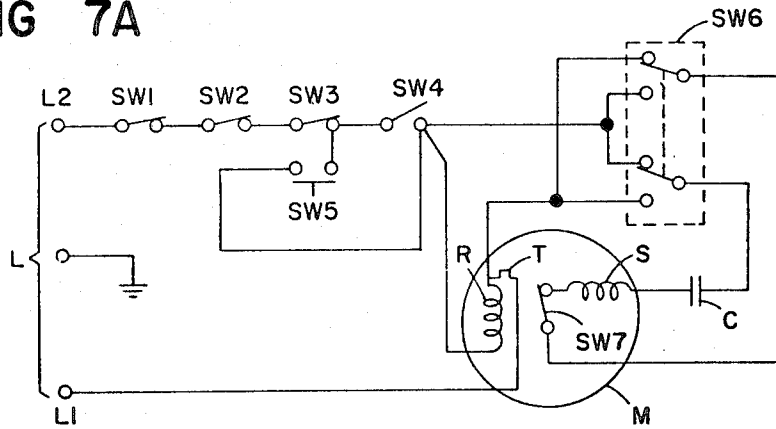


FIG 7B

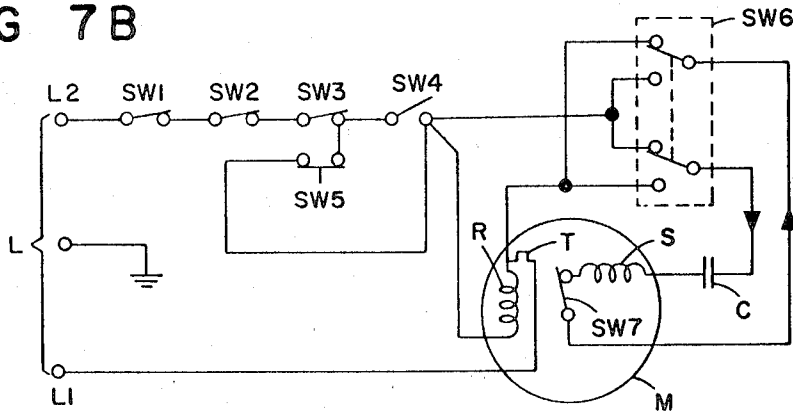
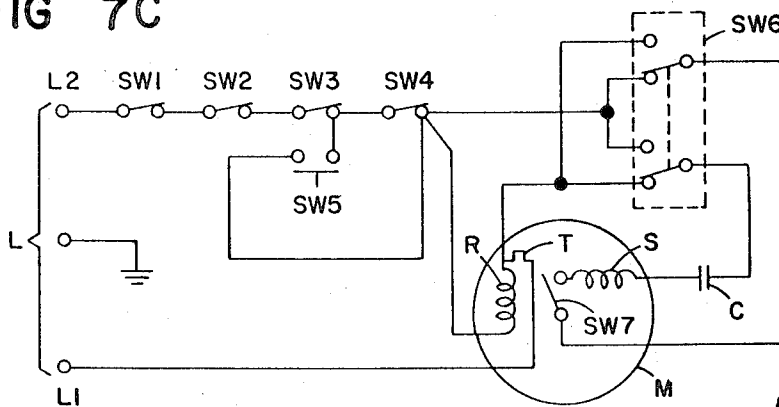


FIG 7C



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FIG 7D

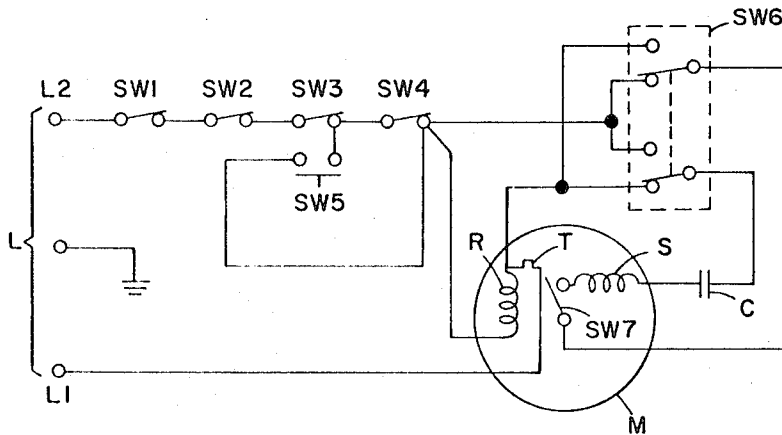
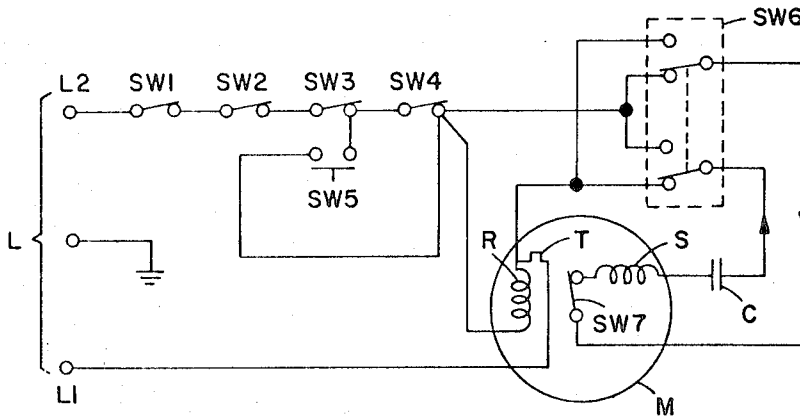


FIG 7E

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CONTROL CIRCUIT FOR TRASH COMPACTOR

BACKGROUND OF THE INVENTION

In trash compactors having a ram driven by an electric motor, some sort of electrical control circuit is customarily employed for operating the ram. Typically, these provide for automatic reversal of the ram at the bottom of its compacting stroke and include various safety interlocks. However, such circuits have tended to be rather complex and expensive, using current sensitive relays or other devices to sense when the ram has encountered a predetermined amount of resistance from the trash in order to reverse the ram's direction. Some prior compactors even limit the compacting stroke to a fixed distance above the bottom of the trash container regardless, thus limiting or reducing the amount of compaction irrespective of the nature or amount of the trash in the container. All of this is unnecessary, and simpler, less costly and more efficient circuits and components are obviously desirable from commercial and performance standpoints.

SUMMARY OF THE INVENTION

The present invention here summarized and later claimed is confined to an electrical control circuit for the ram, although certain other inventive features of the trash compactor are also shown in the drawings and disclosed in the more detailed description which follows this summary.

The ram of the trash compactor is driven by an electric motor having run and start windings, the latter incorporating a centrifugal switch. One position of a reversing switch, operated by movement of the ram, directs current through the start windings in one direction when the ram is in its initial position. A manually operated, momentary start switch activates the arm downwardly and after the centrifugal switch has opened, the reversing switch is moved to its other position to prepare for current flow through the start windings in the reverse direction. Hence, when the motor slows enough to reclose the centrifugal switch, owing to the resistance of the compacted trash, the motor is reversed and the ram automatically returns to its initial position, at which point a limit switch breaks the circuit to the motor. A key operated safety switch and a stop switch are also connected in series with the motor. An interlock switch in series with the motor also prevents operation of the ram unless a slide-out mount, which carries the removable container in which the trash is compacted, is in proper position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of the exterior of a trash compactor according to the present invention illustrating the outer cabinet.

FIG. 2 is a vertical elevation of the interior of the compactor taken generally along the line 2—2 of FIG. 1, certain portions of the chassis, the ram and its drive and the trash container mount being additionally sectioned to illustrate their details.

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2 but with the trash container mount omitted for more clarity.

FIG. 4 is an exploded isometric view of the ram and its drive.

FIG. 5 is an enlarged isometric view of the slide-out mount for the removable container in which the trash is compacted.

FIG. 6 is a detail view taken along the line 6—6 of FIG. 5.

FIGS. 7A, B, C, D and E schematically illustrate the electrical control circuit according to the present invention and its operating sequence during a compacting cycle.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The trash compactor consists of a chassis 10 formed essentially of a heavy, downwardly flanged rectangular floor plate 11 reinforced beneath by a transverse channel assembly 12. Just inboard of and along the side edges of the floor plate 11 are located two broad, shallow vertical channels 13 disposed in facing relation to each other as illustrated in FIGS. 2 and 3. The lower ends of the channels 13 are provided with horizontal tongues 13a which pass through slots 11a along the side flanges of the floor plate 11 and engage its under face, being secured thereto by bolts 13b (see FIGS. 2 and 5). The channels 13 extend nearly to the top of the compactor and are capped by a heavy, downwardly flanged top plate 14, also reinforced above by a pair of transverse channel assemblies 15. The respective opposite flanges of the channels 13 are connected by heavy crossplates 16 just beneath the top plate 14, all to form in effect a heavy, cage-like structure in which the ram operates. Over the chassis 10 is slipped an open front, rectangular sheet metal cabinet 17 whose forward edges are flanged at 17a and provided with a toe space 18. The front of the cabinet is closed by three panels, 19, 20 and 21 against the cabinet flanges 17a, the upper edge of the panel 21 being provided with a hand grip 22 for purposes to be later described. The cabinet 17 is secured only to the rear and side edges of the floor plate 11, being otherwise spaced from the chassis 10 in order to minimize transmission of vibration, and the floor and top plates 11 and 14 extend forward to just behind the toe space 18 and the panel 19, respectively, (see FIGS. 1 and 2).

The ram assembly, generally indicated at 30 (see FIGS. 2, 3 and 4), consists of an upper horizontal plate 31 of rectangular shape generally spanning the area bounded by the four inner corners of the channels 13 and provided with transverse upward flanges 32. From the side edges of the plate 31 depend a pair of deep skirt plates 33, reinforced by angle braces 34 about the four edges of the plate 31 and by flanges 35a and 35b along their four vertical and two bottom edges. Over the four corners formed by the skirt plates 33 and their flanges 35a are secured nylon glides 36 which slidably bear against the inner corners of the channels 13. Beneath the upper plate 31 are welded the upper ends of a pair of trapezoidal shaped supports 37 braced by flanges 38 along their upright edges and disposed in spaced, back-to-back relation centrally of the plate 31. Welded to the lower ends of the supports 37 is the upper face of a circular bottom plate 39 centrally disposed with respect to the upper ram plate 31. The latter is centrally bored between the supports 37 to receive a flanged swivel seat 41 for a swivel nut 42 having a squared upper boss 42a, the seat 41 and nut 42

being retained by a flange plate 43 bolted through the plate 31, the plate 43 having a squared aperture 43a receiving the boss 42a and so preventing rotation of the nut 42. Through the latter is threaded a long, Acme type vertical screw 44, its threads being interrupted at 45 toward its upper end and provided thereabove with a pair of opposite flats 46 on which is threaded a nut 47 (see FIG. 2). The latter supports a large, cogged driven gear 48 whose hub 49 fits the flats 46 to fix the gear 48 relative to the screw 44. On the hub 49 is placed a sleeve needle bearing 50 which is received in a flanged bushing 51 seated in an aperture 52 in the chassis top plate 14 and bolted thereto between the channel assemblies 15. Above and below the bushing 51 are interposed a pair of washer-type needle thrust bearings 53, each sandwiched between a pair of flat washers 54. Through the bushing 51 extends the upper end of the screw 44, the latter and thus the entire ram assembly 30 being suspended from the bushing 51 by means of a nut 55 bearing against the upper-most washer 54. In order to prevent whipping of the screw 44, its lower end is extended down through an aperture (not shown) in the ram bottom plate 39. Forward of the ram assembly 30 a hat-shaped bracket 58 is bolted to the under face of the chassis top plate 14 from which is vertically suspended an appropriate electric motor M, the upper end of its drive shaft carrying a small cogged drive gear 59, the gears 48 and 59 being connected by a cogged drive belt 60. To the ram bottom plate 39 is removably attached a circular ram head assembly 90 which will not be further described since it plays no part in the present invention.

Accordingly, as the screw 44 is driven in the appropriate direction, the entire ram assembly 30 moves downwardly owing to the swivel nut 42. The four nylon glides 36, which in effect provide a total of eight bearing faces, fit tightly against the inner corners of the chassis channels 13 and are heavily greased. The screw 44, which provides a single axis of thrust centrally disposed with respect to the ram assembly 30 and parallel to the glides 36, absorbs most of the resistance encountered by the ram assembly 30 as it descends. Any tendency for it to "cock" or "twist" is effectively resisted and accommodated by the strength of the ram assembly 30, the extensive length of the eight surfaces of the nylon glides 36 and the substantial lateral spacing of the latter from the axis of the screw 44. The interrupted thread portion 45 of the screw 44 prevents over-travel of the ram 30 upon its upward movement. The driven gear 48, which may be of powdered metal or cast from aluminum or iron, is provided with 84 cogs while the drive gear 59 has 10 to 13 cogs, the motor M being a standard 1/8 hp, 115 VAC unit of 1725 rpm having start and run windings.

The slide-out mount 120 for the trash container (see FIGS. 2 and 5) is formed by a rectangular floor pan 121 having shallow side and rear end walls 122 and a large centrally located, circular aperture 123 therein normally axially aligned with the ram head 90 and somewhat larger in diameter. To the exterior of the side walls 122 along the floor pan 121 are affixed the outer members 124 of a pair of three-piece, ball bearing full extension glides 125, of conventional type, whose stationary members 126 are secured across the flanges of the chassis channels 13 just above the floor plate 11. The floor pan 121 is also provided with a front wall

127, extending the full width of the cabinet 17, which is forwardly stepped to form the cabinet toe space 18 and carries a toe plate 128. A pair of upright, trapezoidal braces 129 welded to the floor pan 121 and the inner faces of the side and front walls 122 and 127 secure the front wall 127 to the floor pan 121 and the cabinet front panel 21, carrying the hand grip 22, is secured in turn to the front wall 127 above the toe plate 128. Two different sized spring clips 140 are fastened to the inner face of the front wall 127 for holding spray cans of deodorant. Inwardly of the corners of the floor pan 121 flour flat, container supporting springs 141 extend radially into the aperture 123. Each spring 141 consists of a cantilevered arm 142 and a shank 143 terminating in vertically split tongues 144 formed in the opposite end of the shank 143. The latter lies atop the floor pan 121 while the tongues 144 engage the upper and lower faces of the floor pan 121 through a hole 145 through the latter in order to locate the spring 141, its lateral movement being restrained by a downset tang 146 formed in the shank 143 and engaging another hole 147 in the floor pan 121 (see FIG. 6).

The springs 141 support a bucket-like trash container 180 fitting the aperture 123 in the floor pan 121. The container 180 is normally supported on the spring arms 142 above the chassis floor plate 11 in which position it is just below and axially aligned with the ram head 90 when fully retracted (see FIG. 2). When the ram 30 is in its fully retracted position as shown in FIG. 2, the container 180 can be pulled forwardly out of the cabinet 17 on its mount 120, as indicated by the arrow in FIG. 2, by the hand grip 22 in order for trash to be deposited. When the container 180 is full, the ram 30 is activated and descends to compress the trash at which time the springs 141 deflect allowing the container 180 to sink through the aperture 123 until its bottom sits firmly upon the chassis floor plate 11.

Turning now to FIGS. 7A - E, the electrical control circuit for the compactor will now be described. One side L1 of the 115 VAC power supply line L is connected directly to one end of the run windings R of the motor M through a typical thermal overload switch T within the motor M. The other side L2 is connected in series with four s.p.s.t. switches SW1, SW2, SW3 and SW4, themselves also connected in series. SW1 is a safety interlock switch biased normally open and located in a box 190 supported by a bracket 191 at the extreme rear of the chassis floor plate 11 adjacent its right hand corner (as viewed from the front) so that the box 190 is elevated above the rear wall 122 of the slide-out mount 120 (see FIGS. 2, 3 and 5). SW1 is operated by a horizontal pin 192 projecting rearwardly from an upstanding bracket 193 (see FIG. 5) secured to the rear wall 122 of the slide-out mount 120 which passes through a hole in the front face of the box 190 and closes SW1 only when the mount 120 is pushed fully in. SW2 is a key operated safety switch and SW3 a manually operated ram stop switch, both mounted on the front control panel 19. SW4 is a ram top limit switch biased normally closed and located under the chassis top plate 14 on a bracket 194 (see FIG. 4) in one of its forward corners to be opened by the forward flange 32 of the upper ram plate 31 when the ram 30 is in its uppermost position. A s.p.s.t. momentary start switch SW5 is wired in parallel with SW4 and also

located on the control panel 19. The downstream side of SW4 is connected to the other end of the run windings R and to one of each pair of the alternate contacts of a d.p.d.t. ram directional switch SW6 located beside SW4 on the bracket 194 and operated in the same manner, the two circuit-making members of SW6 being moved by the flange 32 of the upper ram plate 31 to the position shown in FIG. 7A and biased to the position shown in FIG. 7C. The other of each pair of alternate contacts of SW6 are both connected to the line L1 at the run windings R through the thermal overload switch T. One of the circuit making members of SW6 is connected in series with one end of the start windings S of the motor M through a start capacitor C and the other circuit making member of SW6 to the other end of the start windings S through a centrifugal s.p.s.t. switch SW7 within the motor M and normally closed when the motor M is below a predetermined run speed. The operating sequence of the compactor is then as follows:

As shown in FIG. 7A, the ram 30 is at rest at the top of its stroke and the container mount 120 pushed fully in, whereby the safety interlock switch SW1 is closed, the top limit switch SW4 is open and the ram directional switch SW6 is in the position illustrated; the key switch SW2, the manual stop switch SW3 and the centrifugal switch SW7 are all closed. To activate the ram 30, the momentary start switch SW5 is first closed, as shown in FIG. 7B, completing the circuit from L2 to the run windings R and to the start windings S through SW6, the direction of current flow through the latter windings being indicated by the arrows in FIG. 7B. The ram 30 thus starts to descend, permitting the top limit switch SW4 to close and maintain the circuit to the start and run windings S and R of the motor M, whereupon SW5 can be released, all as shown in FIG. 7C. After the motor M is up to speed the centrifugal switch SW7 opens the circuit through the start windings S, the motor M thereafter being operated by the run windings R only, and as the ram 30 further descends the directional switch SW6 moves to its alternate position preparatory for reversing the direction of current flow through the start windings S. When the ram 30 has compressed the trash in the container 180 to a point where its resistance slows the motor M sufficiently, at which point the ram 30 is exerting about 3,200 lbs. of force upon the trash, the centrifugal switch SW7 recloses to re-energize the start windings S, through which the current flows in the reverse direction as shown by the arrows in FIG. 7D owing to the previous movement of the directional switch SW6, thus reversing them motor M and starting the ram 30 upward. As the motor M gets up to speed, the centrifugal switch SW7 reopens, as shown in FIG. 7E, and the ram 30 continues to rise until the flange 32 of the upper ram plate 31 opens the top limit switch SW4, thus breaking the circuit to the motor M and halting the ram 30. At the same time, the directional switch SW6 is returned to its original position and the centrifugal switch SW7 recloses, whereby the circuit is restored to the condition shown in FIG. 7A, ready for another compacting cycle. Travel of the ram 30 up or down can be halted by opening the manual stop switch SW3 which breaks the circuit from L2 to the motor M under all conditions. Reclosing SW3 will cause the ram 30 to return to its ini-

tial, upper position, regardless of in which direction it had been going, owing to the fact that in either event SW6 is in the motor reversing position shown in FIGS. 7C - 7E and SW7 is closed. The key safety switch SW2 is incorporated so that the compactor can be locked up to protect children or to avoid unauthorized use inasmuch, as is apparent, the compactor is inoperative until SW2 is closed. The safety interlock switch SW1 prevents any operation of the ram 30 unless the container mount 120 is fully pushed in.

Should there be no trash in the container 180, or even should the latter have been entirely removed for some reason, the compactor can still be operated so long as the container mount 120 is pushed in. In theory, the ram 30 could simply descend until it contacts the bottom of the container 180 or the chassis floor plate 11, as the case may be, and then reverse in the foregoing manner, all without harm. Hence, it is theoretically unnecessary to employ any device for measuring the resistance encountered by the ram 30 in order to reverse it or to limit the compacting stroke to a predetermined distance above the bottom of the container 180. In practice, however, in order to keep the length of the ram drive screw 44 such that the overall height of the cabinet 17 permits it to be "built-in" under a typical kitchen counter or the like, the length of the stroke of the ram 30 must often be restricted so that it does not "run-off" the screw 44 before it would otherwise contact the chassis base plate 11 or the bottom of the container 180, as the case might be. This is required in the case of the embodiment shown, and for that purpose four stops 195 (see FIG. 5) are welded in the corners of the channels 13 which engage the flanges 35b of the ram 30 when the ram head 90 has descended to a position equivalent to about 1-1/2" from the bottom of the container 180, thus halting the ram 30 and causing it to reverse in the manner explained above regardless of whether the container 180 is empty or is removed from its mount 120. Even so, the degree of compaction is still uniform and for all practical purposes independent of the amount of trash in the container 180.

Though the present invention has been described in terms of a particular embodiment, being the best mode known of carrying out the invention, it is not limited to that embodiment alone. Instead, the following claims are to be read as encompassing all modifications and adaptations of the invention falling within its spirit and scope.

I claim:

1. An electrical control circuit for a trash compactor having a ram movable from an initial position to successive positions to compact trash in a container carried on a slide-out mount having inner and outer positions wherein said container is respectively in trash compacting and trash receiving positions relative to said ram, said ram being driven by an electric motor having start and run windings, said circuit comprising: a centrifugal switch in series with said start windings, said switch being moved to its circuit open position by centrifugal force when said motor exceeds a predetermined speed and moved to circuit closed position when said motor is below said speed; a reversing switch having a pair of circuit making members in series with the respective sides of said start windings and first, second, third and fourth switch contacts, each of said first and

fourth contacts being connected in series with one side of said run windings and each of said second and third contacts being connected in series with the other side of said run windings, both of said circuit making members having a first position in circuit making relation to said first and third contacts and a second position in circuit making relation to said second and fourth contacts, said reversing switch being operatively associated with said ram so that both of said circuit making members are in their first position when said ram is in its initial position, said centrifugal switch is in circuit closed position and said motor is de-energized, and in their second position when said ram is in successive positions thereof and said motor exceeds said predetermined speed; a power supply line having one side connected through a limit switch in series with said second and third contacts and the other side of said run windings, another said of said line being connected in series with said one side of said run windings, said limit switch

being in circuit open position when said ram is in said first position thereof and in circuit closed position when said ram is in said successive positions thereof; and a stop switch in series with one side of said power supply line, said stop switch being manually movable to circuit open position.

2. The circuit of claim 1 including a safety switch in series with one side of said supply line, said safety switch being operatively associated with said mount so that said safety switch is in its circuit making position when said mount is in its inner position and in its circuit open position when said mount is in its outer position.

3. The circuit of claim 2 including a start switch in parallel with said limit switch, said start switch being normally biased to its circuit open position and manually momentarily movable to its circuit closed position.

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