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TWO-STAGE BAGGING MACHINE

6 Sheets-Sheet 1



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2,869,296

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6 Sheets-Sheet 2

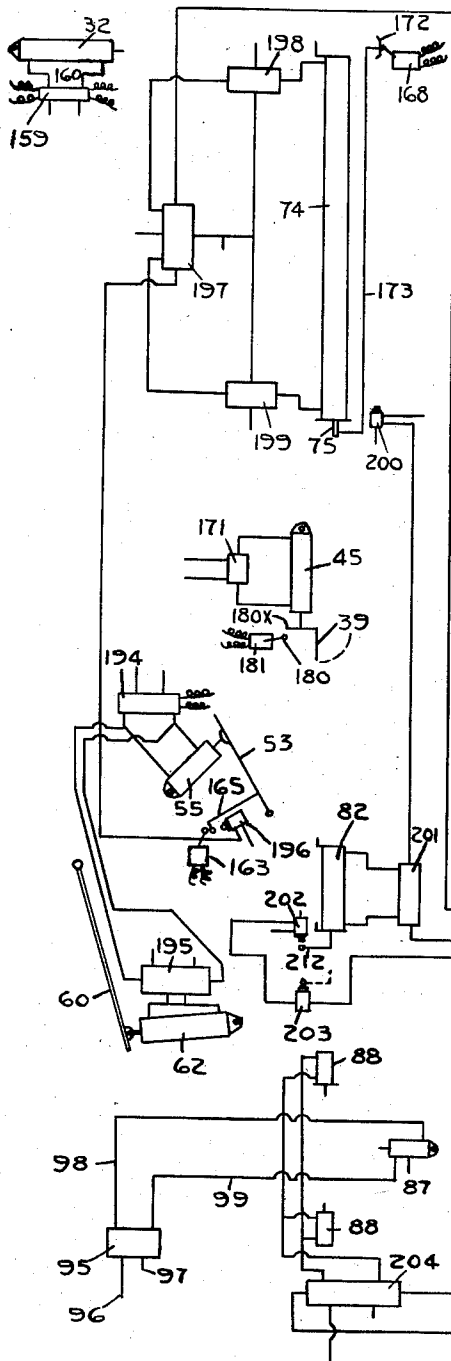


FIG. 10

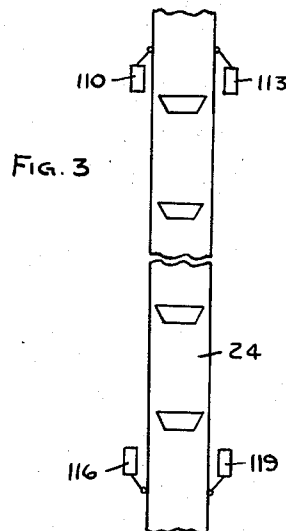


FIG. 3

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6 Sheets-Sheet 3

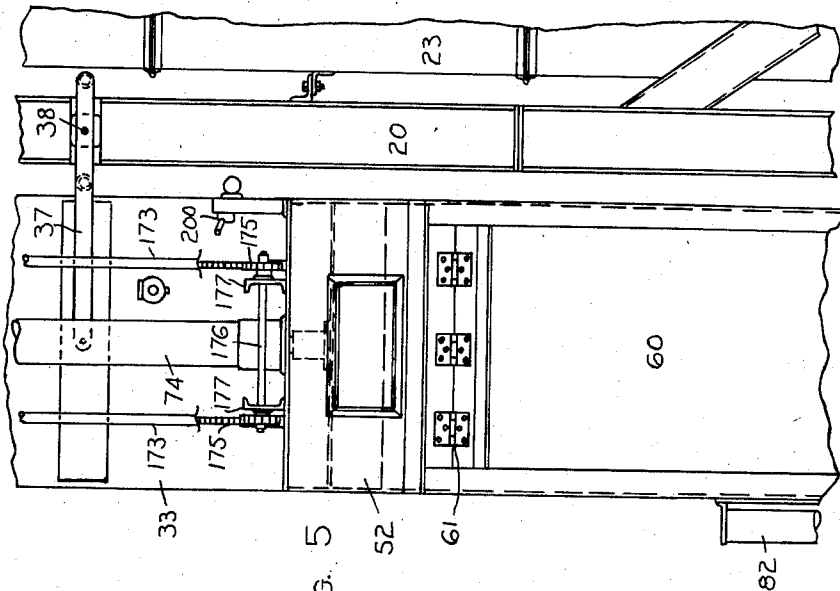


FIG. 5

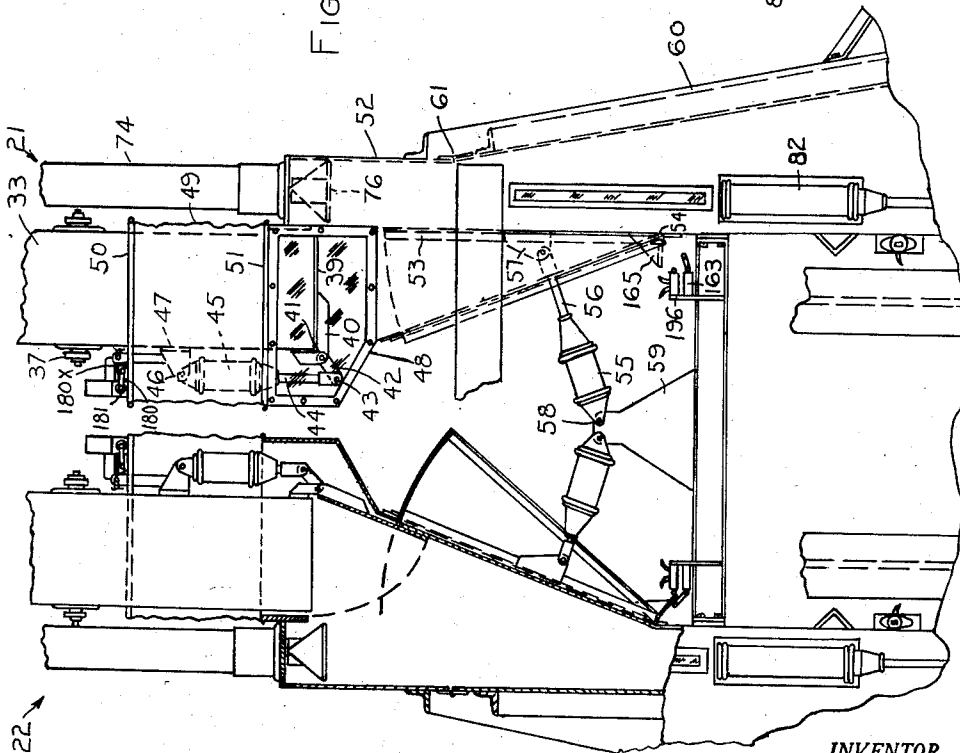


FIG. 4

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6 Sheets-Sheet 4

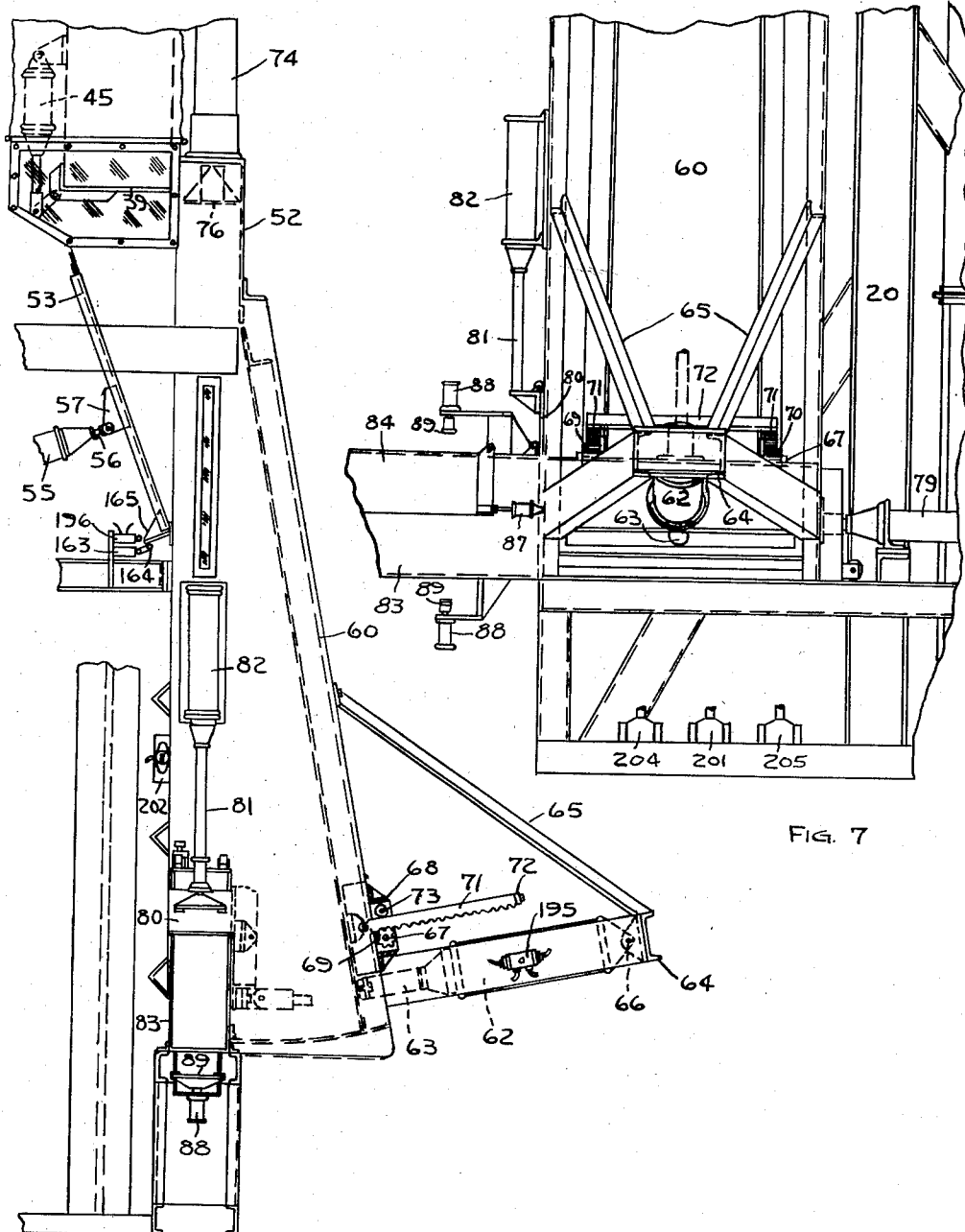


FIG. 6

FIG. 7

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6 Sheets-Sheet 5

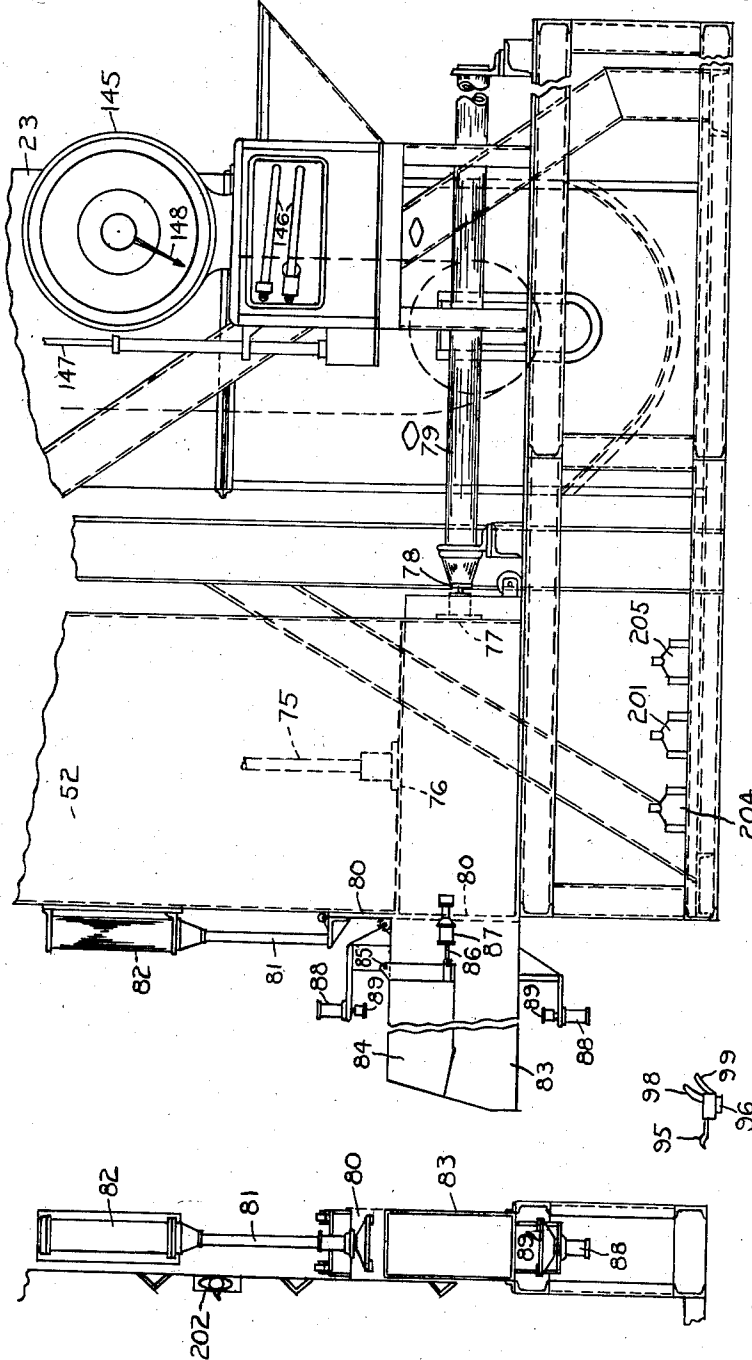


Fig. 8

Fig. 9

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TWO-STAGE BAGGING MACHINE

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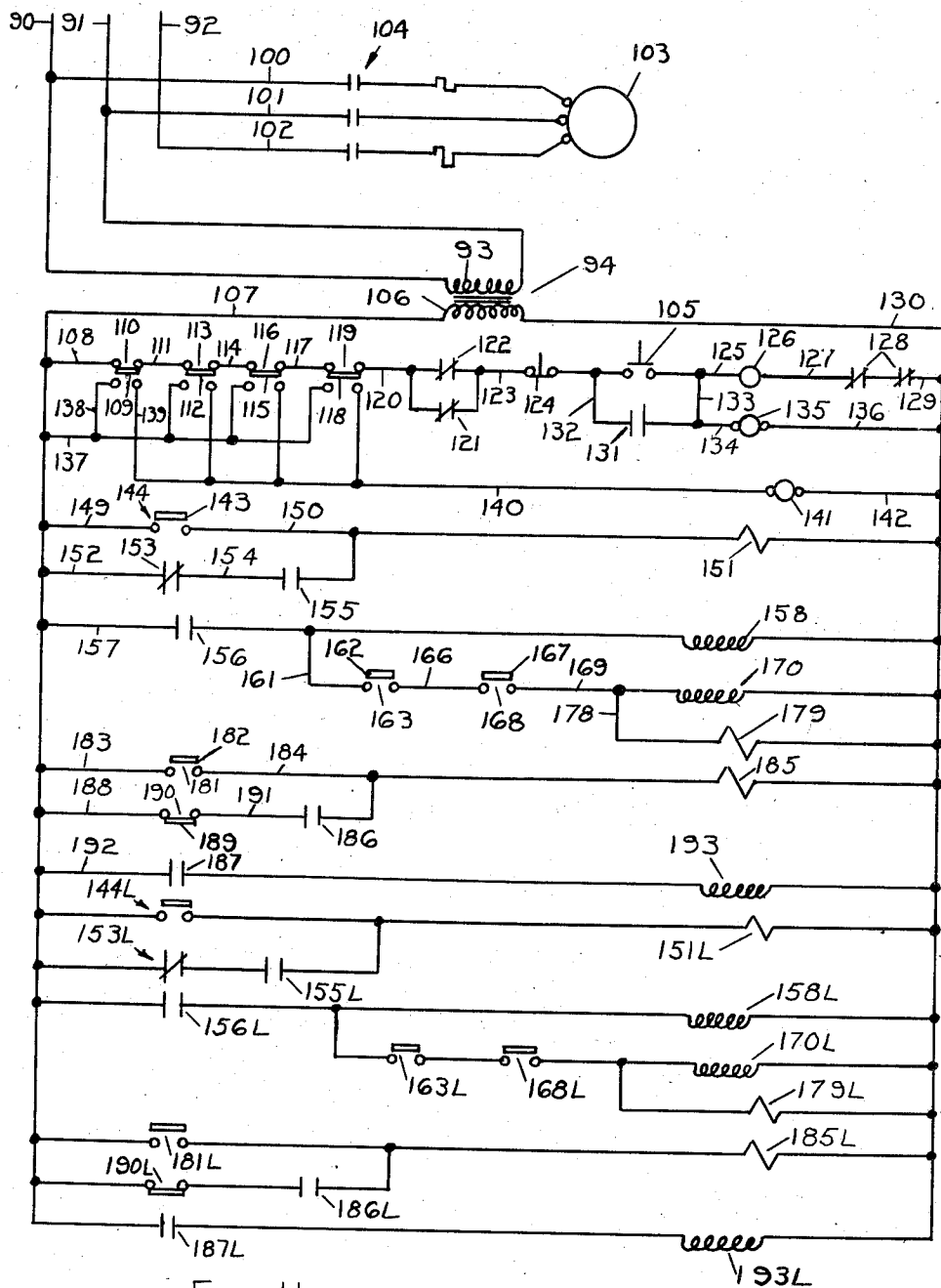


FIG. 11

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TWO-STAGE BAGGING MACHINE

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Application July 31, 1956, Serial No. 601,323

20 Claims. (Cl. 53—24)

The present invention relates to a machine primarily designed for packaging, under compression, materials such as rock wool or the like, which are compressible, when in a mass, but which are also resilient and which therefore tend to re-expand upon release of the compressing force. It has been found that when a mass of such material is compressed in a first direction and is subsequently compressed in a second direction, substantially perpendicular to the first direction, its tendency to re-expand, upon the release of compressive forces, is greatest in the last-named direction, somewhat less in the first-named direction, and a minimum in a direction perpendicular to the first-named direction and to the second-named direction. It is an object of the present invention, therefore, to provide a machine in which such a mass of material is compressed into an elongated mass of substantially rectangular cross section by exerting force first in one direction substantially perpendicular to the longitudinal axis of the intended ultimate shape of the mass, then is compressed in a second direction, likewise transverse to such longitudinal axis but perpendicular to the first direction, and then is projected into a container, closed except at one end, in the direction of the longitudinal axis of the mass, so that the tendency of the compacted mass to expand in the direction of the first and second compressions will be resisted by solidly closed walls of the container.

A further object of the present invention is to provide a two-stage machine in which a continuous flow of material to be packaged will be diverted first to one side of the machine and then to the other side thereof so that the compressing and packaging steps can be performed on a mass of such material at one side of the machine while material is being fed to the other side thereof, and vice versa. A further object of the invention is to provide, in such a machine, an intermediate chamber, at each side of the machine, between the diverter means and the compression station, in which intermediate chamber the quantity of material to be included in each package may be automatically measured before such material is discharged to the compression station. A still further object of the invention is to provide automatic means, responsive to the accumulation of a predetermined and variable mass of material in such an intermediate chamber, effective to divert the flow of material from that intermediate chamber to the intermediate chamber on the other side of the machine, discharge the material from that first-named intermediate chamber to the corresponding compression station, conduct the compression cycle, and discharge the material from the compression station to a waiting container and thereupon prepare that side of the machine to receive a fresh charge of material as soon as the intermediate chamber at the other side of the machine has been charged to its preselected capacity. A further object of the invention is to provide, in such a machine, means for stopping the flow of material to the machine in case one intermediate chamber accumulated

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its predetermined load before the intermediate chamber at the opposite side of the machine is prepared to receive a fresh charge of material.

Further objects of the invention will appear as the description proceeds.

To the accomplishment of the above and related objects, my invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific construction illustrated and described, so long as the scope of the appended claims is not violated.

Fig. 1 is a front elevation of a machine constructed in accordance with the present invention;

Fig. 2 is a side elevation thereof, certain parts being omitted for clarity of illustration;

Fig. 3 is a fragmentary, somewhat diagrammatical view illustrating means for stopping the machine in case of malperformance of the material-delivery means;

Fig. 4 is an enlarged, front elevational view, parts being broken away and/or shown in section, illustrating the weigh-chamber discharge doors, the compression station receiving doors and a fragment of a first compression means;

Fig. 5 is a fragmentary side elevation of the parts illustrated in Fig. 4;

Fig. 6 is a fragmentary front elevation of one side of the machine, showing the first compression means and the delivery snout upon an enlarged scale;

Fig. 7 is a fragmentary side elevation showing the parts illustrated in Fig. 6;

Fig. 8 is a fragmentary side elevation illustrating the weighing scale and the discharge means at one side of the machine;

Fig. 9 is a fragmentary elevation of the parts illustrated in Fig. 8;

Fig. 10 is a fluid piping diagram; and

Fig. 11 is an electrical wiring diagram.

Referring more particularly to Figs. 1 and 2, it will be seen that there has been illustrated a machine comprising a frame indicated generally by the reference numeral 20, supporting identical, but allochirally arranged, weighing, compressing, and discharging systems indicated, respectively, by the reference numerals 21 and 22. Within a housing 23, supported on the frame 20, there has been illustrated a bucket elevator 24 which is adapted to be driven continuously, during the operation of the machine, from a motor 103 (Fig. 11) operatively connected to drive a sprocket 25. So long as the motor 103 is energized and material to be packaged is supplied to the elevator 24, such material will be continuously delivered to a hopper 26 with which both of the systems 21 and 22 communicate, as is clearly illustrated in Fig. 1. Inclined partitions 27 and 28 within the hopper 26 partially divide the hopper into separate chambers, respectively communicating with the systems 21 and 22; and a flap valve 29, mounted upon an axis coincident with the apex formed between the partitions 27 and 28, is movable between its illustrated position, in which material from the hopper will be directed to the system 21, and a position approximately 90° counterclockwise removed from its illustrated position, in which material will be directed from the hopper into the system 22.

The valve 29 is mounted upon an axle 30 to which is connected an arm 31 operable to shift the valve between its stated positions, through the medium of a fluid motor 32.

As has been stated, the two systems 21 and 22 are identical, and therefore only one will be described in detail. The system 21 comprises a weigh chamber 33 which is

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supported, for vertical movement relative to the machine frame, upon a pair of beams 34. As is clearly illustrated in Figs. 1 and 2, hangers 35, suitably secured to opposite surfaces of the chamber 33, are supported from the forward ends of the beams 34, the beams, in turn, being fulcrumed upon suitable supports 36 mounted on the frame 20. Preferably, there is provided, also, a pair of links 37, pivotally mounted at 38 on the frame, and engaging the chamber 33 near its lower end to guide the chamber in its movements.

The opposite ends of the beams 34 are connected, through suitable links and levers, to a scale or equivalent counterbalance means 145 in a manner to be more fully described hereinafter.

The lower end of the weigh chamber 33 is normally closed by a door 39 (Figs. 1 and 4). Door 39 is supported upon a hinged lever 40, pivoted at 41 to the chamber 33, and having an arm 42 pivotally connected at 43 to the piston rod 44 of a fluid motor 45 pivotally supported at 46 upon a bracket 47 fixed to the chamber 33. Preferably, the lower end of the chamber 33 is enclosed in a housing 48 fixed to the frame 30 and preferably having at least one transparent wall. A sleeve 49, which is preferably formed of air-permeable fabric, surrounds the lower portion of the chamber 33 and is fixed at one end to a support 50 movable with the chamber 33 and at its opposite end to a support 51 fixed to the housing 48, the elements 50 and 51 being sealed, respectively, to the chamber 33 and the housing 48.

A compression chamber 52 is fixedly supported from the frame 20 and extends to a level slightly above the lower, open end of the housing 48, as is most clearly illustrated in Figs. 1 and 4. The chamber 52 is axially offset from the weigh chamber 33 and is formed, near its upper end and in the wall adjacent the weigh chamber 33, with an opening adapted to be closed by a door 53 hinged at 54 to the compression chamber wall. A fluid motor 55 having a piston rod 56 pivotally connected to a bracket 57 fixed to the door 53 is pivotally connected at 58 to a bracket 59 fixedly supported on the frame 20. It will be readily perceived that when the piston rod 56 is forced outwardly, the door 53 will be moved to close the opening in the chamber 52; and when the piston rod 56 is retracted, the door 53 will be opened to act as a chute to direct material discharged from the weigh chamber 33, into the compression chamber 52.

That wall of the compression chamber 52 opposite the door 53 consists primarily of a movable wall section 60 hinged, as at 61, near the upper end of the chamber 52 and movable between its illustrated position (Figs. 4 and 6) and a vertical position as suggested in dotted lines in Fig. 6. The machine is so designed and controlled that the wall section 60 is always in its inclined position when material is discharged into the chamber 52, but is moved to its vertical position, after the chamber 52 has been charged, to compress the material in a horizontal direction. Such movement of the wall 60 is effected by a fluid motor 62 having a piston rod 63 connected to the lower end of the wall section 60. Bracket means 64 is supported from the machine frame 20 and is braced by elements 65 to form an abutment for the outer end of the motor 62, said motor being pivotally connected as at 66 to the bracket means 64.

In order to guard against warpage or twisting of the lower end of the wall section 60 during its material-compressing movement, it is preferred to mount an axle 67 upon bracket means 68 fixed with respect to the bracket means 64, and carrying a pair of pinions 69 and 70. Racks 71, 71 are pivotally connected, at their one ends, to the opposite edges of the wall section 60 and are preferably connected together, at their opposite ends, by a stretcher 72. Preferably, the bracket means 68 will carry rollers 73 bearing upon the racks 71 to hold the same firmly in mesh with the pinions 69 and 70, respectively.

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Mounted for reciprocation in the compressor chamber 52 is a presser head 76 carried by the piston rod 75 of a fluid motor 74. Normally, the piston rod 75 (see Figs. 2, 8 and 10) is fully retracted to hold the presser head 76 in its position illustrated in Fig. 6, above the opening in the compressor chamber controlled by the door 53; but said presser head is movable, under the influence of the motor 74, to the position illustrated in Fig. 8 for fully compressing the charge of material in a direction perpendicular to the direction of the compression effected by the movement of the wall section 60. It will be appreciated, from an examination of Fig. 8, in conjunction with Fig. 6, that the ultimate form of the compressed mass will be a body elongated from left to right as viewed in Fig. 8 and rectangular in cross section, as indicated by the shape of the snout 83 as viewed in Fig. 6. The rear end of the lowermost portion of the compression chamber is defined by a ram head 77 carried upon the piston rod 78 of a fluid motor 79 fixedly supported on the frame 20. The forward end of that portion of the compression chamber is defined by a vertically movable gate 80. Said gate 80 is operatively connected to the piston rod 81 of a fluid motor 82 fixed to the frame or to the forward wall of the compression chamber 52. As will be apparent upon inspection of Fig. 8, retraction of the piston rod 81 will lift the gate 80 above the level of the lowermost position of the presser head 76, whereupon, projection of the piston rod 78 will force the compressed mass out of the compression chamber and into and through the delivery snout 83. The parts are so proportioned and designed that full projection of the piston rod 78 will discharge the compressed mass through the outer, or delivery, end of the snout 83 (see Figs. 2 and 8).

The snout 83 consists of a fixed section and a movable section 84 hinged to the fixed section at 85. Piston rod 86 of a fluid motor 87 is connected to the snout section 84 so that retraction of the piston rod 86 will swing the snout section 84 in a counter-clockwise direction about its pivot 85 to collapse the outer end of the snout to facilitate the sleeving thereon of a bag or similar container (not shown). Such container will preferably have a cross-sectional contour corresponding to that of the expanded snout, and will be closed except at one end. When the snout is contracted, the open end of the bag or container may be readily slipped onto the snout, to a degree such that its open end will be projected slightly beyond the clamping elements 89, 89 which are supported by the piston rods of fluid motors 88, 88. When the motors 88 are actuated to shift their clamping members 89 toward the snout, the clamping members will engage the end of the container to hold the same frictionally against the snout. Now, when the gate 80 is lifted and the motor 79 is actuated to project its ram head 77, the compacted mass of material in the lower end of the compression chamber will be forced through the snout and into engagement with the closed, outer end of the container. As this moment, the motors 88, 88 will be actuated to retract their clamping members 89, 89, whereupon further projection of the ram head 77 will push the container, along with the compacted mass of material, to and beyond the delivery end of the snout.

Because the mass of material has been compacted primarily in directions perpendicular to the length of the compacted mass, there will be little, if any, tendency of that mass to bulge through the open end of the container; and consequently the container may be readily closed either manually or through the medium of suitable sealing mechanism.

In Fig. 11, there has been diagrammatically illustrated, in simplified form, the electrical system of control of the machine. Line wires 90, 91 and 92 lead (preferably through a manually-controlled switch, not shown) from a source of electrical power; and wires 90 and 91 are connected, respectively, to the opposite ends of the

primary coil 93 of a step-down transformer 94. Wires 100, 101 and 102 connect the line wires, through a conventional magnetic motor starter relay 104, to energize the motor 103 through which the conveyor 24 is driven.

A treadle 95 (Figs. 2, 8 and 10) is mounted conveniently adjacent each snout 83. Fluid under pressure (preferably air) is led from a suitable source, through conduit 96 (Fig. 10), and is controlled by the treadle 95 to flow either through conduit 98 to the rear end of motor 87 or through conduit 99 to the front end of that motor. The valve is a conventional four-way air valve having an exhaust conduit 97. When the treadle is depressed, air flows from conduit 96 through conduit 99 to retract the piston rod 86, while air is exhausted from the opposite end of the motor 87 through the conduits 98 and 97. Thus, the snout section 84 is swung in a counter-clockwise direction to collapse the snout to facilitate the mounting of a container thereon. The valve is so constructed that, when the treadle is released, the flow passages are reversed and air will flow from the conduit 96 through conduit 98 to the opposite end of motor 87 to project the piston rod 86, air being simultaneously exhausted from the front end of the motor through conduits 99 and 97. At the beginning of the day's operation of the machine, a bag or similar container will be thus mounted on each of the two delivery snouts; and, of course, a new container will be similarly sleeved on each snout at the beginning of each new cycle of operation of the associated assembly.

To start the machine, the operator will press starter button 105 (Fig. 11). This will establish a circuit from the secondary coil 106 of the transformer 94 through wire 107, wire 108, bridge-piece 109 of normally closed limit switch 110, wire 111, bridge-piece 112 of normally-closed limit switch 113, wire 114, bridge-piece 115 of normally-closed limit switch 116, wire 117, bridge-piece 118 of normally-closed limit switch 119, wire 120, normally-closed relay switch 121, wire 123, stop switch 124, start switch 105, wire 125, coil 126 of the motor starter relay, wire 127, overload switches 128 of the motor starter, wire 129 and wire 130 back to the transformer coil 106.

Energization of the coil 126 closes the switch 104 to energize the motor 103. Thereby the elevator 24 is put into operation and delivery of material to the hopper 26 begins.

Assuming that the valve 29 is in the position illustrated in Fig. 1, material will now begin to flow into the right-hand weigh chamber 33 whose delivery door 39 is closed. The scale 145 has been set, by adjustment of the counter-balance weights on arms 146 thereof (Fig. 8), to a predetermined value corresponding to the weight of material to constitute a desired charge to be compressed and delivered through the righthand snout 83. In the illustrated embodiment of the invention, the scale is of the "weigh-back-type" in which the parts are preliminarily set to move the indicator arm 148 to a position corresponding to the desired weight of the charge; and, as material is delivered to the chamber 33, thus gradually swinging the beams 34 in a counter-clockwise direction as viewed in Fig. 2, the indicator arm 148 approaches "0" on the scale dial. Of course, the beams 34 are connected to the scale mechanism through links 147 and conventional trains within the scale mechanism. A switch 144 (Fig. 11), built into the scale mechanism, includes a bridge-piece 143 which is moved into bridging relation with its terminals when the indicator arm 148 reaches "0" on the scale dial.

Energization of the coil 126 also closes switch 131 to establish a holding circuit, independently of the start switch 105, from transformer coil 106 through wire 107, wire 108, limit switches 110, 113, 116 and 119, switch 121, wire 123, stop switch 124, wire 132, switch 131, wire 133, wire 125, coil 126, wire 127, relays 128, wire 129 and wire 130; and to energize green indicator light 135 through wire 134, leading from switch 131, and wire 136 to wire 130.

As is clearly illustrated in Fig. 3, limit switches 110 and 113 are disposed adjacent the opposite edges of the conveyor 24 near the upper end thereof, while limit switches 116 and 119 are similarly disposed near the lower end of the conveyor, the arrangement being such that, if the conveyor belt should wander in either direction laterally of its optimum path, it will open one of those limit switches. If switch 110, for instance, is so opened, its bridge-piece 109 will be moved to engage the opposite contacts of the switch, thereby breaking the energizing circuit for the coil 126 to permit the switch 104 to open, whereby the motor 103 will be stopped; and, at the same time, closing a circuit from transformer coil 106 through wire 107, wire 137, wire 138, bridge-piece 109, wire 139, wire 140, red light 141, wire 142 and wire 130 back to the transformer. Thus, as the motor stops, the green indicating light 126 will be extinguished and the red indicating light 141 will be energized to notify the operator that the conveyor belt must be adjusted before the machine can be put back into operation.

It will be noted that the four limit switches are connected, in series, in the energizing circuit for the coil 126; and that each of those switches is wired, in a manner corresponding to the wiring just described with relation to the switch 110, to perform the same functions, including illumination of the signal light 141.

When the predetermined weight of material has accumulated in the weigh chamber 33 to move the scale arm 148 to "0," the bridge-piece 143 of scale-actuated switch 144 will have been moved to close a circuit which extends from the transformer coil 106 through wire 107, wire 149, bridge-piece 143 and wire 150 through relay coil 151 to wire 130 and back to the transformer coil. Energization of relay coil 151 closes switches 155 and 156. Switch 155 establishes a holding circuit for coil 151 around scale switch 144 and through time delay switch 153, such circuit being traced from the transformer coil 106 through wire 107, wire 152, time delay switch 153, wire 154, and switch 155 to wire 150 which leads through coil 151 to wire 130 and back to the transformer. Closure of switch 156 establishes a circuit from coil 106 through wire 107, wire 157 and switch 156 through coil 158 and thence to wire 130 and back to the transformer.

The coil 158 is an element of solenoid 159 (Fig. 10) which controls a four-way air valve 160 dominating the fluid motor 32 (Figs. 1 and 10) which, in turn, controls flap valve 29. The solenoid 159 includes, also, coil 158L (Fig. 11). Energization of coil 158, in the manner above described, shifts the valve 160 to supply air to the righthand end of motor 32 and to exhaust the left-hand end thereof, whereby the piston rod of the motor 32 will be retracted to move the valve 29 in a counter-clockwise direction to direct the material through the hopper 26 to the weigh chamber of system 22; and energization of coil 158L will shift the valve 160 to its opposite position to project the piston rod of motor 32 to return the valve 29 to its illustrated position.

Coil 158 having been energized, as above explained, the valve 29 will be shifted away from its illustrated position to discontinue the supply of material to the weigh chamber 33 of the system 21.

Switch 163 (Figs. 4, 6, 10 and 11) is wired normally open, but is held closed, when door 53 is open, by a trip 165 carried by said door and engaging arm 164 of switch 163 when the door 53 is open. Switch 168 (Figs. 2, 10 and 11) is also wired normally open, but is held closed, when presser head 76 is in its uppermost position, by a pad 172 carried at the upper end of a rack 173 which moves with the presser head, and which engages arm 174 of switch 169 at the top of the presser head stroke.

It may here be noted that a pair of racks 173 is connected to move with the presser head, the respective racks meshing with pinions 175 (Fig. 5) fixed to op-

posite ends of an axle 176 journaled in bearing members 177, 177 which are, in turn, fixedly mounted on the machine frame. The primary function of the racks, of course, is to support the opposite end portions of the presser head 76 against warpage or twisting during the compressing action of the head.

Switches 163 and 168 thus being held closed, closure of switch 156 by energization of coil 151, as above described, establishes a further circuit from transformer coil 106 through wire 107, wire 157, switch 156, wire 161, bridge-piece 162 of switch 163, wire 166, bridge-piece 167 of switch 168 and wire 169 through solenoid coil 170 which controls valve 171 (Fig. 10), to wire 130 and back to the transformer. Valve 171 is a single-solenoid, spring return, four-way valve so connected and arranged that, when coil 170 is thus energized, it supplies fluid under pressure to the lower end of motor 45, simultaneously exhausting the upper end thereof, to retract piston rod 44 and open door 39. The material theretofore charged into the weigh chamber 33 will thereby be dumped through the lower end of the weigh chamber, and will be guided, by the open door 53, into the compression chamber 52. Quite obviously, the coil 170 cannot thus be energized to open door 39 unless door 53 is in open position, whereby switch 163 is held closed; nor can coil 170 be energized unless presser head 76 is in its uppermost position to hold switch 168 closed.

Connected in parallel with coil 170, through wire 178 leading from wire 169, is coil 179 of the time delay relay which includes switch 153. Thus, coil 179 is energized upon energization of coil 151 provided switches 163 and 168 are closed. The said time delay relay is a conventional pneumatic unit in which the switch 153 is normally closed. Energization of the coil 179 starts the time delay cycle of said unit; and after a pre-set lapse of time, the switch 153 will be opened. Thus, the holding circuit for coil 151 will be opened; and, upon deenergization of that coil switches 155 and 156 will open. When switch 156 is opened, coil 170 controlling valve 171 will be deenergized. As stated above, valve 171 includes a spring which, upon deenergization of solenoid 170, will return the valve to normal position, whereby air will be supplied to the upper end of motor 45 and will be exhausted from the lower end thereof to project piston rod 44 to close door 39. In the optimum form of the machine, the above-mentioned time lapse will be approximately three seconds which is found to be sufficient for discharging the material from the weigh chamber 33 to the compression chamber 52.

A trip 180X moves with the piston rod 44 (Fig. 4) and, as the door 39 closes, said trip strikes the actuating arm 180 of normally open limit switch 181 (Figs. 1, 4, 10 and 11) and momentarily closes bridge-piece 182 across the terminals of said switch 181. This establishes a circuit from the secondary coil 106 through wire 107, wire 183, bridge-piece 182 and wire 184 through coil 185 to wire 130 and back to the transformer. Coil 185 controls switches 186 and 187, energization of said coil closing said switches. Closure of switch 186 establishes a holding circuit for coil 185, independently of switch 181, which extends from transformer coil 106 through wire 107, wire 188, switch 190, wire 191, switch 186 to wire 184 and thence through coil 185 and wire 130 to the transformer. The bridge-piece 189 of switch 190 is normally closed.

Closure of switch 187 establishes a circuit from transformer coil 106 through wire 107, wire 192 and switch 187 through coil 193 of solenoid valve 194 (Fig. 10).

Solenoid valve 194 is a single solenoid, spring return four-way air valve which controls motor 55 and which also acts as a pilot for valve 195. When the coil 193 is energized, it shifts valve 194 to supply air to the lefthand end of motor 55 to project the piston rod 56 thereof to close door 53.

Valve 195 is a spool type four-way master air valve

with air pilot control. When valve 194 is shifted, as above-described, the resultant air flow shifts the spool of valve 195 to supply air to the righthand end of motor 62 and to exhaust air from the lefthand end thereof. Thus, piston rod 63 will be projected to swing the lower end of wall section 60 in a clockwise direction to apply lateral compression to the mass of material in the compression chamber 52.

Trip 165 on door 53 momentarily engages the actuating arm of air valve 196 (Figs. 4, 6 and 10) as door 53 moves to closed position. Air valve 196 is a three-way pilot air valve used to control air valve 197 which, in turn, controls the flow of air, through valves 198 and 199 to the opposite ends of motor 74. When valve 196 is thus momentarily actuated by trip 165, it delivers a slug of air to valve 197 to change the position of the valve spool to open valve 198 to direct a flow of air to the upper end of motor 74; and at the same time, the valve 199 is shifted to exhaust air from the lower end of motor 74. Thus, piston rod 75 will be caused to move downwardly to compress, in a vertical direction, the material in the chamber 52. In the optimum form of the machine, as illustrated herein, the dimensions of the compressed mass, after the presser head reaches the position illustrated in Figs. 2 and 8, will be thirty-six inches from right to left as viewed in Fig. 8, sixteen inches from top to bottom as viewed in Fig. 8 and eight inches from right to left as viewed in Figs. 6 and 9.

As the presser head 76 attains the position of Fig. 8, the pad or trip 172 on the rack 173 engages the actuating arm of pilot air valve 200 (Figs. 2, 5 and 10). Pilot air valve 200 controls valve 201 which is a spool type four-way air valve with pilot air control. When valve 200 is thus tripped, it supplies a slug of air to valve 201 which shifts the spool of the latter valve to deliver air to the lower end of motor 82 and exhaust air from the upper end thereof. Thereby, the piston rod 81 will be retracted to lift the gate 80. A trip 212 moving with the gate 80 momentarily trips pilot air valve 202 (Figs. 6, 9 and 10) as the gate 80 attains its opened position. When valve 202 is thus tripped, it directs a momentary flow of air through valve 203 which is normally open, but which, in the closed position of gate 80, is held closed by trip 212. The momentary flow of air from valve 202 and through valve 203 serves to shift the spools of valves 204 and 205. Valves 204 and 205 are four-way spool type air valves. The pilot action shifts the spool of valve 204 to direct air to the proximal ends of motors 83, 83 to project the clamping elements 89, 89 thereof to secure the bag in place on the snout 83. The pilot action shifts the spool of valve 205 to open valve 207 to the air supply and to close valve 206 from the air supply, thus directing air to the righthand end of motor 79 and exhausting air from the lefthand end thereof to project piston rod 78 and ram head 77.

As the piston rod 78 moves toward the left, a trip 208, moving with said piston rod, momentarily engages the actuating arm of valve 209 at about the moment when the mass of compacted material comes into contact with the closed, lefthand end of the bag on snout 83. This momentary actuation of valve 209 supplies a slug of air to shift the spool of valve 204 to reverse the flow of air to motors 83, 83, thereby retracting their clamping elements to free the bag to move off the snout 83, as the ram head 77 ejects the compacted material therefrom.

Shortly before the ram head 77 reaches the lefthand end of its stroke, the trip 208 momentarily engages the actuator arm of switch 190 (Figs. 10 and 11) to shift the bridge-piece 189 thereof out of contact with its terminals, thereby opening the above-traced holding circuit for coil 185. This, in turn, results in the opening of switch 187 to deenergize coil 193 of solenoid valve 194 to reverse the direction of air flow to motor 55, to open door 53. At the same time, valve 195 is shifted to reverse the direction

of air flow to motor 62, whereby wall section 60 will be returned to its inclined position.

At the end of the material-ejecting stroke of the ram head 77, the trip 208 strikes the actuating arm of valve 210, thereby supplying a momentary flow of air through that valve to valves 205 and 197. This flow shifts valve 205 to reverse the air flow therethrough to valves 206 and 207 to supply air to the lefthand end of motor 79 and to exhaust air from the righthand end thereof, whereby the ram head 77 is returned to its starting position. The flow through valve 210 to valve 197 shifts that valve to supply air to the lower end of motor 74 and to exhaust air from the upper end thereof, whereby the plunger 76 is retracted to its uppermost position.

As the piston rod 78 reaches its fully retracted position, the trip 208 strikes the actuator arm of valve 211 to reverse valve 201, whereby air is supplied to the upper end of motor 82 and is exhausted from the lower end thereof to return the gate 80 to its closed position.

As the gate 80 attains its closed position, the trip 212 engages the actuating arm on valve 203 to close the said valve. So long as the valve 203 is closed, actuation of valve 202 cannot supply air to valves 204 and 205. It has been found that sometimes an operator will manually trip the valve 202, either accidentally or intentionally if he thinks that something may have gone wrong with the machine. In the absence of the valve 203, held closed by the trip 212, such manual actuation of the valve 202 would cause the ram head 77 to move toward the left; and, if such movement should occur while the gate 80 is closed, of course serious damage to the machine would result.

Upon completion of the actions above-described, the cycle of the system 21 has come to an end, and the system 21 is ready to receive a new charge of material from the hopper 26. Meantime, the system 22 has been receiving material from the hopper 26; and the machine is preferably so designed that the above-described cycle of the system 21 will be completed shortly before the predetermined weight of material has been delivered to the weigh chamber of the system 22. Controls identical with those above-described for the system 21, and including elements 144L, 151L, 153L, 155L, 156L, 158L, 163L, 168L, 170L, 179L, 181L, 185L, 186L, 187L, 190L, and 193L, illustrated in Fig. 11, are provided in the system 22. When the predetermined weight of material has been accumulated in the weigh chamber of the system 22, switch 144L, in the scale incorporated in the system 22, will be closed. Provided the weigh tube 33 of the system 21 is not, at that time, filled to its predetermined capacity, the valve 29 will thereby be returned to its illustrated position to direct material from the hopper 26 to the weigh tube 33 of the system 21, it being remembered that the door 39 thereof has been closed, through operation of the time delay unit including the coil 179 and the switch 153, independently of the actuation and completion of the rest of the cycle. The weigh chamber 33 of the system 21 thus begins to accumulate material as the system 22 goes through the remainder of its cycle. If, however, the predetermined weight of material should be accumulated in the weigh chamber of the system 22 at a time when the weigh chamber 33 of the system 21 is filled to its predetermined capacity, the whole machine will be shut down. It will be remembered that the energizing circuit for the coil 126 of the motor control relay, which dominates the switch 104, passes through one or the other of switches 121 and 122, which are normally closed and which are wired in parallel with respect to each other in that circuit. Coil 151, which is energized by closure of the scale switch 144, acts, when energized, to open switch 122; and coil 151L, which is energized by closure of the scale switch 144L, similarly acts, upon energization, to open switch 121. Thus, if both scale switches 144 and 144L are closed at the same time, both switches 121 and 122 will be open; and the energizing circuit for the coil 126 will thus be broken.

A problem which is encountered in the handling of material similar in characteristics to rock wool, is the entrapment of air in the body of the mass of material. The provision of the fabric sleeve 49 permits air to flow, almost unimpeded, between the interior of the housing 48 and the atmosphere, as material is dumped from the weigh chamber 33 into the compression chamber 52. The fact that the wall 60 of the compression chamber is standing in its inclined, or open, position at the time when the mass of material is dumped into the chamber 52, provides for the free escape of air from the compression chamber as the mass of material falls therein. If desired, air flues (not shown) may be provided between the interiors of the weigh chambers, near the upper ends thereof, and the interior of the conveyor housing 23; and preferably, sleeves or boots (not shown) similar to the sleeve 49, will be provided between the upper ends of the weigh chambers and the discharge mouths of the hopper 26.

What is claimed as the invention is:

1. In a device of the class described, a pair of laterally-spaced, substantially vertical weigh chambers, a door movably mounted adjacent the lower end of each weigh chamber for closing the same, at times, hopper means adjacent the upper ends of said weigh chambers for direct communication therewith, counterbalance means supporting each weigh chamber for independent vertical movement relative to said hopper means, said hopper means being provided with an opening for the passage of material therinto, reversely-movable means mounted in said hopper means to direct the flow of material through said hopper means alternatively to said weigh chambers, a compression chamber disposed below each weigh chamber, an upper door for each compression chamber movable between an open position to direct material flow from its weigh chamber to its compression chamber and a closed position preventing such flow, each compression chamber further having a movable wall shiftable between an open position and a closed position to compress material in said compression chamber in one direction, plunger means for each compression chamber, each such plunger means being normally disposed at a level above the upper door of its compression chamber, means for moving each plunger means from its normal position to a position below said upper door to compress material in its compression chamber in another direction, and further plunger means for each compression chamber for discharging the compressed material for such chamber.

2. The device of claim 1 including automatic means for opening said first-named door of each weigh chamber in response to downward movement of that weigh chamber to a predetermined degree, and means rendering said automatic means ineffective when the upper door of the compression chamber associated with that weigh chamber is closed.

3. The device of claim 1 including automatic means responsive to downward movement of either weigh chamber to a predetermined degree to shift said reversely-movable means to direct material flow from said hopper to the other weigh chamber.

4. The device of claim 1 including automatic means responsive to downward movement of each weigh chamber to a predetermined degree to open the first-named door of that weigh chamber, time-delay means energized by actuation of said automatic means to close said first-named door after a predetermined time interval, and means actuated by closure of said first-named door to close the upper door of the associated compression chamber.

5. The device of claim 4 including means actuated by closure of said first-named door to shift the movable wall of said associated compression chamber to its closed position.

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6. The device of claim 5 including means actuated by closure of said upper door to energize said means for moving the plunger means associated with said compression chamber to compress the material in said chamber.

7. The device of claim 6 including means actuated by movement of said plunger means to a predetermined degree to energize the associated further plunger means to discharge such compressed material.

8. The device of claim 1 including a snout registering with each compression chamber near the lower end thereof in line with the direction of movement of said further plunger means, gate means normally interposed between each snout and its associated compression chamber, and means for shifting said gate means, to establish open communication between the snout and its associated compression chamber just before material-discharging movement of said further plunger means.

9. The device of claim 8 in which each snout is collapsible to facilitate the sleeving thereon of a container which is closed except for one end, means for expanding said snout after a container has been sleeved thereon, and clamping means operable to engage such a container and to press portions of the same against walls of said snout.

10. The device of claim 8 in which the cross-sectional contour of each snout substantially corresponds to that of the mass of material after final compression in the associated compression chamber and to that of a container, closed except at one end, adapted to be sleeved on said snout, the throw of said further plunger means being sufficient to drive such mass of compressed material substantially through the entire length of the associated snout.

11. In a machine of the class described, means providing a compression chamber having a longitudinal dimension and two lateral dimensions, said chamber being provided with an inlet port at one end thereof, one lateral wall of said chamber being hinged, near the inlet end of said chamber, to permit the ends of said wall remote from said chamber inlet end to swing outwardly to vary one lateral dimension of said chamber to a degree variable proportionally with the distance from said chamber inlet end, means for delivering a mass of compressible material through said inlet port to said chamber, means automatically actuated upon completion of such delivery for swinging said remote end of said hinged wall inwardly to compress such mass in the direction of said one lateral dimension to a degree variable in proportion to the longitudinal distance from the location at which said wall is hinged, means automatically actuated upon completion of such compression for reducing the longitudinal dimension of said chamber to compress such mass in the direction of said longitudinal dimension, and means automatically actuated upon completion of such further compression for moving the compressed mass into a container, closed except for one end, in a third direction whereby re-expansion of such mass in the directions of such compression thereof is opposed by solid walls of such container.

12. The method of packing resilient, compressible material which comprises the step of providing a container which is solidly closed except at one end, establishing a mass of such material which mass has a vertical dimension and two horizontal dimensions, one of said horizontal dimensions increasing progressively from the top toward the bottom of said mass, compressing said mass in such a manner as to render said one horizontal dimension substantially uniform from the top to the bottom of said mass, then exerting pressure on the top of said mass to compress the mass and reduce its vertical dimension while maintaining the original compression of such mass, thereafter introducing such mass into said container, through the open end thereof, by

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exerting pressure on said mass in the direction of the other of said horizontal dimensions, whereby re-expansion of such mass in the directions of such compression thereof, is opposed by solid walls of said container, and thereafter closing said one end of said container.

13. In a machine of the class described, a substantially vertically-arranged compression chamber adapted to receive a charge of compressible material at a point near the top thereof, one lateral wall of said chamber being hinged, near the upper end of said chamber to permit the lower end of said wall to swing outwardly to vary the lateral dimension of said chamber, a first motor means for swinging said wall, a plunger mounted for substantially vertical reciprocation in said chamber between a retracted position above said charging point and a point near the bottom of said chamber, a second motor means for reciprocating said plunger, means for energizing said first motor means to shift said hinged wall in a chamber-contracting direction, and means for energizing said second motor means to move said plunger downwardly after such movement of said chamber wall.

14. The machine of claim 13 including an axle mounted on a fixed axis to span said movable wall near the lower end thereof, a pinion fixed to said axle near each end thereof, and a rack meshing with each pinion, said racks being fixed to said movable wall respectively adjacent the opposite edges thereof.

15. In a machine of the class described, a weigh chamber, means for delivering resiliently-compressible material to said chamber, counter-balance means supporting said weigh chamber for substantially vertical movement, a door movably mounted adjacent the lower end of said weigh chamber for closing the same, a compression chamber disposed below said weigh chamber, an upper door for said compression chamber movable between an open position to direct material flow from said weigh chamber into said compression chamber and a closed position preventing such flow, said compression chamber further having a wall shiftable between an open position and a closed position to compress material in said compression chamber in one direction, plunger means reciprocably mounted in said compression chamber and normally disposed at a level above the upper door of said compression chamber, means for moving said plunger means from its normal position to a position below said upper door to compress material in said compression chamber in another direction, further plunger means for discharging the compressed material from said compression chamber in a third direction, a snout registering with said compression chamber in line with the direction of movement of said further plunger means, gate means normally interposed between said compression chamber and said snout, means for shifting said gate means, to establish open communication between said compression chamber and said snout, just before material-discharging movement of said further plunger means, the cross-sectional contour of said snout substantially corresponding to that of the mass of material after final compression in said compression chamber and to that of a container closed except at one end, adapted to be sleeved on said snout, the stroke of said further plunger means being sufficient to drive such mass of compressed material substantially through the entire length of said snout, clamp means associated with said snout for retaining such a container against movement relative to said snout, and means actuated by movement of said further plunger means and effective to release said clamp means, at a point intermediate the ends of said stroke and substantially coincident with the arrival of the leading end of said mass of material at the delivery end of said snout.

16. The machine of claim 15 including means actuated by said further plunger means, intermediate the ends of its stroke, to shift said upper door from its closed position to its open position.

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17. The machine of claim 15 including means actuated by said further plunger means, at the ends of its material-discharging stroke, to retract said further plunger means.

18. The machine of claim 17 including means actuated by said further plunger means, at the end of its retracting stroke, to return said gate means to its normal position.

19. The machine of claim 15 including means actuated by movement of said gate means from its normal position to open position for initiating material-discharging movement of said further plunger means, and means effective, when said gate means is in its normal position, to prevent such initiation of movement of said further plunger means by external manipulation of said gate-actuated means.

20. In a machine of the class described, a pair of laterally-spaced, substantially vertical weigh chambers, a door movably mounted adjacent the lower end of each weigh chamber for closing the same, at times, hopper means adjacent the upper ends of said weigh chambers for direct communication therewith, means for continuously delivering material to said hopper means, counter-

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balance means supporting each weigh chamber for independent vertical movement relative to said hopper means, reversely-movable means mounted in said hopper to direct the flow of material from said hopper alternatively to said weigh chambers, means for each weigh chamber responsive to downward movement thereof to a predetermined position to shift said reversely-movable means to direct material flow from said hopper means to the other weigh chamber, and means effective, upon downward movement of both said weigh chambers to said predetermined positions, to stop said means for delivering material to said hopper means.

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