United States Patent

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[54] **MATERIALS HANDLING APPARATUS FOR TREATMENT STATION**
4 Claims, 5 Drawing Figs.

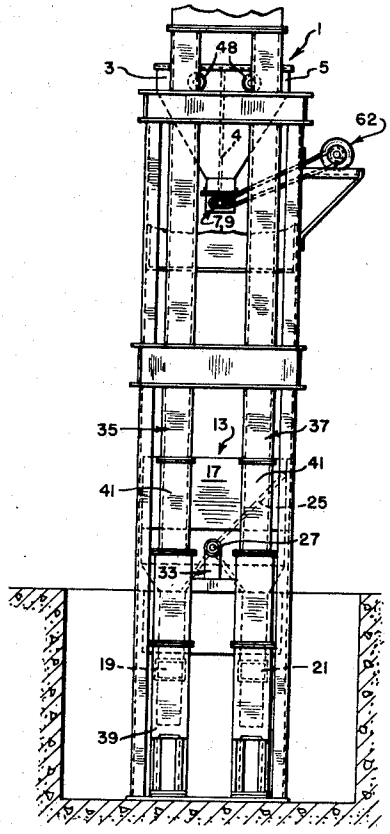
[52] **U.S. Cl.** **118/310,** 118/312
[51] **Int. Cl.** **B05c 5/00**
[50] **Field of Search** ..... 118/308, 326, 309, 310, 312; 51/8; 222/(Inquired)

[56] **References Cited**
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ABSTRACT: Apparatus for handling a plurality of differing particle materials at a station for treating objects, such as shell molds which are treated by showering them with the particle materials. The apparatus provides a compartmented storage hopper for storing and selectively discharging one or more of the materials being handled and further provides a collection hopper to collect the excess particle material while maintaining segregation of the materials used at the station and finally provides means for returning the materials to the storage hopper.

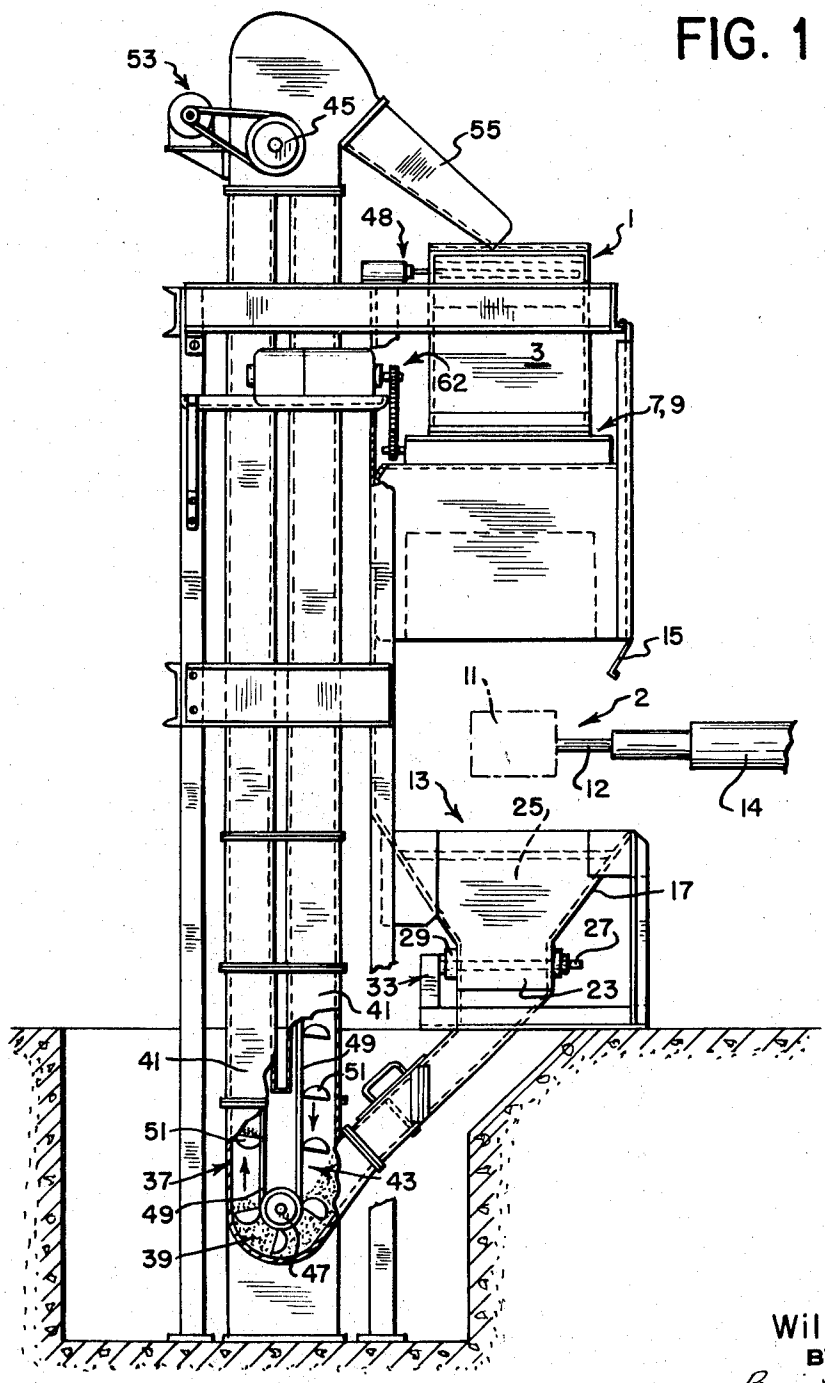


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FIG. 1



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FIG. 2

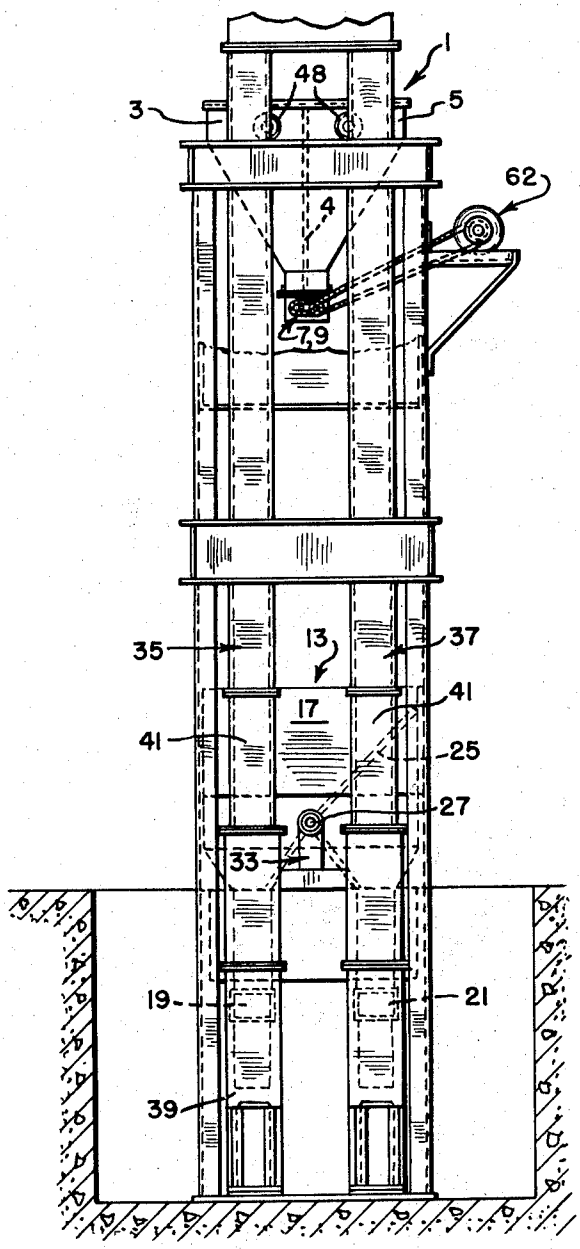
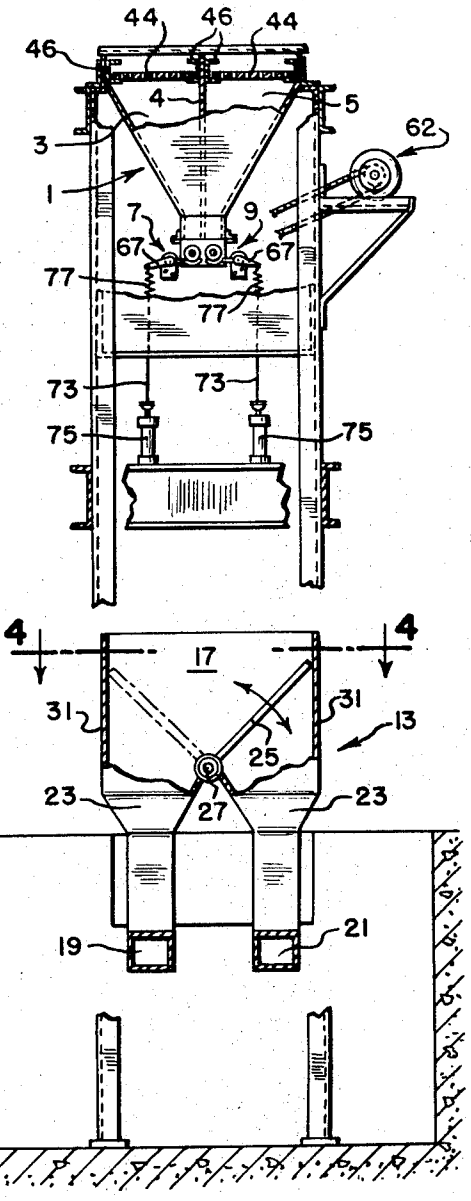


FIG. 3



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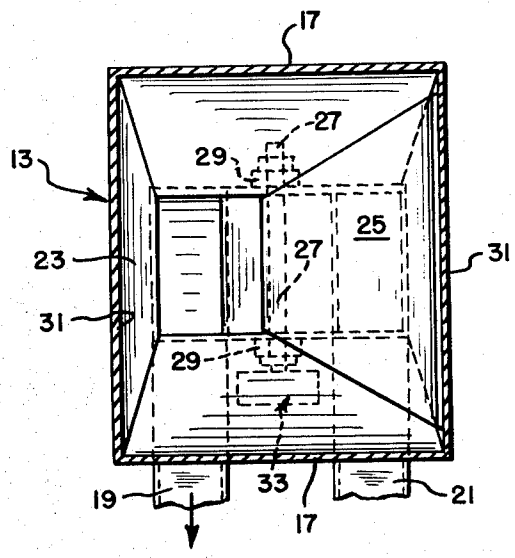


FIG. 4

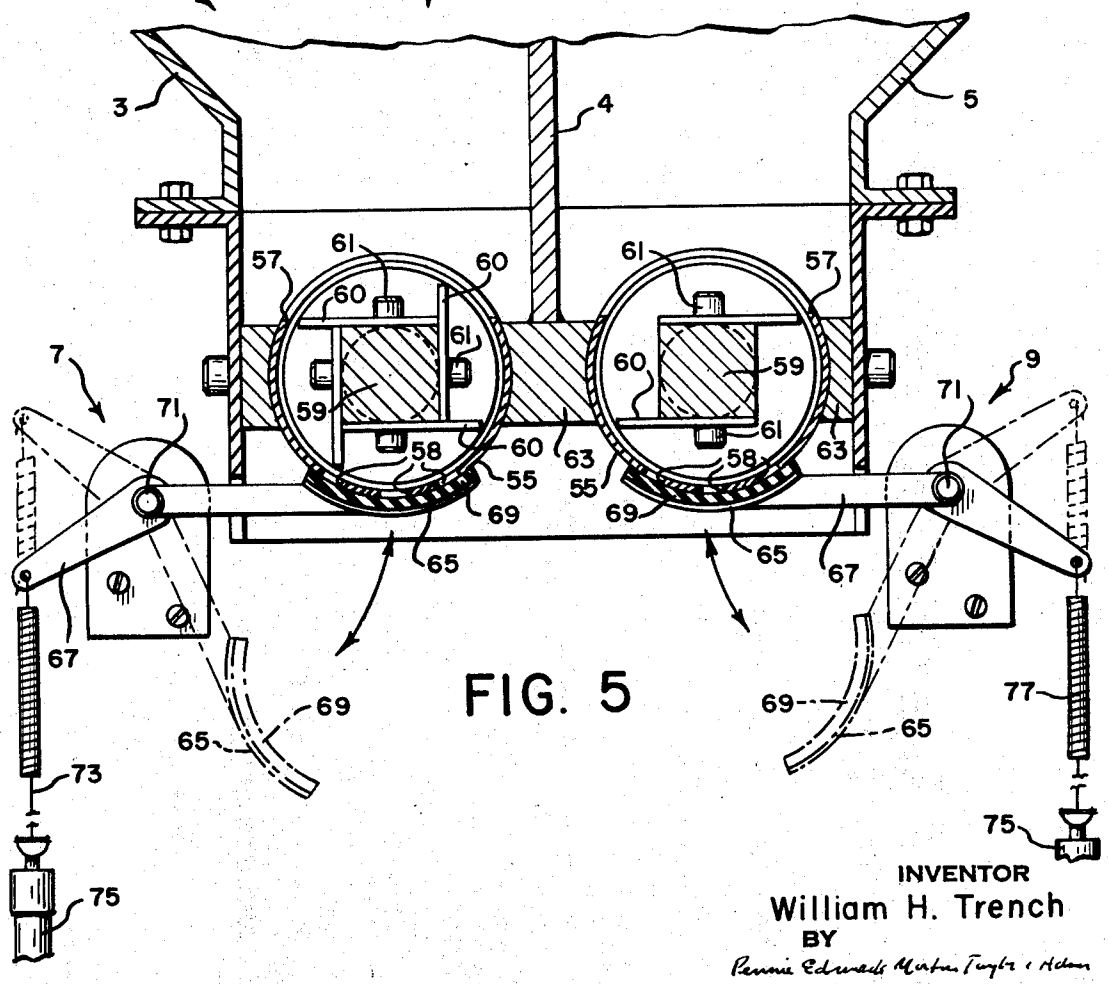


FIG. 5

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MATERIALS HANDLING APPARATUS FOR TREATMENT STATION

BACKGROUND OF THE INVENTION

In the production of shell molds for investment casting, wax patterns are dipped in liquid suspensions containing refractory materials and are thereafter treated by showering the wet coated patterns with organic or refractory particle materials in such a manner that some of the particles rest on and adhere to the surface of the coated patterns while the excess particles are collected for storage and reuse. Where treatment using more than one type of material is accomplished at one treatment station, it has been found that the changing from a shower or treatment of one material to another material is required to be accomplished quickly, easily and without contaminating the material by intermixing one with other materials being used.

In the semiautomatic handling of shell molds, such as described in U.S. Pat. No. 3,278,998 issued Oct. 18, 1966, the formation of a particle layer using more than one material is preferably accomplished at one treatment station to increase the speed of treatment and to minimize the length of travel of the shell molds thus reducing the size and cost of the conveyer equipment used. The ability to treat the molds at one station with different materials is particularly advantageous when it is necessary to make several changes of the material used or changes of particle size of a material during a production run.

SUMMARY OF THE INVENTION

It has been found that several materials may be readily handled using a compartmented storage hopper having rotable dispensing or discharging means for each compartment and a collection hopper to collect the excess materials which collection hopper has a plurality of outlets with closure means for guiding a material into one of the outlets while preventing its travel through other outlets.

Broadly, the present invention comprises storage means including a plurality of compartments, rotatable discharge unit associated with each compartment for discharging the material to a treatment area, a collection hopper for receiving and the excess material leaving the treatment area which hopper has a plurality of exit conduits leading to conveyer means for returning each material to its storage compartment and also includes conduit closure means which serves to permit flow into one conduit while closing off the other conduits.

It is a feature of the invention that the discharging unit in the compartments and the closure means at the collection hopper are adapted to readily control and synchronize a rapid change in the material being dispensed and showered onto the molds.

It is also a feature of the invention that closure means for a dual collection hopper may include a properly configured deflector door to permit flow of material first solely through one exit conduit and then without a significant time lapse a different showering material is diverted solely through another conduit.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a side elevational view;

FIG. 2 is a front elevational view;

FIG. 3 is a partial front elevational view of the apparatus;

FIG. 4 is a plan view of the collector hopper; and

FIG. 5 is an enlarged sectional view of the storage hopper discharge arrangement.

Referring further to the drawings and particularly to FIGS. 1 and 2, a dual material system is shown in which a storage hopper 1 is divided by vertical wall 4 into two compartments 3 and 5 for holding two types of particle material, for example, a refractory material, in compartment 3 and an organic material in compartment 5. A plurality of separate storage hoppers may also be used instead of the compartmented hopper as illustrated in the drawings. Examples of refractory materials suitable for mold production are fused silica, zircon, alpha quartz, electrically fused stabilized zirconia, tabular alumina, fused alumina, fire-clay grog, fused mullite and fused magnesia. Examples of suitable organic materials are sawdust, wood chips, plastic particles, ground corn cobs, ground walnut shells and organic fibers. It has been found that for some treatment uses two or more dispensing units provide a better shower and treatment than one larger unit and therefore the same material may be placed in more than one compartment for simultaneous discharge. It is also contemplated that the material may be segregated according to different particle characteristics and placed in separate compartments to permit selective showering of one particle type and then a different particle type. Each material is discharged from its compartment by operating the rotary dispensing units 7 and 9. The shell mold or other object to be treated is positioned in treatment area 2 below the storage hopper 1 with the force of gravity providing movement of the showering material onto and past the mold. The showering materials may also be moved by forces other than gravity, for example, forced air currents may be used to move the particle material toward and around the mold.

Collector hopper 13 has upper converging side walls 17 and two outlet conduits 19 and 21 to lead away the refractory, organic or other material used for treatment. Lower converging side walls 23 of hopper 13 connect the hopper and the conduits. Conduits 19 and 21 lead to the lower ends of bucket conveyers 35 and 37, respectively. Elevators 35 and 37, each having the same construction, include a lower collection sump 39, vertical enclosures 41, and a belt bucket carrier 43. Each carrier 43 includes an upper sleeve 45, a lower sleeve 47, a belt 49, a plurality of buckets 51 and a motor drive unit 53 to drive each upper sleeve.

Material dumped by buckets 53 falls down either of the chutes 55 onto horizontal screen frames 44 positioned in and supported by guides 46 to permit the screen frames to be reciprocated back and forth by air cylinder units 48. The material is shaken through the screen frame to break up any caking of the material and to screen out any over-sized particles or groups of particles. The material remains stored in compartments 3 and 5 until dispensing units 7 and 9 are operated to discharge it.

Turning to FIGS. 3 and 5, dispensing units 7 and 9 comprise stationary horizontally disposed cylinders 55 having openings 57 in the upper section which openings extend substantially the entire length of the cylinders to receive material from the bottom of the storage compartments. Cylinders 55 have longitudinal slot openings 58 in their lower sections through which the material is discharged. Disposed for rotation within each cylinder 55 is a shifting shaft 59 which is round at its ends for accommodation in suitable bearings. Shafts 59 are rotated at selected speeds by belt drive unit 62. Substantially the entire central portion of the shaft is rectangular in cross section and carries extending blades 60 secured to the shaft by bolts 61. Cylinders 55 are secured to frame piece 63 in the lower sections of the storage compartments. The number of blades 60 may vary depending on the material to be sifted from the cylinders through slot openings 58. To prevent material from discharging from slot openings 58 curved gates 65 having lengths sufficient to cover the slot openings are mounted on pivotable arms 67 to be urged against the lower section of the cylinder. Gates 65 have linings 69 made of rubber or other suitable resilient material to form a better seal with the surfaces of the cylinders.

Arms 67 are pivotable about pins 71 by wires 73 which are urged downwardly by air cylinder units 75 to pivot gates 65 and to close slot openings 58. Springs 77 prevent gates from being urged with excessive force against the cylinders. Gates 65 open by the force of gravity when air cylinder units are deenergized

The size and shape of the openings or orifices in the lower section of the cylinder may be varied to produce different patterns. This change may be accomplished by replacing the

cylinders. Changes in the speed rotation of the shafts will vary the rate or amount of the material dispensed.

Referring again to FIG. 1, shield 15 guides the particle materials during their descent to reduce to a minimum material falling outside the mouth of collector hopper 13. Shell mold 11 is supported by spindle 12 and arm 14 which arm carries the mold into and out of the treatment area 2. Arm 14 may also raise, lower and change the angle of the mold in area 2 to provide desired coating and showering of the mold surface.

Pivotable deflector door 25 is pivotable about axle 27 which is mounted in bearings 29 (FIG. 4). Axle 27 is pivoted by rotary actuator 33 which is preferably electrically operated through a solenoid or other suitable arrangement to turn the door to one side or the other. Door 25 is rotated until it reaches a resting position against either vertical hopper wall 31. In either selected position the door 25 deflects the material down one conduit and prevents its passage into the other conduit. It is contemplated that sliding doors may also be used instead of a deflector door. Each sliding door would function to prevent flow of material into a conduit when it is closed. The use of sliding doors would be particularly applicable to systems where more than two conduits lead away from the collector hopper 13.

Referring now to the deflector door shown in FIG. 3, it is seen that conduit 21 is blocked while conduit 19 is open when door 25 is pivoted to the position there shown. Suitable mechanism for coordinating the door movement and the operation of either dispensing unit 7 or 9 may preferably be used to prevent contamination of the materials by the improper positioning of the door.

In the operation of the apparatus, a material is placed in each of the storage conveyer compartments directly or by operation of conveyers and the mold to be treated is moved into the treatment station. The control arrangements which are preferably positioned near the foundation floor level for the convenience of the operator, is arranged to energize the various motors and actuators to selectively permit the mold to be treated with one of the materials. Drive unit 62 is energized to rotate shafts 59 and air cylinder unit 75 is to be de-energized permitting the associated gate 65 to drop open to shower material down from one of the compartments. At the same time deflector door 25 is properly positioned and the conveyer system is started to return excess material to the storage hopper compartment.

When it is desired to treat with the second material, the gate for the cylinder dispensing the first material is closed by energizing the air cylinder 75. The other gate is then opened, the deflector door pivoted to the other side of the hopper collector and the other conveyer turned on to recirculate the second material. The control system provides an interlock arrangement so that discharge of the first material must be stopped before discharge of the second material may begin and also provides that the deflector door is always properly positioned when one or the other gate is opened.

When a different dispensing shower is desired, the speed of rotation of the sifting shafts may be varied to increase or decrease the rate of dispensing and the sloted cylinders may be substituted for cylinders having orifices of different size, shape and arrangement.

I claim:

1. An apparatus for conveying, storing and discharging a plurality of particle materials to permit the selective discharge of each material to a common treatment area comprising:
   a. storage means including a plurality of compartments for storing the materials;
   b. discharge means associated with each compartment for discharging material from each compartment;
   c. a treatment area to which all materials are selectively discharged for treating an object positioned therein;
   d. collecting hopper means for collecting excess material not utilized in the treatment area, said collecting hopper means in turn comprising:
      i. entrance guide means for guiding said excess material;
      ii. a plurality of exit conduits leading from the guide means;
      iii. closure means for closing all but one conduit and permitting material to enter a conduit which is not closed; and
   e. conveyer means for conveying each material collected in the collecting hopper means conduits to its respective storage compartment.

2. The apparatus of claim 1 in which the storage means consists of two compartments and in which the collecting hopper means has two exit conduits and a closure means which includes a pivotable door.

3. An apparatus for providing the treatment of objects with differing particle materials in which each material is moved onto and past the object to be treated comprising:
   a. storage means including two material containing compartments for storing differing treatment materials;
   b. discharge means in the lower section of each compartment for discharging the material therefrom said discharge means including:
      i. orifice opening in the lower section of each compartment; and
      ii. a generally horizontally-disposed rotary member adjacent said orifice opening to cause particle material to pass through said opening;
   c. a treatment area to which all materials are discharged to treat an object therein;
   d. a collecting hopper means for collecting material passing through the treatment area, said collector hopper means in turn comprising:
      i. entrance means for receiving material passing the object;
      ii. two exit conduits leading from the entrance means; and
      iii. a pivotable door for selectively closing either exit conduit and guiding material into the other exit conduit; and
   e. conveyer means for conveying material from each conduit to the compartment in which each such material is stored.

4. The apparatus of claim 3 in which the discharge means includes orifice closing means for closing the orifice opening to prevent material from passing through the orifice opening.