

[54] **METHOD AND DEVICE FOR
DISCHARGING RUBBISH AND WASTE
THROUGH PNEUMATIC DUCTS**

[75] Inventor: **Marcel Buisson**, Chartres, France

[73] Assignee: **Societe d'Etudes et Realisations de
Complexes Industriels Divers**
Impasse des Ventes Marsaueux,
Dreux, France

[22] Filed: **Feb. 22, 1973**

[21] Appl. No.: **334,890**

[30] **Foreign Application Priority Data**

Feb. 24, 1972 France 72.06208
Oct. 19, 1972 France 72.37013

[52] U.S. Cl. **302/2 R, 243/2, 243/6,
243/7, 302/23, 302/24**

[51] Int. Cl. **B65g 51/08**

[58] Field of Search 243/2-4, 6-9,
243/19, 20, 22, 23; 302/2 R, 21, 23, 24, 39

[56] **References Cited**

UNITED STATES PATENTS

3,148,845	9/1964	Buckwald et al.	243/6 X
3,232,559	2/1966	Grosswiller et al.	243/7 X
3,237,881	3/1966	Grosswiller et al.	243/7 X
3,305,191	2/1967	Buchwald	243/4
3,408,113	10/1968	Bouladon	302/2 R

3,556,603	1/1971	Liebenberg	243/2 X
3,588,176	6/1971	Byrne et al.	302/2 R
3,687,503	8/1972	Ekstrom et al.	302/39

Primary Examiner—Evon C. Blunk

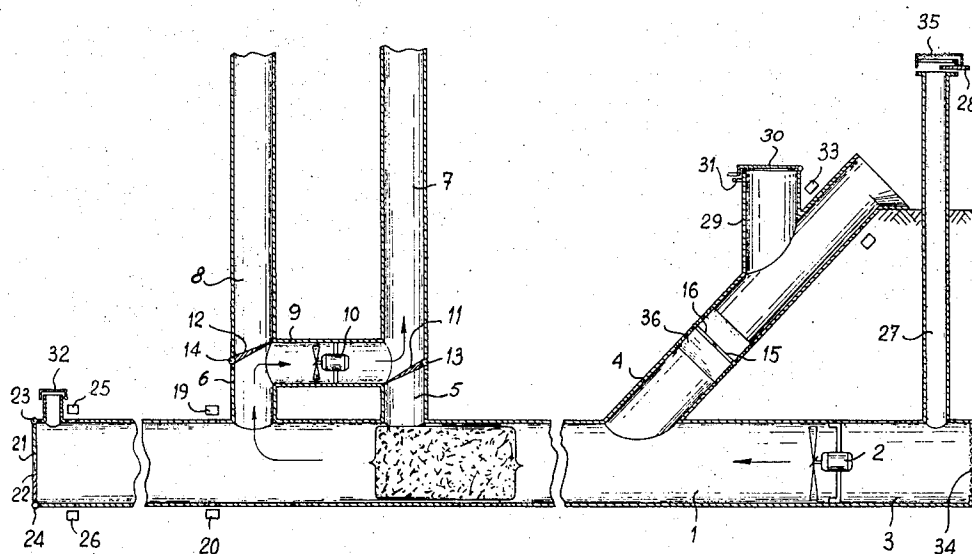
Assistant Examiner—W. Scott Carson

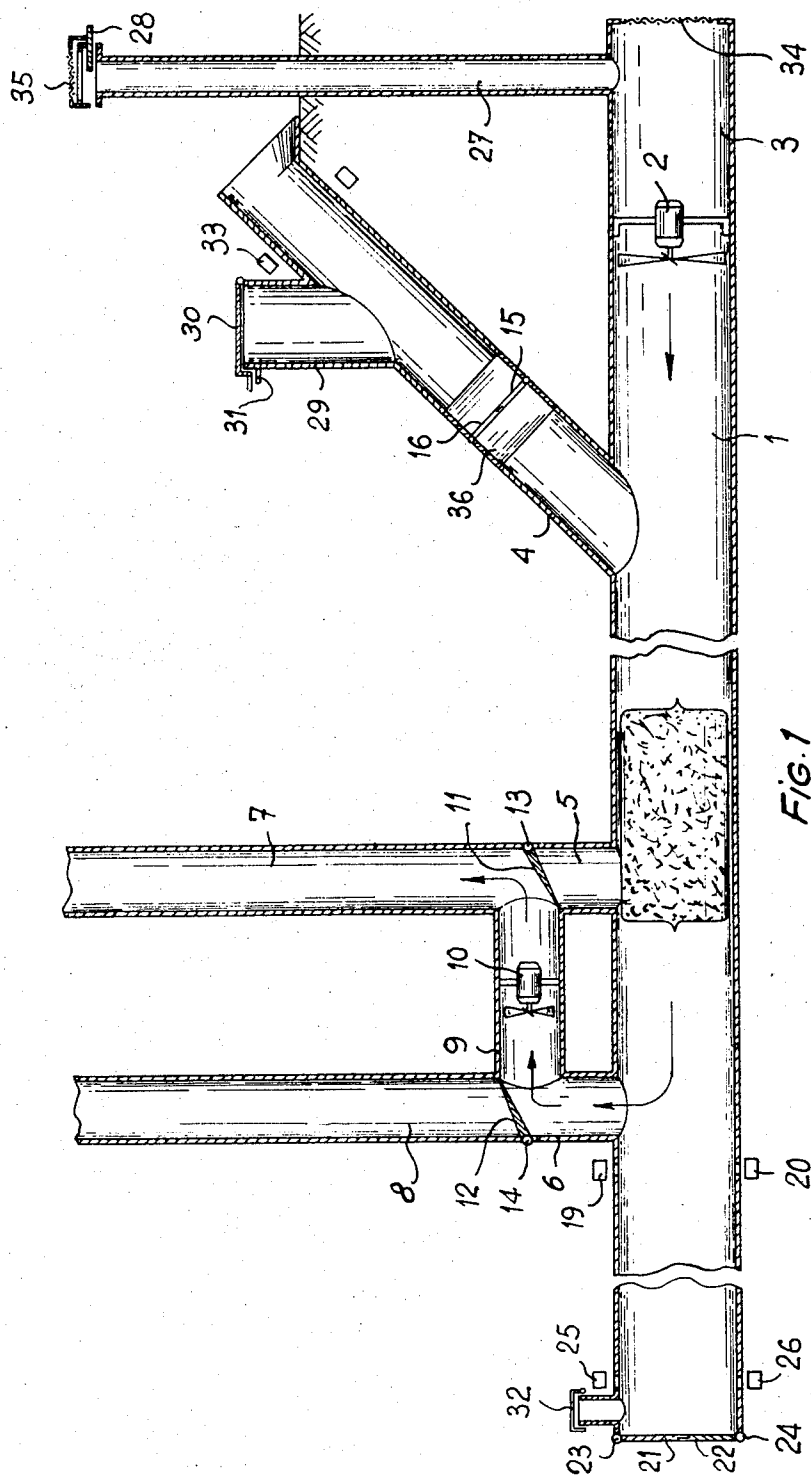
Attorney, Agent, or Firm—Eric H. Waters

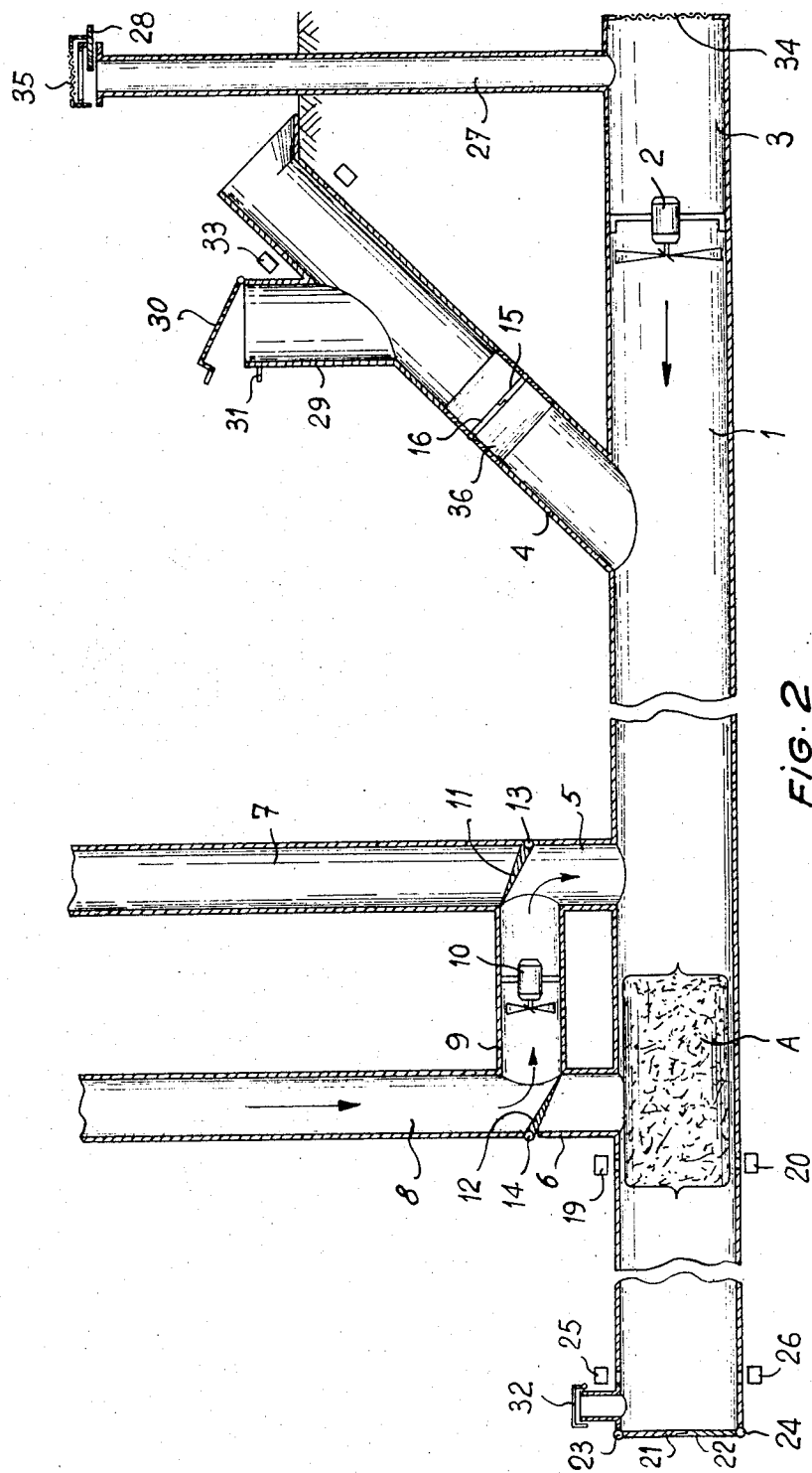
[57] **ABSTRACT**

Apparatus for disposing of materials packed in bags and the like comprising a main duct in which at least one infeed duct opens downstream of a fan which feeds air under pressure into the main duct and upstream of an outlet. The main duct comprises a single gate located at its outlet end with no further obturation, the gate opening outwards and being urged to its closed position. A non-return valve opens outwardly from the main duct to the atmosphere and is disposed in the immediate vicinity upstream of the outlet. At least one propulsive assembly is coupled to the main duct at a location between the infeed duct and the outlet. A suction is produced in the main duct by the propulsive assembly to promote advance of the material in the main duct conjointly with the fan until the material reaches the propulsive assembly whereupon in order to urge the material further downstream towards the outlet the propulsive assembly produces pressure and the material advances under the pressure of the fan and that of the propulsive assembly.

15 Claims, 2 Drawing Figures







METHOD AND DEVICE FOR DISCHARGING RUBBISH AND WASTE THROUGH PNEUMATIC DUCTS

Apparatus is known for disposing of household waste in which the waste is introduced into pneumatic ducts which lead to grinders, incinerators, or other centralized destruction devices.

This apparatus has many drawbacks on account of the extremely diverse nature of the waste which is introduced into it, and which necessitates extremely powerful fans and also ducting which is particularly resistant both to abrasion and shocks.

Furthermore, since this apparatus requires that the waste is destroyed in a centralized plant, the ducts from the dwellings are extremely long due to the drawbacks relating to feedback which would result from the destruction plant being too close to the dwellings themselves.

Finally, the waste, which is conveyed directly in the ducts, has the disadvantage of producing clinging deposits which result, for example, from the fact that paper can adhere to sticky and greasy residues. To remedy these faults as far as possible, extremely powerful fans are used which operate for a relatively long time and which have the resultant deficiency of causing considerable clouds of dust at the outlet of the ducts by reason of the fact that they forcibly expel the lighter and dryer particles.

Pneumatic transportation devices are also known for objects of consistent dimensions exactly matched to those of the tubes. Because of this match, the energy losses are small and in any case, since the weight of the object is small, the installations may be simple and reliable.

The present invention relates to the transportation of relatively bulky bags or the like which are heavy and of irregular dimensions. It thus applies to the disposal of roughly packed waste, rubbish and other materials.

To this end, the invention contemplates an apparatus for discharging materials packed in bags or the like, of the type including a main duct into which an infeed duct opens downstream of a fan and upstream of an outfeed, wherein the main duct is closed at its outfeed by an outward-opening gate which is returned to its closed position, a non-return valve which allows air to leave but not to enter being provided in the immediate vicinity of the outfeed from the duct.

The non-return valve may be pre-loaded, and the apparatus may include at least one extra fan situated outside the main duct but connecting with it through two passages, both situated downstream of the infeed duct but one upstream of the other and both open to the atmosphere, each of these passages containing a movable closure valve which can occupy one of two positions as required, in the first of which the downstream passage is closed to atmosphere and open to the duct while the upstream passage is closed to the duct and open to atmosphere, while in the second position the downstream passage is closed to the duct and open to atmosphere while the upstream passage is closed to atmosphere and open to the duct.

The two valves in each assembly may be controlled in synchronization by a drive device such as a hydraulic or pneumatic ram, an electro-magnet, or other similar device.

Downstream of at least the first assembly, the main duct is advantageously equipped with a member which senses the presence of a bag or the like containing the waste or rubbish, this member controlling the motor belonging to the valves in one or more assemblies.

Each infeed duct may be equipped with a member which senses the presence of an outer bag containing waste or rubbish, this member controlling one or more fan motors, and the sensing member may control the fan motor or motors and the valve motor in each assembly.

At least one of the infeed ducts preferably communicates with an opening fitted with a gate which is able to accept waste or rubbish other than that introduced through the infeed proper.

The gate may have a catch which is associated with a member which senses the presence of a bag or the like and which is situated at the outfeed from the main duct so that the gate is held closed when the fan is operating.

Advantageously, the sensing member provided in each infeed duct controls both the motor of the main fan, the motor of one or more auxiliary fans and the corresponding closure valves so that the whole through-put of air pumped by the main fan is absorbed by the total suction through-put of the auxiliary fans, with the possible addition of the through-put through the non-return valve.

The maximum flow through the non-return valve may be at least equal to that from the main fan, and the two passages associated with the same auxiliary fan, which open into the main duct, may be separated from one another by a distance at least equal to the length of the largest bag or the like which is intended to move through the duct.

The suction power of the auxiliary fans may be at least equal to the pressure loss occurring upstream of the main fan.

The main duct preferably communicates with a building into which the infeed duct or ducts open by a passage situated upstream of the fan, and this passage may be fitted with a movable and adjustable closure member enabling the suction flow to be adjusted in the building.

Each infeed duct may be fitted with a non-return valve situated immediately upstream of the main duct.

In order that the invention may be more clearly understood, reference will now be made to the accompanying drawings which show one embodiment thereof by way of illustrative and non-limiting example, and in which:

FIGS. 1 and 2 are schematic cross-sections of apparatus according to the invention in which the auxiliary fan assemblies are shown in two different positions.

Referring now to the drawings, it will be seen that the apparatus according to the invention comprises a main duct 1, containing a fan 2, and communicating with the atmosphere at its end 3, and which has one or more sloping infeed ducts 4.

Downstream of the infeed duct 4, two passages 5 and 6 open into the duct 1 and communicate with the atmosphere at their ends 7 and 8. The two passages 5 and 6 are linked by a passage 9 in which is situated an auxiliary fan 10.

The two passages 5 and 6 contain closure valves 11 and 12 which are pivotally mounted on axles 13 and 14.

The fan 10 always turns in the same direction but, depending on the position of the valves 11 or 12 (see FIGS. 1 and 2 respectively) there is either suction from, or delivery into, the duct 1, in the following way.

In the position shown in FIG. 1, the valve 11 is in its lowermost position, while the valve 12 is in its uppermost position so that rotation of the fan 10 causes suction in the interior of the duct 1 and delivery to atmosphere through the passages 6, 9 and 7.

On the other hand, in the position in FIG. 2, the valve 11 is in its uppermost position, while the valve 12 is in its lowermost position, and the rotation of the fan 10 (which is still in the same direction) causes suction from atmosphere through the passage 6 and delivery into the duct 1 through the passage 5.

This installation is particularly applicable to dwellings which are equipped with waste-disposal units terminating at a building in which the rubbish is packed in bags or the like using any known means.

In this case, the mouth of the infeed duct 4 is located in this building and it is advisable to provide an auxiliary duct 27 which also opens into the building and which includes an adjustable closure member 28 so that a pressure drop occurs in the building each time the fan 2 is started up, which enables smells, dust, etc., to be removed.

It may also be necessary to provide an extra infeed duct 29 which opens either into the same building as that in which the rubbish is packed, or into a different building, and which enables the rubbish bagged-up by the various inhabitants of the premises to be disposed of through the plant.

This infeed duct 29 is provided with a cover 30 fitted with a catch 31 which is attached to a control member such as an electro-magnet, the energization circuit of which is connected on the one hand to that of the fan 2, and, on the other hand, to that of a photoelectric cell 25.

As a result of these arrangements, the cover 30 is held firm by the catch 31 when the fan 2 is running to prevent premature suction through the duct 29 when some person wishes to deposit a bag of rubbish.

Conversely, the catch 21 is released by the circuit of the cell 25 as soon as this circuit has stopped then fan 2.

The outfeed from the duct 1 can be situated in any desired building and may open, for example, above a hopper, a railway dump-truck, a vehicle or any other appropriate piece of equipment.

Two valves 21 and 22 form an outfeed gate from the main duct 1 and can close in a substantially sealed manner to prevent any entry of air.

Furthermore, in the immediate vicinity of this end of the duct 1 is a pre-loaded non-return valve 32 which allows a controlled outward flow of air but prevents any entry, as will be explained below.

The spacing between the two passages 5 and 6 is greater than the length of the longest bag A, so that the two passages can never be simultaneously blocked by a bag.

The operation of this plant is as follows:-

When a bag or the like is introduced into the infeed duct 4, a member 33 which senses the presence of the bag acts on the motor 2 of the main fan and on the mo-

tors 10 of the auxiliary fans to activate them. The member 33 also acts on 11 and the valves 12 so that the fans 10 operate in suction from the duct 1 to atmosphere.

With this arrangement, the valves 11 and 12 are set to their suction orientation under the control of the member 33.

It may be preferable for the valves 11 and 12 to be constantly biased to this position and for them to be orientated, one by one, by the members 19, 20 to the delivery position, using electro-magnets for example.

It is then possible to use the members 25, 26 not only to stop the fans 2 and 10 but also to return the valves 11 and 12 to their suction position.

The air delivered into the duct 1 by the main fan 2 comes from the atmosphere through the duct 3, which has a filter 34, and from the building where the bags are fed in. The air from the building passes into the duct 27 which has adjustable flow valve 28 and a filter 35. The air thus sucked in through the filters 34 and 35 is delivered into the main duct 1 from which it emerges through the passages 6, 9 and 7, being sucked in by the fans 10.

When a bag begins its journey, there is thus a flow of air in the main duct 1 which shows neither a pressure-drop nor an over-pressure. In the duct 4 there is a pressure-drop which assists the opening of valves 15 and 16 and sucks in the bag in the fashion of a venturi.

The duct 4 is of circular section but in order to envelope the bags completely, flaps 15 and 16 are provided which are rectangular and form a square which is contained within a square-section segment 36 of the duct.

Since the junction between the ducts 1 and 4 forms a venturi throat, the joint portions must be worked out so that the induction effect is not disturbed by turbulence tending to pump air back into the duct 4. They should, of course, be matched to the bags passing from the duct 4 into the duct 1.

It can be seen that the pressure from the main fan 2 is adequate at the beginning. Its throughput of air is fully absorbed by the suction of the fans 10 and, if desired, by the valve 32 which is pre-loaded to open to atmosphere as soon as the over-pressure in the duct 1 reaches a predetermined adjustable value. This valve 32 may be of any known type using a spring, a counterweight, etc.

When the installation has a fairly short duct 1 so that only the main fan 2 is needed, it is necessary that the valve 32 be able to provide an outlet to atmosphere which is adequate to discharge the air delivered by the fan 2 so that there is no over-pressure in the duct 1 before a bag arrives in this duct 1.

When more than one auxiliary fan 10 is required, the installation operates in the way just described until the bag arrives downstream of the passage 6 of the first flow-augmentor system opposite cell 19 and its reflector 20. This member then acts on the valves 11 and 12 of the first flow-augmentor system so that the appropriate fan 10 no longer sucks in air from the duct 1 through the passage 6 to direct it to atmosphere through the passages 9 and 7, but sucks in air from atmosphere through the passage 8 and delivers it into the duct 1 through passages 9 and 5. During the reversal of the position of the valves 11 and 12, the bag A continues to be subject to the pressure from the main fan 2

and to the suction from other possible downstream flow-augmentor systems.

The members 19 and 20 may advantageously be provided not downstream of the passage 6 as shown, but upstream of the passage 6. The time required to pivot the valves 11 and 12 is, in fact, relatively long and it is advisable that the valves come into action in as accurate a manner as possible.

Depending on the speed of movement of the bag A, the distance between the members 19 and 20 and the passage 5, and the time required to pivot the valves 11 and 12, it may be useful to provide a time-lag between a signal being transmitted from the members 19 and 20 and the valves 11 and 12.

The power of the fans 10 must be at least equal to the pressure loss to which the fan 2 is subjected in the duct 1 between the point where it is located and the first passage 5.

If P = the total power,

PVP = the power of the fan 2,

PVA = the power of the fan 10,

pc = the pressure loss between 2 and 10,

then:

$P = PVP - pc + PVA$.

What we claim is:

1. Apparatus for disposing of materials packed in bags and the like, said apparatus comprising a main duct having opposite ends, a fan in said main duct, at least one infeed duct opening into the main duct downstream of said fan, a single gate located at one of said ends of the duct and serving as an outlet, said duct being completely open and non-obtured between said fan and said gate, said gate opening outwards and being constantly urged to a closed position, a non-return valve coupled to said main duct to connect said main duct to the atmosphere, said nonreturn valve being disposed in the immediate vicinity upstream of said outlet of the main duct, and at least one propulsive means coupled to said main duct at a location between said infeed duct and said outlet for producing suction in said main duct to promote advance of the material in said main duct until the material reaches said propulsive means whereupon said propulsive means produces pressure in said main duct to urge the material further downstream towards said outlet concurrently with the pressure of said fan.

2. Apparatus as claimed in claim 1 wherein said propulsive assembly comprises two pipes each having one end connected to the atmosphere and an opposite end connected to the main duct, the first of said pipes being disposed downstream of the other pipe along said main duct by a distance only slightly greater than the length of one bag of material to be conveyed in said main duct, a further pipe connecting said two pipes together, a one-way fan in said further pipe, and a closure valve in each of said two pipes, each closure valve having two positions, in the first of which the downstream pipe is closed to the atmosphere and open to the duct while the upstream pipe is closed to the duct and open to the atmosphere while in the second position the down-

stream pipe is closed to the duct and open to the atmosphere while the upstream pipe is closed to the atmosphere and open to the duct, so that one of said pipes is only used for sucking air into the main duct while the other of said pipes is only used for forcing air into the said main duct.

3. Apparatus as claimed in claim 2, comprising control means for said closure valves of said propulsive assembly for alternatively setting both closure valves in their respective positions.

4. Apparatus as claimed in claim 3 wherein said control means comprises a sensor disposed downstream of said propulsive means for sensing the presence of a bag of material to adjust the positions of the valves.

5. Apparatus as claimed in claim 2, comprising sensing means in said infeed duct for sensing the presence of a bag of material and controlling operation of said fan in response thereto.

6. Apparatus as claimed in claim 5, wherein said sensing means is coupled to and controls the operation of the fan in the main duct, the fan in the further pipe and the closure valves so that the entire throughput of air pumped by the main fan is absorbed by the total suction throughput of said fan in the auxiliary pipe and possible discharge of air through the non-return valve.

7. Apparatus as claimed in claim 6 wherein said sensing means is coupled to said closure valves to control the operation thereof.

8. Apparatus as claimed in claim 2 comprising a sensor means in said main duct proximate said outlet for sensing the presence of a bag of material and controlling operation of said fan in response thereto.

9. Apparatus as claimed in claim 2, wherein the power of the fan in said further pipe is at least equal to the pressure loss occurring downstream of the main fan.

10. Apparatus as claimed in claim 1 comprising means having an opening with a gate connected to said infeed duct for introduction of waste in addition to the material introduced in said infeed duct.

11. Apparatus as claimed in claim 10 wherein said gate includes a catch, and comprising a sensing means situated at the outlet of the main duct and associated with said gate for sensing the presence of a bag of material, for holding the gate in closed position when the fan is operating.

12. Apparatus as claimed in claim 1, wherein the maximum throughput through said non-return valve is at least equal to that of the main fan.

13. Apparatus as claimed in claim 1 comprising a passage situated upstream of the fan and leading into said main duct for communication with a building into which said infeed duct opens.

14. Apparatus as claimed in claim 13 comprising a movable, adjustable closure member in said passage for adjusting the suction flow to the building.

15. Apparatus as claimed in claim 1, wherein the non-return valve is pre-loaded.

* * * * *