

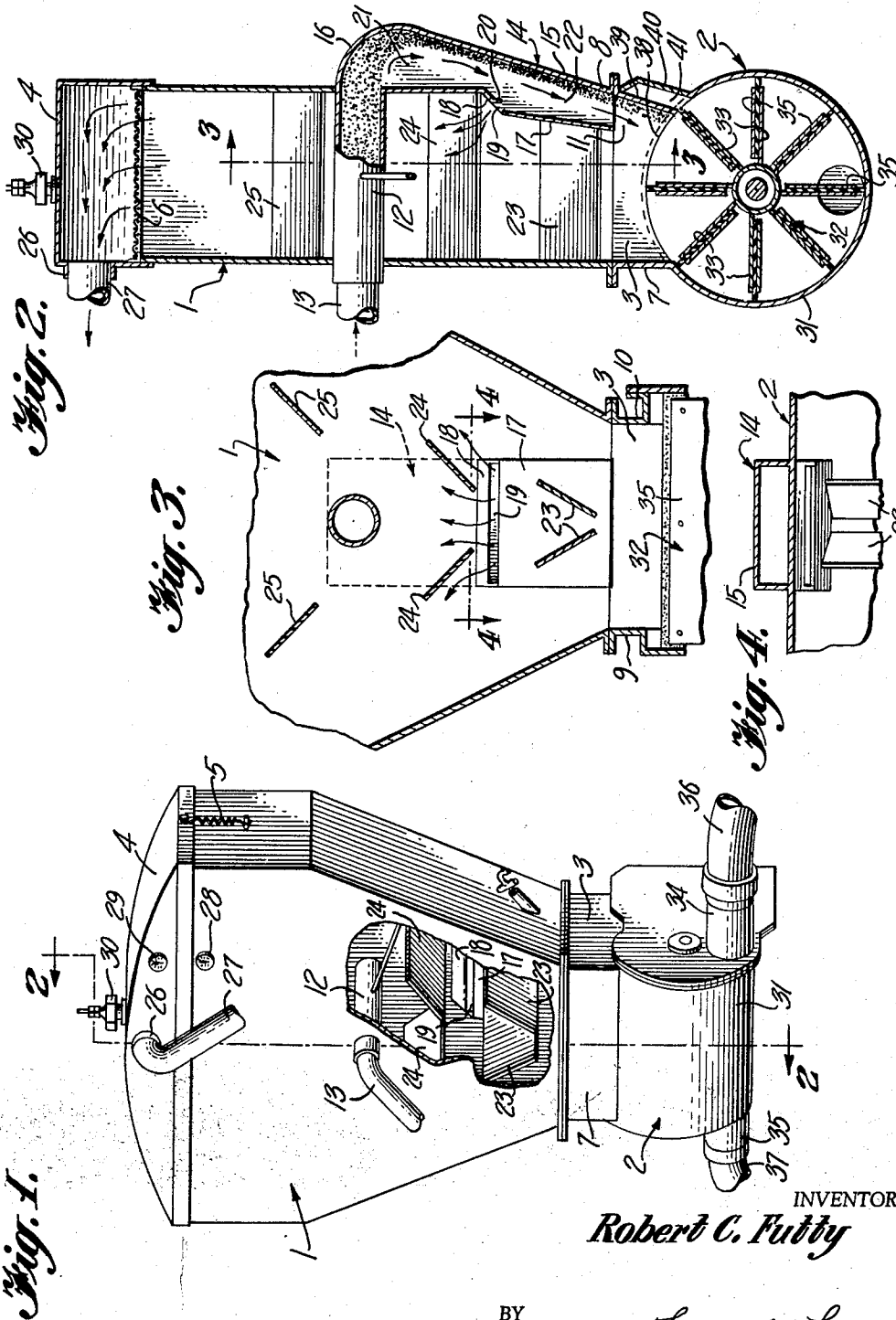
Dec. 15, 1959

R. C. FUTTY

2,917,344

FEED APPARATUS FOR GRANULAR MATERIAL

Filed Feb. 2, 1959



INVENTOR
Robert C. Fuddy

BY *Mason, Fenwick & Lawrence*
ATTORNEYS

1

2

2,917,344

FEED APPARATUS FOR GRANULAR MATERIAL

Robert C. Fuffy, Conestoga, Pa., assignor to Ripco, Incorporated, Oxford, Pa., a corporation of Delaware

Application February 2, 1959, Serial No. 790,436

4 Claims. (Cl. 302—59)

This invention relates to feed apparatus for handling granular material, and particularly to such apparatus wherein the material is handled and fed by means of moving bodies of air either under vacuum or pressure.

Many different materials are handled at times through the entrainment of the materials in a column of air for movement from place to place. When a destination has been reached, the material and entraining air must be separated. Numerous separators have been proposed and used for this purpose, but considerable difficulty has been encountered in obtaining complete separation without excessive turbulence. This creates many problems, particularly where the material being handled has relatively fine particles which will form a dust-like cloud under turbulence. It is desirable that the separation be made with as little agitation of the product as possible for most efficient operation.

A further problem in connection with this type of material handling arises in systems where the air is carried by vacuum, separated and then delivered in measured quantities to a line which is under pressure for further distribution. Although air locks are used, the measuring cavities of the lock are under pressure when they open to the vacuum chamber of the separator, and will quickly exhaust to the chamber disrupting the separating action and the flow of material to the measuring chambers. This results in inaccurate measurements.

The general object of the present invention is to provide feeding mechanism which will include improved means to separate material being handled from an entraining body of air with a minimum of turbulence.

A more specific object is to provide such apparatus so arranged and proportioned that the separation takes place by a natural movement of the material being handled, while the entraining air gradually leaves the material and takes a different course.

A further object is to provide apparatus of this kind wherein the several passageways through which the material moves are designed to materially reduce air speed at time of separation while the material is permitted to continue movement at a relatively uniform rate.

A further object of the invention is to provide separating apparatus which will deliver separated material to the outlet with substantial force to assure full loading of a measuring receptacle which may be used in connection with the separator.

Yet another object is to provide means in a combined air separator and air lock dispensing valve to discharge air pressure from the several pockets of the dispensing valve prior to entry of the pocket into the stream of material discharging from the separator, to prevent back pressure against the material and improper loading of the pocket.

Other objects of the invention will become apparent from the following description of one practical embodiment thereof when taken in conjunction with the drawings which accompany, and form part of, this specification.

In the drawings:

Figure 1 is a perspective view of material feeding apparatus, including a separator and an air lock dispensing valve, which embodies the principles of the present invention, parts of the casing being broken away to show the interior;

Figure 2 is a vertical, transverse section through the structure, taken on the line 2—2 of Figure 1;

Figure 3 is a partial vertical section through the apparatus, and is taken on the line 3—3 of Figure 2; and

Figure 4 is a fragmentary horizontal section taken on the line 4—4 of Figure 3.

In general, the invention includes feeding apparatus having a separator with an air lock dispensing valve at the outlet, wherein material being handled is led to a point adjacent the separator outlet while under the influence, or partial influence, of entraining air and given an impetus in the direction of the outlet before the entraining air is separated out to the end that the material moves through the outlet into the dispensing valve with some force. After the material is given a definite impetus toward the outlet, the air is separated out without causing direction change of the material. To further the objective of forceful, air-free entry of the material into the valve, means are provided for discharging air-pressure from the valve chambers before they are brought into communication with the material stream at the separator outlet.

Referring to the drawings in detail, there is shown material feeding apparatus which includes a separator 1 and a dispensing valve 2. The dispensing valve is connected to the bottom of the separator and material being handled will pass through the separator and into the valve.

The separator takes the form of a suction case having a lower housing section 3 and a top 4. The lower section and top may be designed to fit together in any desired manner, and suitable fastenings, such as yieldable spring clamps 5, will be used to hold the case parts assembled. A screen 6 separates the case into upper and lower chambers, and may conveniently be mounted at the line of separation between the lower case section and the top.

The lower section of the case tapers downwardly, so that the bottom of the case is of much smaller cross-sectional area than the top. This is important to the operation of the device, as will be pointed out later. To accomplish this, the front and back walls 7 and 8 are preferably parallel to each other, and the side walls 9 and 10 converge downwardly. The bottom of the case is open to form an outlet 11.

Material is brought into the lower section of the case by means of an inlet pipe 12 which extends through the case from the front wall to the back at a point substantially at the center of the case. The inlet pipe projects slightly at the front of the case and may be connected to a suitable hose 13 which will deliver material to the separator. The inlet pipe opens through the rear wall of the case into a material conduit 14 which is of considerably larger cross-section than the inlet pipe. This conduit is of rectangular horizontal cross-section. The back wall 8 of the suction case forms the front wall of the conduit. The conduit back wall 15 declines forwardly so as to approach the back wall of the suction case to form a downwardly tapering passageway. The back wall 15 at its top curves smoothly forwardly, as at 16, to the case back wall to form a guide along which material entering from the horizontal inlet pipe will flow to direct its course downwardly along the back wall of the conduit. The front wall of the conduit, that is that portion of the back wall of the suction case in the area of the conduit, is offset as at 17, inwardly from a point about midway the length of the conduit to the bottom thereof. The upper end of the offset wall 17 is con-

3

nected to the lower edge of the wall above by an inclined bridging wall 18. The bridging wall 18 is slotted across its full width to form an air outlet 19. The bridging wall 18 has a depending lip 20 along its full-length adjacent the back edge of the outlet 19 which will serve as a baffle to deter the movement of material being handled through the outlet.

By reason of the sloping back wall of the conduit and the offset in the conduit front wall, the conduit is provided with two connected chambers 21 and 22 in communication with one another and with their back walls lying in a common plane and forming a continuation of one another. The chambers are substantially the same, in that each has a relatively large chamber at its inlet end and tapers downwardly. Thus, air movement will be slower at the entrance end of each chamber than at the outlet end. The upper end of each chamber therefore will serve as an expansion chamber to permit partial separation of the air from the material while the material continues along the back wall of the conduit by reason of the inertia of its movement through the inlet pipe assisted by gravity. The precise action will be described in detail hereinafter.

The inside of the lower case is bridged by pairs of baffles 23, 24 and 25. The baffles of each pair are oppositely inclined, and the baffles of the respective pairs from bottom to top are spaced apart progressively greater distances. The baffles will serve to intercept material particles which may be ascending in the case with the vehicle air. As the speed of the ascending vehicle air progressively decreases with the upwardly increasing case area, the particles so intercepted will be free to drop back by gravity.

The top of the case has an air outlet 26 which may be connected by a hose 27 to a vacuum source. The lower case and top may be provided with pressure gauges 28 and 29 on opposite sides of screen 6, so that when the screen becomes clogged it will be indicated by a differential pressure reading on the two gauges. A suitable relief valve 30 may be mounted in the top, if desired.

The dispensing valve 2 has a cylindrical housing 31 to receive a rotary dispenser 32 having a plurality of radially positioned vanes 33. The vanes are the full width of the housing and are shown as made of rubber so that their edges may flex to maintain good sealing contact with the housing walls. The spaces between the vanes form dispensing chambers, and if properly filled will deliver accurate predetermined quantities. Axially aligned inlet and outlet air ports 34 and 35 are provided near the bottom of the housing connected to a suitable air supply base 36 and material delivery hose 37, respectively. When the several dispensing chambers are positioned between the inlet and outlet ports, air from hose 36 will force the material from the chambers and out through the delivery hose 37. If the chambers contain equal amounts of material and the dispensing rotor is rotated at a uniform rate, the delivery from hose 37 will be uniform.

The entrance throat 38 to the housing of the dispensing valve will have one wall 39 which forms a continuation of the back wall 15 of the material conduit 14 of the separator. This wall will be a fake wall, in part at least, and the real wall 40 of the housing throat will be spaced slightly from it to form a pressure reducing chamber 41 adjacent the point where the dispensing chambers will open to the throat and to the stream of incoming material. Each dispensing chamber will leave its dispensing position between the inlet and outlet ports 34 and 35 filled with air under pressure of the line 36. If the chamber is permitted to open to the vacuum chamber in the separator while under pressure, the air under pressure will spurt out blowing back the material flowing toward the chamber and creating turbulence in the material. This would occur as each chamber opened to the separator.

4

By providing the chamber 41 at the entrance side of the throat, the pressure in the dispensing chamber can expand into chamber 41 to reduce the pressure to that of the separator. This will be done with no effect upon the inflowing material.

In operating the device, the valve 2 is coupled to the bottom of the separator so that the entrance throat of the valve housing will be in communication with the outlet 11 of the separator. The vacuum hose 27 will be connected to a suitable vacuum source, and the air hose 36 will be coupled to a source of air under pressure. The pick-up hose 13 will be placed in a bin truck or other receptacle to be unloaded, and the delivery hose 37 positioned to deposit material where it is desired. With the parts coupled and positioned as described, air with entrained material will be drawn in through hose 13 to the separator inlet pipe 12, through that pipe and conduit 14 where the air and material are separated. The air will ascend through the separator case and screen 6, and leave the device through the hose 27. The material will be thrown into the pockets, or chambers, of the dispensing valve, moved to the bottom of the valve and blown out through hose 37. The valve of course will serve to keep the two bodies of vehicle air separated and transfer the material from one vehicle to the other.

The separation of the air from the material takes place in the separator in such manner that substantially no turbulence is created, and the air is taken off while the material is permitted to continue along a directed course under the impetus that the moving air stream has given it. It will be evident, that the air and material will be moving as a unitary column through the inlet pipe 12. As the column emerges from the pipe into the wider conduit 14, the air can expand and, of course, will move at reduced speed. The material, however, will continue its course unabated, and follow the curved top of the conduit back wall to change its course to a downward direction. Centrifugal force set up by movement of the material along the curve will cause the material to compact and densify against the conduit wall. This will squeeze out the already expanded air leaving the air and material substantially stratified. The material will occupy the same cross-sectional area as it travels downwardly, but the chamber area reduces, so that the air speed will increase as the lower portion of the upper chamber is reached. The increased air speed will tend to give added impetus to the material, so that it will enter the lower chamber moving rapidly and guided toward the dispensing valve. The intervening distance of travel of the material is so short that the material will be thrown with some force into the chambers of the dispensing valve, thus insuring a compact loading of the chambers. As the entrance end of the lower chamber in the conduit is of enlarged area, the air will again expand and its movement will be slowed. As the air and material have already been stratified by movement through the upper chamber, the separated air can move out through the slot 19 into the separator case and upward through screen 6 to the outlet hose 27. Most flotation particles of material in suspension in the air approaching slot 19 will be intercepted by lip 20 to fall back into the conduit. As all of the entraining air will not pass out through slot 19, that remaining will have its speed increased as it passes through the narrowing chamber. This will again have the effect of pushing the material along its path so that the material remains under the moving influence of the vehicle air until it is virtually in the dispensing valve. Due to the fact that the air volume in the conduit has been substantially reduced by exit of part of this air through slot 19, there will be no turbulence created as the remaining air rounds the bottom edge of the separator case back wall to travel upwardly to the screen. Here again, any fine particles remaining in suspension will be turned back by striking the baffles 23, 24 and 25.

5

By reason of the above described structure and operation, the dispensing chambers will be properly filled, without agitation or turbulence. The fact that the expansion chamber 41 has been provided to permit release of air under pressure trapped in the dispensing valve chambers will permit compact filling of the dispenser valve without the turbulence-creating spurts of air which would otherwise occur as each chamber opened to the entrance throat.

While in the above one practical embodiment of the invention has been disclosed, it will be understood that the precise details of structure shown and described are simply by way of illustration, and the invention may take other forms within the scope of the appended claims.

What is claimed is:

1. In apparatus for feeding granular material by suspension in a moving body of vehicle air, a separator for separating the vehicle air from the material being fed comprising, a suction case having spaced front, back and side walls and being open at the bottom, an inlet pipe for vehicle air and entrained material traversing the suction case, a conduit along one wall of the case having an inlet end communicating with the inlet pipe and an outlet end terminating at the open bottom of the case, said conduit having a back wall arranged at an acute angle to the axis of the inlet pipe and curving smoothly at the top toward the inlet pipe and across the path material will take in emerging from the inlet pipe to form a guide to change the direction of travel of material through the separator and set up a centrifugal force to cause the material to compact against and move along the said back wall, said inlet end of the conduit being of greater cross-sectional area than the inlet pipe to permit the vehicle air to expand and reduce its speed upon entry into the conduit, said conduit tapering inwardly to its mid-section to again increase the speed of air travel to give added impetus to movement of material along the back wall of the conduit, said conduit being widened below said taper to allow the air to again expand and reduce speed and tapering inwardly from the widened area to the outlet, said conduit having an exit slot in the widened

6

area at the conduit midsection communicating with the interior of the suction case to permit a part of the expanded air to escape from the conduit to the case, and said case having an air outlet located above the horizontal plane of the slot in the conduit.

2. Feed apparatus as claimed in claim 1 wherein the cross-sectional area of the suction case increases from the bottom toward the top.

3. Feed apparatus as claimed in claim 2 wherein baffles are arranged across the suction case below the air outlet to intercept flotation material particles rising in the suction case with air moving toward the air outlet, and a screen across the suction case above said baffles and below the air outlet.

4. Feed apparatus as claimed in claim 1, including a dispensing valve attached to the open bottom of the separator having an entrance throat with one wall forming a continuation of the back wall of the conduit, said valve having a housing opening to said throat and a rotor having a plurality of vanes defining dispensing chambers therebetween rotatably mounted in the housing, air inlet and outlet openings axially aligned at opposite sides of the valve housing at a point remote from said throat and being parallel to the axis of rotation of the rotor, and an expansion chamber having a mouth adjacent the wall of the throat forming a continuation of the conduit back wall to which the dispensing chambers may open prior to opening to said throat.

References Cited in the file of this patent

UNITED STATES PATENTS

858	Montgomery	July 28, 1838
1,385,870	Gieseler	July 26, 1921
2,230,425	Finnegan	Feb. 4, 1941
2,506,273	Linderoth	May 2, 1950
2,750,233	Yellot	June 12, 1956
2,757,049	Temple	July 31, 1956
2,858,212	Durant	Oct. 28, 1958

FOREIGN PATENTS

284,790	Switzerland	Aug. 15, 1952
---------	-------------	---------------