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AIR FLOW CONTROL FOR PNEUMATIC CLASSIFYING SYSTEM

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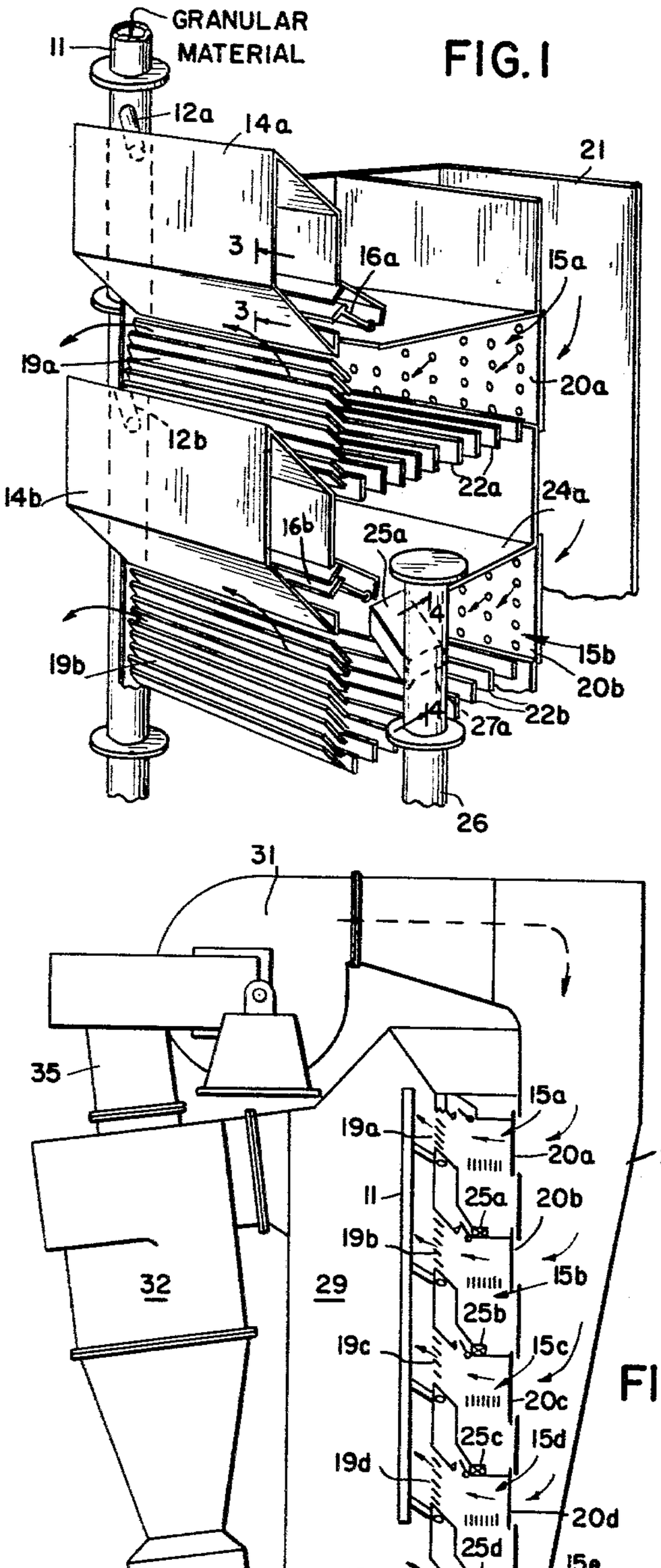

FIG. 1

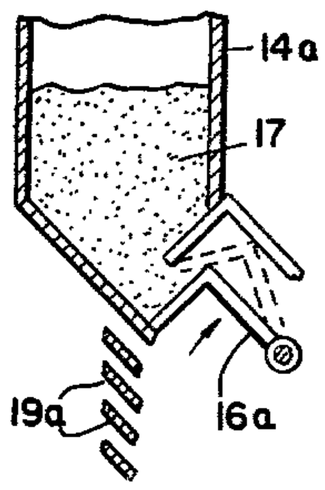

FIG. 3

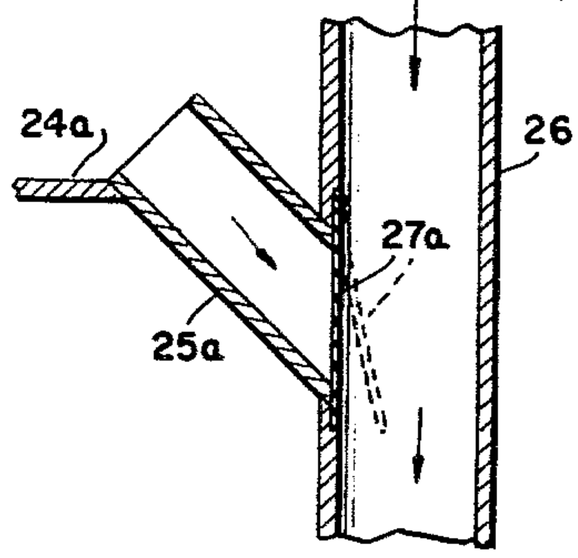

FIG. 4

FIG. 2

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AIR FLOW CONTROL FOR PNEUMATIC CLASSIFYING SYSTEM

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3 Claims. (Cl. 209—133)

This invention relates to the classification and collection of granular material, and, more particularly, to the classification and collection of granular material utilizing a flowing gas to withdraw relatively fine partcles of the material.

In industries in which a granular material forms a working product, it is oftentimes necessary to classify the material into various groupings of particularly sized particles. To ensure that any individual grouping contains particles only of a certain size, e.g., of a size greater than that of a predetermined reference particle, it is necessary that the classification process employed be adapted for fine control. Further, if a number of individual classifying units are to be utilized, each of which contributes to the same grouping of particles, it is necessary that the classification throughout the units be uniform.

The present invention is directed toward uniformly classifying and collecting granulur material, using any number of classifying units that are adapted to classify the material by employing a flow of gas therethrough. A resistance member is provided for each unit through which the gas, coming from a common source, must flow. The resistance to the flow of gas provided by each member is large with respect to the resistance to the flow within the classifying unit itself. Thus, the flow of gas through each of the units is determined by the associated resistance member alone. Since this flow determines the classification, and since the resistance members are chosen to provide equal flow resistances, a uniform classification throughout the units results, regardless of the distribution of the granular material.

The invention further contemplates a unique cut-off device positioned in the discharge pipes of all the classifying units to prevent an equalizing flow of gas to the units through a common outlet conduit. Such an equalizing flow would destroy the effects of the resistance members.

Although the invention has been described above in general terms, a better understanding of it may be obtained by consulting the following detailed description, which is to be read in conjunction with the appended drawing, in which:

FIG. 1 is a fragmentary view in perspective showing a pair of classifying units embodying the principles of the present invention;

FIG. 2 is a diagrammatic view of a classifying system employing the units shown in FIG. 1;

FIG. 3 is a fragmentary sectional view of a portion if the apparatus shown in FIG. 1 taken along the section line 3—3 of that figure and looking in the direction of the arrows, showing the details of a gate mechanism that regulates the flow of granular material to a classifying unit; and

FIG. 4 is a fragmentary sectional view of a portion of the apparatus shown in FIG. 1 taken along the section line 4—4 of that figure and looking in the direction of the arrows, showing the details of a gas seal flap.

Referring to FIG. 1, a granular material from a source (not shown) is applied to an input pipe **11**. The material flows through the pipe **11** and into a series of input lines **12***a*, **12***b* . . . , only two of which are shown in the figure, that are coupled to input sections **14***a* and **14***b* of similarly constructed classifying units **15***a* and **15***b*, respectively.

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Referring by way of example to the unit **15***a*, the granular material flowing into the input section **14***a* passes through an adjustable gate **16***a*. As shown in FIG. 3, the gate **16***a* is capable of being maintained in a plurality of positions intermediate the open and closed positions shown in dotted and full lines, respectively. During classification the gate **16***a* is retained at least partially open, and the granular material, as shown at **17** in the input section **14***a*, passes through the gate to form a thin curtain of material flowing in front of a plurality of baffle plates **19***a*. At all times during classification there should be enough granular material in the section **14***a* to ensure that a gas seal is formed in the gate **16***a*.

Referring again to FIG. 1, a flowing gas from a gas conduit **21** is introduced into the classifiers **15***a* and **15***b* through a pair of perforated resistance plates **20***a* and **20***b*, respectively, as shown by the arrows. Again using the classifier **15***a* as an example, the gas flowing through the perforated resistance plate **20***a* sweeps through the curtain of granular material formed in front of the baffle plates **19***a* and carries fine particles of the material through the plates to the apparatus shown in FIG. 2.

The perforated resistance plates **20***a* and **20***b* shown in detail in FIG. 1 are constructed to provide gas flow resistances that are large with respect to the gas flow resistances provided by the granular material within the classifying units. Accordingly, the flow of gas through each unit is dependent almost entirely upon the flow resistance of the associated perforated resistance plate. It is this flow that determines the degree of classification within a unit. Thus, since the classifying units have equal cross-sectional dimensions and since the perforated plates are constructed to provide equal flow resistances, the rates of gas flow through the classifying units are equal, thereby providing classifications throughout the units that are uniform and not dependent upon the distribution of granular material.

The granular material within the classifying units **15***a* and **15***b* of FIG. 1, not swept through the baffile plates **19***a* and **19***b*, passes downwardly through a series of horizontally positioned baffle plates **22***a* and **22***b*, respectively, provided in the units to eliminate turbulences. Referring again to the classifier **15***a* as an example, the granular material passing through the baffle plates **22***a* impinges upon a plate **24***a* and passes therefrom into a discharge member **25***a*.

Referring to FIG. 4, the discharge member **25***a* leads into a common outlet conduit **26** through a flexible flap **27***a*. When no granular material flows through the discharge member, the flap **27***a* is in the position shown in full lines, thereby closing off the discharge member from the outlet conduit **26**. When granular material passes through the discharge member **25***a*, however, the flap **27***a* is forced to the open position shown in dotted lines, and granular material passes into the outlet conduit. In this fashion the flap **27***a* and the flap **27***b* (not shown) prevent the classifying units **15***a* and **15***b* from being coupled together through the common outlet conduit **26** when no granular material is passing through either one of the associated discharge members. Such a coupling between units would equalize pressures throughout the units and destroy the effects of the perforated resistance plates **20***a* and **20***b*. For this same reason, i.e., to prevent the equalization of pressures throughout the units, the granular material is kept at a level in the input sections **14***a* and **14***b* sufficientlc high to ensure that no gas leaks through the gates **16***a* and **16***b*.

FIG. 2 shows a system for classifying and collecting granular material. The system comprises classifying units **15***a* through **15***e*, which include associated per-

forated resistance plates 20*a* through 20*e*, respectively. The system is not limited, of course, to the number of units shown. Each of the units 15*a* through 15*e* operates as described above, and gas entrained fine particles of granular material pass through the baffle plates 19*a* through 19*e* and are discharged into a chamber 29. Most of the fine particles of granular material drop downwardly and are passed out of the chamber 29 through an outlet 30. The gas, with the remaining portion of the fine particles of granular material, is drawn by a fan arrangement 31 into another chamber 32 out of which the remainder of the fine particles fall through an outlet 34. The gas, drawn by the fan 31, passes upwardly through a conduit 35 and through the fan into the gas conduit 21 to be reapplied to the classifying units 15*a* through 15*e*.

Coarse particles of granular material, not passing through the baffle plates 19*a* through 19*d*, pass via the discharge members 25*a* through 25*d* into the outlet conduit 26 (shown only in FIGURE 1), which leads into a coarse material outlet 36. Coarse particles from the classifying unit 15*e* drop directly into the coarse material outlet.

A unique arrangement for providing a uniform classification of granular material throughout a plurality of classifying units has been described. This arrangement is, of course, subject to modifications which will depart from the exact form of the apparatus shown, but which will, nonetheless, be truly embraced within the inventive concepts involved. For this reason, such modifications should be deemed to be encompassed by the following claims which are set forth to define the invention.

What is claimed is:

1. A classifying and collecting system for granular material, comprising means for applying a granular material to a plurality of classifying units each of which utilizes a separate flow of gas therethrough to classify the granular material, each of the classifying units having a gas input with a perforated plate positioned therein through which gas must flow to enter the classifying unit, the perforated plates all having substantially equal resistances to the flow of gas therethrough, each of said resistances being large with respect to the gas flow resistance provided by the granular material within each of the classifying units to provide a flow of gas through each unit dependent almost entirely upon the flow resistance of the perforated plate in the input of said unit, a gas outlet coupled to each of the classifying units, a conduit member coupled to all of the gas inputs, means for applying a flowing gas to the conduit member to provide for the passage of substantially equal portions of the flowing gas through the perforated plates and into the classifying units to carry away fine particles of the granular material through the gas outlet, means for collecting the fine particles of the granular material carried by the gas through the gas outlet, and means for collecting from each of the classifying units coarse particles of the granular material not carried away by the gas flowing through the classifying units.

2. Apparatus as recited in claim 1 wherein the means for collecting the coarse particles of granular material comprises a common outlet conduit, a plurality of discharge pipes each of which couples a different classifying unit to the outlet conduit for conveying the coarse particles of granular material from the units to the conduit, and means for closing off each discharge pipe when no granular material is flowing therethrough, thereby preventing a flow of gas from one classifying unit to another.

3. Apparatus as recited in claim 2, wherein the closing off means comprises a plurality of flexible flaps each of which is positioned across a different discharge pipe and each of which is biased in a position to close off its associated pipe, the positioning of each flap being such that a flow of granular material through the associated discharge pipe urges the flap away from its biased position, thereby opening the discharge pipe into the common outlet conduit and allowing the granular material to flow into the conduit.

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