

Description

The invention relates generally to a solids blending apparatus as described in the pre-characterizing part of claim 1 and as known from US-A-4,068,828.

It is often necessary to blend or homogenize hopper car- or truck-size batches of particulate materials or solids in order to produce uniform mixtures. In the plastics industry, for example, slight variations in properties of polymers may occur in different production runs. Blending of the pellets made in such runs is important to insure products of uniform quality. As disclosed in U.S. Patents No. 3,216,629, 3,275,303, 3,456,922 and 4,068,828, efficient blending of particulate materials can be accomplished by the use of apparatus which comprises a vessel having a plurality of vertically extending conduits therein. The solids to be blended are positioned within the vessel surrounding the conduits. The conduits are provided with openings through which the particles enter the conduits to flow by gravity downwardly through the conduits to a common collection zone.

DE-A-2 819 726 describes a gravity blender. This blender has conduits connecting the interior of a vessel with the discharge end of the vessel. A recycle conduit is provided.

While blending apparatus of the general type disclosed in the foregoing patents has been found to be quite effective, it has been found to be desirable to obtain improved sampling and blending of particulate materials or solids from the lower region of such blending apparatus.

The present invention resides in a blending apparatus as defined in claim 1. Preferred embodiments are defined in the dependent claims.

In accordance with the present invention, improved blenders of the general type described above are provided. The blenders of the present invention employ a baffle which blocks a substantial amount of communication between the upper region of the blender vessel and the lower region of the blender vessel. The lower region of the blender vessel is defined by a downwardly converging, preferably frustoconically shaped, bottom wall terminating in a solids outlet at its lowermost portion. The baffle comprises an inverted generally conically shaped portion, which portion is spaced inwardly from the bottom wall to form a downwardly converging annular passage therebetween which communicates between the upper region of the vessel and the solids outlet. At least one drain conduit communicates between a conduit which is in communication with a sampling point in the upper region of the vessel and a corresponding opening in the bottom wall, the drain conduit being adapted to convey solids by gravity therethrough from a location in the lower region of the vessel to the conduit.

It is an object of the present invention to provide improved blender apparatus for sampling and blending particulate materials or solids.

It is another object of the invention to provide an

improved method of sampling and blending particulate materials or solids.

It is yet another object of the present invention to provide method and apparatus for improving the sampling, blending and flow of particulate materials or solids from the lower region of a blender vessel.

It is still another object of the present invention to provide improved method and apparatus for sampling and blending particulate materials or solids which method and apparatus are reliable and economical in operation.

Other aspects, advantages, and objects of the present invention will become readily apparent to those skilled in the art upon further study of the instant specification, claims and drawings in which:

Fig. 1 is a side elevation view of one embodiment of the present invention with portions thereof broken away to illustrate the lower portion of the blender in vertical cross section;

Fig. 2 is a horizontal cross section view taken along line 2-2 of Fig. 1;

Fig. 3 is a horizontal cross section view taken along line 3-3 of Fig. 1;

Fig. 4 is a horizontal cross section view similar to Fig. 3 illustrating another embodiment of the present invention;

Fig. 5 is a partial side elevation view of another embodiment of the present invention;

Fig. 6 is a partial vertical cross section view showing interior construction details of the embodiment of Fig. 5;

Fig. 7 is an enlarged detail cross section view illustrating a form of interconnection between conduits of generally rectangular cross section; and

Fig. 8 is an enlarged detail cross section view illustrating a form of interconnection between conduits of generally circular cross section.

Referring now to the drawings, and to Figs. 1 and 2 in particular, there is illustrated therein an upright, generally cylindrical vessel 10 comprising a generally cylindrical sidewall 12, a top closure 14, and a downwardly converging, generally frustoconically shaped bottom wall or closure 16. The top closure 14 is provided with a solids inlet or filling port 18, and the bottom wall or closure 16 is provided with a solids outlet or withdrawal pipe 20 which communicates with the convergent lower end portion of the bottom wall 16. The vessel 10 can be suitably supported in a vertical position by means of a plurality of legs 22. The sidewall 12 and top closure 14 define and enclose the upper region of the vessel 10, while the bottom wall 16 defines and encloses the lower region of the vessel 10.

A plurality of conduits 24, 26, 28, 30, 32 and 34 are positioned in the upper region of the vessel 10 by means of suitable supports 36 so that the conduits are secured in generally vertical mutually parallel relation within the vessel. The upper end portion of each of the conduits is provided with at least one opening 37 therein providing communication between the interior of the conduit and the upper region of the vessel 10. The lower end



portion of each of the conduits extends downwardly through the lower region of the vessel 10 and communicates with the corresponding opening 38 in the bottom wall 16, which opening 38 in turn communicates with the upper end portion 40 of a corresponding first inclined conduit 42 which communicates at the lower end portion 44 thereof with the interior of an outlet conduit 46 which surrounds and is concentrically aligned with the solids outlet 20.

As shown in Fig. 3, at least one, and preferably a plurality of openings 48 are located in the bottom wall 16 of the vessel 10 intermediate the upper region of the vessel and the solids outlet 20. In the embodiment shown in Fig. 3, the openings 48 are employed with each opening 48 being preferably substantially equidistant from the next adjacent openings 38. Each opening 48 provides flow communication between the interior of the lower region of the vessel 10 and the upper end portion 50 of a corresponding drain conduit 52. The lower end portion 54 of each drain conduit 52 is in flow communication with a corresponding first inclined conduit 42.

Each drain conduit 52 provides means for conveying particulate materials or solids by gravity therethrough from a location in the lower region of the vessel 10 via a corresponding opening 48 to a corresponding first inclined conduit 42. The openings 48 can all be spaced the same distance downwardly along the bottom wall 16 from the sidewall 12 or upper region of the vessel 10, or, alternately, each opening 48 can be spaced a distance downwardly along the bottom wall 16 from the sidewall 18 or upper region of the vessel 10 which is different from the distance by which at least one of the other openings 48 is spaced downwardly along the bottom wall 16 from the sidewall 12 or upper region of the vessel 10, as shown in Fig. 3.

It is also deemed preferable to include a baffle 56 positioned within a corresponding first inclined conduit 42 adjacent and upstream of the point of communication between the corresponding first inclined conduit 42 and the corresponding drain conduit 52, as shown in Fig. 3, to provide a region of reduced cross sectional area in the first inclined conduit 42 upstream of the point of communication with the corresponding drain conduit 52. This region of reduced cross sectional area is less than the cross sectional area in the first inclined conduit 42 at and downstream of the point of communication between the first inclined conduit 42 and the corresponding drain conduit 52. The use of a baffle 56 will permit the continuous introduction of a stream of particulate materials or solids from the corresponding drain conduit 52 into the corresponding first inclined conduit 42 as the particulate materials or solids are passing downwardly through the vessel 10.

The embodiment of Fig. 3 illustrates a vessel 10 which is provided with three openings 48 and three corresponding drain conduits 52 which communicate with alternate first inclined conduits 42. Fig. 4 illustrates another embodiment

wherein each first inclined conduit 42 communicates with three drain conduits 52, each drain conduit 52, in turn, communicating with a corresponding opening 48 in the bottom wall 16 and providing means for conveying particulate materials or solids therethrough from a location in the lower region in the vessel 10 to the corresponding first inclined conduit.

In the embodiments illustrated in both Fig. 3 and Fig. 4, the conduits 42 and 52 are constructed with generally rectangular cross sections, and conveniently employ the exterior surface of the bottom wall 16 to define the top wall of each of the conduits 42 and 52. Fig. 7 illustrates a typical junction between the generally rectangular conduits of 42 and 52, as shown in Fig. 4, and further shows the preferred locations of the baffles 56 at the points of communication between the drain conduits 52 and the corresponding first inclined conduit 42 as described above.

Referring again to Figs. 1 and 2, a baffle 58 is disposed within the vessel 10 between the upper region and the lower region and blocks a substantial amount of communication between the upper and the lower regions. The baffle 58 comprises a first generally conically shaped portion 60 with the apex 62 thereof pointed upwardly, and an inverted second generally conically shaped portion 64 with the apex 66 thereof pointed downwardly. The second generally conically shaped portion 64 will be understood to include within its definition an inverted frustoconically shaped portion with the apparent apex thereof pointed downwardly. The second generally conically shaped portion 64 is positioned beneath and fixedly secured to the first generally conically shaped portion 60 and is spaced from the bottom wall 16 of the vessel 10 to form a downwardly converging annular passage 68 therebetween, which passage communicates between the upper region and the solids outlet 20 of the vessel 10. It is presently preferred that the apical angles of the first and second conically shaped portions 60 and 64, as well as the apical angle of the frustconically shaped bottom wall 16, are all approximately 60°, although smaller or larger apical angles in the range from about 40° to about 80° can be used depending upon the flow characteristics of the particulate materials being blended.

The configuration of the baffle 58 and its position relative to the upper region and the bottom wall 16 of the vessel 10 are advantageous in that they serve to decrease the inventory of particulate materials or solids below the baffle 58 in the annular passage 68 where the only exits are provided by the solids outlet 20 and the additional openings 48 in the bottom wall 16. The baffle 58 provides the additional advantage of preventing or substantially reducing the occurrence of tunneling or "rat-holing" of poorly flowing particulate materials and the occurrence of arching of particulate materials over the solids outlet 20 by decreasing the head of particulate materials or solids on the outlet.

As illustrated in Fig. 1, the vessel 10 can be filled

with particulate materials or solids to be blended by means of a conduit 70 which communicates with the solids inlet 18. A conduit 72, having control means such as a rotary star valve 74 interposed therein, is connected to outlet conduit 46 to withdraw blended particulate materials or solids. Conduit 72 is connected to a withdrawal conduit 76 in which a valve 78 is interposed. In some operations it may be desirable to recycle blended particulate materials or solids from the conduit 72 back to the upper region of the vessel 10. This can be accomplished by means of a conduit 80, having a valve 82 interposed therein, which extends from conduit 72 to the solids inlet 18. A conduit 84, having a valve 86 interposed therein, extends from a source of pneumatic pressure, not shown, to the inlet of conduit 80. The blended particulate materials or solids can thus be elevated and reintroduced into the vessel 10 via conduit 80 by means of pressurized air from the source of pneumatic pressure. The top closure 14 can be provided with a vent 88 to permit the transport air entering from the conduit 80 to be exhausted from the vessel 10.

In a first method of operation in accordance with this invention, the rotation of valve 74 is stopped to block flow through the valve 74 and the vessel 10 is filled with particulate materials or solids to be blended via the conduit 70. The valve 74 is then rotated to allow flow therethrough and the valve 78 is opened to permit the particulate materials or solids to drain by gravity from the vessel 10 to the withdrawal conduit 76. Valve 86 is closed at this time so that no particulate materials or solids are recycled. In another embodiment of this invention, the vessel 10 can be operated in the same manner except that blending is accomplished continuously with particulate materials or solids to be blended being introduced through the solids inlet 18 and withdrawn through conduit 72 at the same time. In still another method of operation, a part or all of the blended particulate materials or solids can be recycled through conduit 80 back to the solids inlet 18 for further blending. Even in the single pass batch blending procedure first described above, it is usually desirable to recycle a part of the blend of particulate materials or solids initially withdrawn from the outlet conduit 46.

The construction of the conduits 24, 26, 28, 30, 32 and 34 can be any suitable construction which will achieve desired blending of particulate materials or solids in the vessel 10. Suitable conduit construction is disclosed in U.S. Patent No. 4,068,828 issued to the inventor of the instant invention and assigned to Phillips Petroleum Company, and the conduit construction disclosed in this patent is incorporated by reference herein. It should be noted that the baffle means disclosed in U.S. Patent No. 4,068,828 to reduce the flow of particulate materials past the openings in the conduits are optional in the apparatus of the present invention.

Referring now to Figs. 5 and 6, an alternate embodiment of the vessel of the present inven-

tion is disclosed therein and is generally designated by the reference character 10a. The vessel 10a differs from the vessel 10 in that slightly modified first inclined conduits 42a and drain conduits 52a of substantially circular cross section are employed in the construction of the vessel 10a. The upper end portion 40a of each of the first inclined conduits 42a is in flow communication with the lower end portion of a corresponding one of the slightly modified conduits 24a, 26a, 28a, 30a, 32a and 34a. The lower end portion 44a of each of the first inclined conduits 42a is in flow communication with a slightly modified outlet conduit 46a. Each modified drain conduit 52a, only one shown, is in full communication at its upper end portion 50a with a corresponding opening 48 in the bottom wall or closure 16 of the vessel 10a. The lower end portion 54a of each drain conduit 52a is in flow communication with a corresponding modified first inclined conduit 42a, as illustrated in Figs. 5 and 8. It is also deemed preferable, as further shown in Fig. 8, to include a baffle 56a, positioned within a corresponding first inclined conduit 42a adjacent and upstream of the point of communication between the corresponding first inclined conduit 42a and the corresponding drain 52a to provide a region of reduced cross sectional area in the first inclined conduit 42a upstream of the point of communication with the corresponding drain conduit 52a which is less than the cross sectional area in the first inclined conduit 42a at and downstream of the point of communication. The use of the baffle 56a will permit the continuous introduction of a stream of solids from the corresponding drain conduit 52a into the corresponding first inclined conduit 42a as solids are passed downwardly through the vessel 10a. The remaining structure of the vessel 10a is identical to and functions in the same manner as the previously described vessel 10. It will be understood that the various schemes for location of the drain conduits 52 and openings 48 described above and shown in Figs. 3 and 4 are equally applicable to the slightly modified drain conduits 52a and openings 48 of the slightly modified vessel 10a.

From the foregoing detailed description, it will be seen that the apparatus and method of use described and illustrated herein eminently achieves the objects of the present invention. Changes may be made in the combination and arrangement of parts or elements is heretofore set forth in the specification and shown in the drawings without departing from the spirit and scope of the invention as defined in and limited only by the following claims.

Claims

1. Solids blending apparatus comprising:
 - a vessel (10) having a solids inlet (18) in an upper region thereof and solids outlet means (20, 46) in a lower region thereof, the lower region being defined by a downwardly converging

with particulate materials or solids to be blended by means of a conduit 70 which communicates with the solids inlet 18. A conduit 72, having control means such as a rotary star valve 74 interposed therein, is connected to outlet conduit 46 to withdraw blended particulate materials or solids. Conduit 72 is connected to a withdrawal conduit 76 in which a valve 78 is interposed. In some operations it may be desirable to recycle blended particulate materials or solids from the conduit 72 back to the upper region of the vessel 10. This can be accomplished by means of a conduit 80, having a valve 82 interposed therein, which extends from conduit 72 to the solids inlet 18. A conduit 84, having a valve 86 interposed therein, extends from a source of pneumatic pressure, not shown, to the inlet of conduit 80. The blended particulate materials or solids can thus be elevated and reintroduced into the vessel 10 via conduit 80 by means of pressurized air from the source of pneumatic pressure. The top closure 14 can be provided with a vent 88 to permit the transport air entering from the conduit 80 to be exhausted from the vessel 10.

In a first method of operation in accordance with this invention, the rotation of valve 74 is stopped to block flow through the valve 74 and the vessel 10 is filled with particulate materials or solids to be blended via the conduit 70. The valve 74 is then rotated to allow flow therethrough and the valve 78 is opened to permit the particulate materials or solids to drain by gravity from the vessel 10 to the withdrawal conduit 76. Valve 86 is closed at this time so that no particulate materials or solids are recycled. In another embodiment of this invention, the vessel 10 can be operated in the same manner except that blending is accomplished continuously with particulate materials or solids to be blended being introduced through the solids inlet 18 and withdrawn through conduit 72 at the same time. In still another method of operation, a part or all of the blended particulate materials or solids can be recycled through conduit 80 back to the solids inlet 18 for further blending. Even in the single pass batch blending procedure first described above, it is usually desirable to recycle a part of the blend of particulate materials or solids initially withdrawn from the outlet conduit 46.

The construction of the conduits 24, 26, 28, 30, 32 and 34 can be any suitable construction which will achieve desired blending of particulate materials or solids in the vessel 10. Suitable conduit construction is disclosed in U.S. Patent No. 4,068,828 issued to the inventor of the instant invention and assigned to Phillips Petroleum Company, and the conduit construction disclosed in this patent is incorporated by reference herein. It should be noted that the baffle means disclosed in U.S. Patent No. 4,068,828 to reduce the flow of particulate materials past the openings in the conduits are optional in the apparatus of the present invention.

Referring now to Figs. 5 and 6, an alternate embodiment of the vessel of the present inven-

tion is disclosed therein and is generally designated by the reference character 10a. The vessel 10a differs from the vessel 10 in that slightly modified first inclined conduits 42a and drain conduits 52a of substantially circular cross section are employed in the construction of the vessel 10a. The upper end portion 40a of each of the first inclined conduits 42a is in flow communication with the lower end portion of a corresponding one of the slightly modified conduits 24a, 26a, 28a, 30a, 32a and 34a. The lower end portion 44a of each of the first inclined conduits 42a is in flow communication with a slightly modified outlet conduit 46a. Each modified drain conduit 52a, only one shown, is in full communication at its upper end portion 50a with a corresponding opening 48 in the bottom wall or closure 16 of the vessel 10a. The lower end portion 54a of each drain conduit 52a is in flow communication with a corresponding modified first inclined conduit 42a, as illustrated in Figs. 5 and 8. It is also deemed preferable, as further shown in Fig. 8, to include a baffle 56a, positioned within a corresponding first inclined conduit 42a adjacent and upstream of the point of communication between the corresponding first inclined conduit 42a and the corresponding drain 52a to provide a region of reduced cross sectional area in the first inclined conduit 42a upstream of the point of communication with the corresponding drain conduit 52a which is less than the cross sectional area in the first inclined conduit 42a at and downstream of the point of communication. The use of the baffle 56a will permit the continuous introduction of a stream of solids from the corresponding drain conduit 52a into the corresponding first inclined conduit 42a as solids are passed downwardly through the vessel 10a. The remaining structure of the vessel 10a is identical to and functions in the same manner as the previously described vessel 10. It will be understood that the various schemes for location of the drain conduits 52 and openings 48 described above and shown in Figs. 3 and 4 are equally applicable to the slightly modified drain conduits 52a and openings 48 of the slightly modified vessel 10a.

From the foregoing detailed description, it will be seen that the apparatus and method of use described and illustrated herein eminently achieves the objects of the present invention. Changes may be made in the combination and arrangement of parts or elements is heretofore set forth in the specification and shown in the drawings without departing from the spirit and scope of the invention as defined in and limited only by the following claims.

Claims

1. Solids blending apparatus comprising:
a vessel (10) having a solids inlet (18) in an upper region thereof and solids outlet means (20, 46) in a lower region thereof, the lower region being defined by a downwardly converging



generally frustoconically shaped bottom wall (16); a baffle (58) disposed within said vessel between said upper region and said lower region, said baffle blocking a substantial amount of communication between said upper and lower regions, said baffle comprising a first generally conically shaped portion (60) with the apex (62) thereof pointed upwardly and an inverted second generally conically shaped portion (64), said second generally conically shaped portion being positioned beneath said first generally conically shaped portion and spaced from the bottom wall (16) of said vessel (10) to form a downwardly converging annular passage (68) therebetween communicating between said upper region and said solids outlet means (20, 46);

a plurality of conduits (24, 26, 28, 30, 32, 34) each positioned within said vessel (10) so as to extend in a generally vertical direction downwardly from said upper region past said baffle (58) through said lower region and through said bottom wall (16), each of said conduits (24, 26, 28, 30, 32, 34) having at least one first opening (37) therein in said upper region to permit solids in said upper region to enter the conduit and flow by gravity downwardly toward said lower region;

first inclined conduit means (42) communicating between the lower end of each of said conduits (24, 26, 28, 30, 32, 34) and said solids outlet means (20, 46) for conveying solids by gravity therethrough from each of said conduits to said solids outlet means;

characterized by at least one drain conduit means (52) communicating between a corresponding first inclined conduit means (42) and a corresponding opening (48) in said bottom wall intermediate said upper region and said solids outlet means for conveying solids by gravity therethrough from a location in said lower region to said corresponding first inclined conduit means (42); said opening (48) in said bottom wall being located circumferentially intermediate said corresponding first conduit means (42) and a next adjacent first conduit means (42).

2. Solids blending apparatus in accordance with claim 1 characterized further to include at least one second drain conduit means (52) communicating between said corresponding first conduit means (42) and a corresponding second opening (48) in said bottom wall intermediate said upper region and said solids outlet means (20) for conveying solids by gravity therethrough from a second location in said lower region to said corresponding first conduit means (42).

3. Solids blending apparatus in accordance with claim 2 wherein said at least one drain conduit means (52) communicates with the corresponding opening (48) in said bottom wall at a location intermediate said corresponding first conduit means (42) and one next adjacent first conduit means (42) and said at least one second drain conduit means communicates with a corresponding second opening in said bottom wall at a location intermediate said corre-

sponding first conduit means and another next adjacent first conduit means.

4. Solids blending apparatus in accordance with claim 3 wherein the corresponding opening (48) in said bottom wall is located nearer to said upper region than is the corresponding second opening in said bottom wall.

5. Solids blending apparatus in accordance with claim 3 characterized further to include at least three of said conduits (24, 26, 28, 30, 32, 34).

6. Solids blending apparatus in accordance with one of the preceding claims characterized further to include at least three of said conduits (24, 26, 28, 30, 32, 34), at least three of said first conduit means (42) each communicating with a corresponding one of said conduits and one of said drain conduit means (52) communicating with each one of at least two of said first conduit means (42), wherein each of said drain conduit means (52) communicates with said corresponding opening (48) in said bottom wall at a location spaced a distance from said upper region which is different from the distance between the location of the at least one other opening (48) and the upper region.

7. Solids blending apparatus in accordance with claim 6 characterized further to include six of said conduits (24, 26, 28, 30, 32, 34), six of said first conduit means (42) and three drain conduit means (52) communicating with corresponding alternate first conduit means (42).

8. Solids blending apparatus in accordance with claim 7 characterized further to include baffle means (56) located within each of said corresponding alternate first conduit means (42) adjacent and upstream of the point of communication with the corresponding drain conduit means (52) for providing a region of reduced cross sectional area in said first conduit means (42) upstream of the point of communication with the corresponding drain conduit means (52) which cross sectional area is less than the cross sectional area in said corresponding alternate first conduit means (42) at a downstream of the point of communication with the corresponding drain conduit means (52).

9. Solids blending apparatus in accordance with claim 1 characterized further to include baffle means (56) located within each of said corresponding first conduit means (42) adjacent and upstream of the point of communication with the corresponding drain conduit means (52) for providing a region of reduced cross sectional area in said first conduit means (42) upstream of the point of communication with the corresponding drain conduit means (52) which cross sectional area is less than the cross sectional area in said corresponding first conduit means (42) at a downstream of the point of communication with the corresponding drain conduit means (52).

10. Solids blending apparatus in accordance with claim 1 wherein the cross sectional area within each said corresponding first conduit



means (42) adjacent and upstream of the point of communication with the corresponding drain conduit means (52) is less than the cross sectional area within said corresponding first conduit means (42) at a downstream of the point of communication with the corresponding drain conduit means (52).

Patentansprüche

1. Feststoff-Mischvorrichtung mit:

einem Kessel 10, der einen Feststoffeinlaß (18) in einem oberen Bereich dessen und Feststoffauslaß-Einrichtungen (20, 46) in einem unteren Bereich dessen hat, wobei der untere Bereich durch eine nach unten zusammenlaufende, im allgemeinen kegelförmige untere Wand (16) definiert ist;

einer Prallfläche (58), die in dem Kessel zwischen dem oberen Bereich und dem unteren Bereich angeordnet ist, wobei die Prallfläche eine wesentliche Menge der Verbindung zwischen dem oberen und unteren Bereich blockiert, und die Prallfläche einen ersten, im allgemeinen kegelförmigen Teil (60) aufweist, dessen Spitze (62) aufwärts zeigt, und einen umgekehrten zweiten, im allgemeinen kegelförmigen Teil (64), wobei der zweite, im allgemeinen kegelförmige Teil unterhalb des ersten, im allgemeinen kegelförmigen Teil angeordnet und von der unteren Wand (16) des Kessels (10) beabstandet ist, um einen nach unten zusammenlaufenden ringförmigen Durchgang (68) dazwischen zu bilden, der zwischen dem oberen Bereich und den Feststoffauslaß-Einrichtungen (20, 46) verbindet;

einer Vielzahl von Leitungen (24, 26, 28, 30, 32, 34), die jeweils in dem Kessel (10) so angeordnet sind, daß sie sich in einer im allgemeinen vertikalen Richtung abwärts von dem oberen Bereich hinter der Prallfläche (58) durch den unteren Bereich und durch die untere Wand (16) hindurch erstrecken, wobei jede der Leitungen (24, 26, 28, 30, 32, 34) wenigstens eine erste Öffnung (37) darin in dem oberen Bereich hat, um Feststoffen in dem oberen Bereich zu ermöglichen, die Leitung zu erreichen und durch Schwerkraft abwärts zu dem unteren Bereich zu strömen;

einer ersten geeigneten Leitungseinrichtung (42), die zwischen dem unteren Ende jeder der Leitungen (24, 26, 28, 30, 32, 34) und den Feststoffauslaß-Einrichtungen (20, 46) verbindet, um Feststoffe durch Schwerkraft hindurch von jeder der Leitungen zu den Feststoffauslaß-Einrichtungen zu leiten;

gekennzeichnet durch wenigstens eine Abfuhrleistungs-Einrichtung (52), die zwischen einer entsprechenden ersten geeigneten Leitungseinrichtung (42) und einer entsprechenden Öffnung (48) in der unteren Wand zwischen dem oberen Bereich und den Feststoffauslaß-Einrichtungen verbindet, um Feststoffe durch Schwerkraft hindurch von einer Stelle in dem unteren Bereich zu der entsprechenden ersten geeigneten Leitungseinrichtung (42) zu leiten; wobei die Öffnung (48) in der unteren Wand umfänglich zwischen der

entsprechenden ersten Leitungseinrichtung (42) und einer nächsten benachbarten ersten Leitungseinrichtung (42) angeordnet ist.

2. Feststoff-Mischvorrichtung gemäß Anspruch 1, ferner gekennzeichnet durch wenigstens eine zweite Abfuhrleistungs-Einrichtung (52), die zwischen der entsprechenden ersten Leitungseinrichtung (42) in einer entsprechenden zweiten Öffnung (48) in der unteren Wand zwischen dem oberen Bereich und den Feststoffauslaß-Einrichtungen (20) verbindet, um Feststoffe durch Schwerkraft hindurch von einer ersten Stelle in dem unteren Bereich zu der entsprechenden ersten Leitungseinrichtung (42) zu leiten.

3. Feststoff-Mischvorrichtung gemäß Anspruch 2, wobei wenigstens eine Abfuhrleistungs-Einrichtung (52) mit der entsprechenden Öffnung (48) in der unteren Wand an einer Stelle zwischen der entsprechenden ersten Leitungseinrichtung (42) und einer nächsten benachbarten ersten Leitungseinrichtung (42) verbindet und wenigstens eine zweite Abfuhrleistungs-Einrichtung mit einer entsprechenden zweiten Öffnung in der unteren Wand an einer Stelle zwischen der entsprechenden ersten Leitungseinrichtung und einer weiteren nächsten benachbarten, ersten Leitungseinrichtung verbindet.

4. Feststoff-Mischvorrichtung gemäß Anspruch 3, wobei die entsprechende Öffnung (48) in der unteren Wand näher an dem oberen Bereich gelegen ist als die entsprechende zweite Öffnung in der unteren Wand.

5. Feststoff-Mischvorrichtung gemäß Anspruch 3, ferner gekennzeichnet durch wenigstens drei der Leitungen (24, 26, 28, 30, 32, 34).

6. Feststoff-Mischvorrichtung gemäß einem der vorhergehenden Ansprüche, ferner gekennzeichnet durch wenigstens drei der Leitungen (24, 26, 28, 30, 32, 34), wobei wenigstens drei der ersten Leitungseinrichtungen (42) jeweils mit einer entsprechenden der Leitungen und einer der Abfuhrleistungs-Einrichtungen (52) mit jeder von wenigstens zwei der ersten Leitungseinrichtungen (42) verbinden, wobei jede der Abfuhrleistungs-Einrichtungen (52) mit der entsprechenden Öffnung (48) in der unteren Wand an einer Stelle verbindet, die mit einem Abstand vom dem oberen Bereich beabstandet ist, der von dem Abstand zwischen der Stelle von wenigstens einer anderen Öffnung (48) und dem oberen Bereich verschieden ist.

7. Feststoff-Mischvorrichtung gemäß Anspruch 6, ferner gekennzeichnet durch sechs der Leitungen (24, 26, 28, 30, 32, 34), wobei sechs der ersten Leitungseinrichtungen (42) und drei Abfuhrleistungs-Einrichtungen (52) mit entsprechenden abwechselnden, ersten Leitungseinrichtungen (42) verbinden.

8. Feststoff-Mischvorrichtung gemäß Anspruch 7, ferner gekennzeichnet durch Prallfläche-Einrichtungen (56), die in jeder der entsprechenden abwechselnden, ersten Leitungseinrichtungen (42) in der Nähe und aufwärts vom Verbindungspunkt mit einer entsprechenden Abfuhrleistungs-Einrichtung (52) gelegen sind, um einen Bereich



von verminderter Querschnittsfläche in den ersten Leitungseinrichtungen (42) aufwärts vom Verbindungspunkt mit den entsprechenden Abführleistungs-Einrichtungen (52) zu schaffen, welche Querschnittsfläche kleiner als die Querschnittsfläche in den entsprechenden abwechselnden, ersten Leitungseinrichtungen (42) an und abwärts vom Verbindungspunkt mit den entsprechenden Abführleistungs-Einrichtungen (52) ist.

9. Feststoff-Mischvorrichtung gemäß Anspruch 1, ferner gekennzeichnet durch eine Prallfläche-Einrichtung (56), die in jeder der entsprechenden ersten Leitungseinrichtungen (42) in der Nähe und aufwärts vom Verbindungspunkt mit den entsprechenden Abführleistungs-Einrichtungen (52) gelegen ist, um einen Bereich von verminderter Querschnittsfläche in den ersten Leitungseinrichtung (42) aufwärts vom Verbindungspunkt mit den entsprechenden Abführleistungs-Einrichtungen (52) zu schaffen, welche Querschnittsfläche kleiner ist als die Querschnittsfläche in den entsprechenden ersten Leitungseinrichtungen (42) an und abwärts vom Verbindungspunkt mit den entsprechenden Abführleistungs-Einrichtungen (52).

10. Feststoff-Mischvorrichtung gemäß Anspruch 1, wobei die Querschnittsfläche in jeder entsprechenden ersten Leitungseinrichtung (42) in der Nähe und aufwärts vom Verbindungspunkt mit der entsprechenden Abführleistungs-Einrichtung (52) geringer ist als die Querschnittsfläche in der entsprechenden ersten Leitungseinrichtung (42) an und abwärts vom Verbindungspunkt mit der entsprechenden Abführleistungs-Einrichtung (52).

Revendications

1. Dispositif pour le mélange de solides, comprenant:

un récipient (10) ayant un orifice (18) d'entrée des solides dans une zone supérieure et un moyen (20, 46) de sortie des solides dans une zone inférieure, la zone inférieure étant définie par une paroi de fond (16) de forme généralement tronconique, divergeant vers le bas;

un déflecteur (58) disposé dans le récipient entre la zone supérieure et la zone inférieure, le déflecteur bloquant une quantité importante de la communication entre les zones supérieure et inférieure, le déflecteur comportant une première partie de forme généralement conique (60) avec son sommet (62) dirigé vers le haut, et une seconde partie de forme généralement conique inversée (64), la seconde partie de forme généralement conique étant placée au-dessous de la première partie généralement conique et espacée de la paroi de fond (16) du récipient (10) pour former entre elles un passage annulaire convergeant vers le bas (68) qui communique entre la zone supérieure et le moyen de sortie des solides (20, 46);

une multitude de conduites (24, 26, 28, 30, 32, 34) placées chacune à l'intérieur du récipient (10) de manière à s'étendre dans une direction gé-

ralement verticale vers le bas à partir de la zone supérieure au droit du déflecteur (58) par l'intermédiaire de la zone inférieure et de la paroi de fond (16), chacune des conduites (24, 26, 28, 30, 32, 34) ayant au moins une première ouverture (37) ménagée dans la zone supérieure pour permettre aux solides se trouvant dans cette zone supérieure d'entrer dans la conduite et de s'écouler vers le bas par gravité dans la direction de la zone inférieure;

un premier moyen de conduite incliné (42) communiquant entre l'extrémité inférieure de chacune des conduites (24, 26, 28, 30, 32, 34) et le moyen de sortie de solides (20, 46) pour acheminer des solides par gravité à travers lui entre chacune des conduites et le moyen de sortie de solides;

caractérisé par: au moins un moyen de conduite de drainage (52) communiquant entre un premier moyen de conduite incliné correspondant (42) et une ouverture correspondante (48) ménagée dans la paroi de fond entre la zone supérieure et le moyen de sortie des solides pour acheminer les solides par gravité entre un endroit situé dans la zone inférieure et le premier moyen de conduite incliné correspondant (42), l'ouverture (48) ménagée dans la paroi de fond étant située circonférentiellement entre le premier moyen de conduite correspondant (42) et un premier moyen de conduite contigu (42).

2. Dispositif pour le mélange de solides selon la revendication 1, caractérisé en outre en ce qu'il comprend au moins un second moyen de conduite de drainage (52) communiquant entre le premier moyen de conduite correspondant (42) et une seconde ouverture correspondante (48) ménagée dans la paroi de fond entre la zone supérieure et le moyen de sortie des solides (20) pour acheminer les solides par gravité entre un second endroit situé dans la zone inférieure et le premier moyen de conduite correspondant (42).

3. Dispositif pour le mélange de solides selon la revendication 2, dans lequel ledit au moins moyen de conduite de drainage (52) communique avec l'ouverture correspondante (48) ménagée dans la paroi de fond à un endroit situé entre le premier moyen de conduite correspondant (42) et un premier moyen de conduite contigu (42) et ledit au moins second moyen de conduite de drainage communique avec une seconde ouverture correspondante ménagée dans la paroi de fond à un endroit situé entre le premier moyen de conduite correspondant et un autre premier moyen de conduite contigu.

4. Dispositif pour le mélange de solides selon la revendication 3, dans lequel l'ouverture correspondante (48) ménagée dans la paroi de fond est située plus près de la zone supérieure que la seconde ouverture correspondante pratiquée dans la paroi de fond.

5. Dispositif pour le mélange de solides selon la revendication 3, caractérisé en ce qu'il comprend en outre au moins trois desdites conduites (24, 26, 28, 30, 32, 34).

6. Dispositif pour le mélange de solides selon



l'une des revendications précédentes, caractérisé en ce qu'il comprend en outre au moins trois desdites conduites (24, 26, 28, 30, 32, 34) au moins trois des premiers moyens de conduite (42) communiquant chacun avec une conduite correspondante desdites conduites et l'un des moyens de conduite de drainage (52) communiquant avec chacun d'au moins deux des premiers moyens de conduite (42), où chacun des moyens de conduite de drainage (52) communique avec une ouverture correspondante (48) de la paroi de fond à un endroit espacé d'une certaine distance de la zone supérieure qui est différente de la distance entre l'emplacement de ladite autre ouverture (48) et de la zone supérieure.

7. Dispositif pour le mélange de solides selon la revendication 6, caractérisé en ce qu'il comprend en outre six desdites conduites (24, 26, 28, 30, 32, 34), six des premiers moyens de conduite (42) et trois moyens de conduite de drainage (52) communiquant avec des premières conduites alternées correspondantes (42).

8. Dispositif pour le mélange de solides selon la revendication 7, caractérisé en ce qu'il comprend en outre un moyen de déflecteur (56) situé à l'intérieur de chacun des premiers moyens de conduite alternés correspondants (42) contigus, en étant en amont, au point de communication avec le moyen de conduite de drainage correspondant (52) pour former une zone ayant une section en coupe réduite dans le premier moyen de conduite (42) en amont du point de communication avec le moyen de conduite de drainage

correspondant (52), section en coupe qui est inférieure à la surface en coupe des premiers moyens de conduite alternés correspondants (42) en aval du point de communication avec le moyen de conduite de drainage correspondant (52).

9. Dispositif pour le mélange de solides selon la revendication 1, caractérisé en ce qu'il comprend en outre un moyen de déflecteur (56) situé à l'intérieur de chacun des premiers moyens de conduite correspondants (42) contigus, en étant en amont, au point de communication avec le moyen de conduite de drainage correspondant (52) pour former une zone ayant une section en coupe réduite dans la premier moyen de conduite (42) en amont du point de communication avec le moyen de conduite de drainage correspondant (52), section en coupe qui est inférieure à la surface en coupe du premier moyen de conduite correspondant (42) en aval du point de communication avec le moyen de conduite de drainage correspondant (52).

10. Dispositif pour le mélange de solides selon la revendication 1, dans lequel la surface en coupe de chaque premier moyen de conduite correspondant (42) contigu, en étant en amont, au point de communication avec le moyen de conduite de drainage correspondant (52) est inférieure à la surface en coupe du premier moyen de conduite correspondant (42) en aval du point de communication avec le moyen de conduite de drainage correspondant (52).

