This invention relates generally to a cyclonic system for syphoning granulated or pulverized material, and more particularly to apparatus for syphoning granular material such as sugar, starch, pulverized cocoa, coffee, cocoa beans, nuts, peanuts and the like.

It is proposed according to the present invention, to provide apparatus that can be adapted to syphon cyclonically any granulated material carried in bulk lots from railroad cars by means of a cyclone air stream which creates a syphon in a flexible hose connected to the receptacle in the railroad car. The cyclone air stream which creates the syphon will draw the material out of the receptacle into the air stream of the conduit and deposit it in the receiver on any floor in the building, there to be conveyed to a storage bin or to a point desired.

The granular material is carried through the conduit in a rapidly moving air stream induced by a cyclone pump operating at high speeds to generate a suction in the apparatus.

It is, therefore, a principal object of the invention to provide a syphoning system for granular material in which an air stream produces a suction in the system and carries the material from a receptacle to a receiving chamber.

A still further object is to provide means for conveying granular material from a receptacle to a storage bin with means for commingling the material in the path of travel of the material.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings, and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

Fig. 1 is a perspective view of an apparatus embodying the invention.

Fig. 2 is an elevational sectional view of a portion of the apparatus shown in Fig. 1, on an enlarged scale.

Fig. 3 is a sectional view taken on lines 3—3 of Fig. 2.

Fig. 4 is a perspective view of a cutting device.

Fig. 5 is a perspective view of another form of cutting device.

Fig. 6 is a perspective view of a valve plate.

Fig. 7 is a longitudinal sectional view of a pump employed in the apparatus.

Fig. 8 is a perspective view of a closure member for the cutter box.

Referring to Fig. 1, there is shown one wall 20 of a closed room 22 where the material is processed. In the room there is mounted a hopper 24. A spout 26 extends from the hopper to a valve box 28. The box is a rectangular structure having a cavity in which is slidable a valve plate member 30. The plate member has a handle 31 and an aperture 32 near one end. This plate member is best shown in Fig. 6.

A pipe 34 has one end connected to the valve box 28, the other end of the pipe extending through an opening 20' in the wall 20 and being connected to one branch 36' of a Y-shaped fitting 36. Fitting 36 is formed with a central branch 37 coupled to one end of a pipe 38 forming a continuation thereof. Pipe 38 extends through an opening 38' in the wall 20 and is connected at its other end to a cylindrical air intake 42. A valve 40 is interposed in the pipe 38. A pipe 46 is connected at one end to the end of branch 37 and is connected at its other end to a pump 48. The shell 49 of pump 48 is sectioned, the sections being joined by bolts 49' extending through horizontally disposed flanges 48' formed along the sections. An electric motor 50 supplied with current through a conductor 52 drives the pump 48 by means of the motor shaft 47, clutch coupling 50' and pump shaft 51.

A pair of aligned pipes 60 and 68 are connected to stem portion 58 of the Y-fitting 36 by means of a coupling 60' and interposed between and suitably connected to the adjacent ends of the pipes 60 and 68 is a hollow cutting box 61. The box is rectangular and is disposed perpendicularly to the axes of the pipes. The box is formed with opposed openings 61' in its side walls communicating with the pipes 60 and 68 whereby providing a continuous conduit. One end of the box is open to receive slidably and removably a cutting device or a closure member, such as the cutting device 62 shown in Fig. 4, adapted to fit in the interior of the box.

The device 62 comprises a generally rectangular shaped frame 64 supporting a plate 65 with a central opening 66 therein. A handle 63 is provided on one end of the frame. A multi-blade cutting member in the form of a knife grid 67 is mounted in the opening 66. The cutting member is so disposed that its opening 66 is in line with the openings 61' and with the ends of the pipes 60 and 68, and the opening in pipe 60 faces the cutting edges of the knife grid 67.

In Fig. 5, a modified form of cutting device 62' adapted to be used with the apparatus is shown. This device has a curved knife grid 67' providing more clearance for the passage of the material therethrough.

Pipe 68 leads to a receiving chamber 56 and connected to and communicating with the lower end of chamber 56 is an opening at one end of a conduit 70, the other end of the conduit being connected to a pipe 72 leading to the interior of a bin 73 through an opening 75 in a removable cover 74 therefor.

The fitting 36 has a further branch 39 to which one end of a pipe 41 is connected. A valve 41' similar to valve 40 may be installed in pipe 41 to control passage of air and material therethrough. A flexible hose 43 is connected to the other end of pipe 41. The free end of hose 43 is open.

Receiving chamber 56 is supported on a table 78 provided with legs 79. A motor 80 drives the conveyor mechanism in chamber 56 via gears 81 and 42. A port 83 closed by a door 84 is provided in the wall of the receiving chamber.

In Figs. 2 and 3, there is shown the internal structure of the receiving chamber 56 and conveyor mechanism. The receiving chamber comprises a shell 85 in the form of a truncated cone. The upper wider end of the shell is closed by a closure plate 86 having openings through which pass the pipes 54 and 68. A rotating shaft 87 passes through an opening in plate 86. The shaft is vertically disposed and carries a helical screw blade 88 thereon. The upper outer end of the shaft carries a bevel gear 89 arranged to mesh with bevel gear 90 on the drive shaft of an electric motor 91 which is mounted on plate 86. The lower end of shaft 87 is journaled in a cross-bar 79 at the lower end of the shell.
A shaft 92 extends axially through the conduit 70 and is connected to and is driven by the motor 80. A gear 82 is mounted on shaft 92 outside the conduit 70 and this gear meshes with gear 81 mounted on a stub shaft 93 journaled in a spout 94 attached to the bottom of shell 85. A plurality of blades or vanes 95 are radially mounted on shaft 93 within the spout 94. A helical blade or vane 96 is sleeved around the shaft 92 inside the conduit 70.

A suction chamber 97 is supported by the cover plate 86 in the top of the chamber 56. This suction chamber comprises a circular plate 101 in a semicylindrical form for a distance half way around the periphery of the plate, and supporting an upstanding solid wall 102 for the other half of the periphery, as shown in Fig. 3. The screen material and wall are fastened at their top ends to the closure plate 86 by bolts 98 or in any suitable manner.

An elongated rectangular bar 103 is fixed in any suitable manner to shaft 73 under plate 101 and is provided with upstanding flanges 102 extending upwardly around the screening material 101. The flanges carry brushes 104 engaging the screening material. Pipe 68 is formed with a bent end extending through an opening in plate 86 and through an opening in plate 101 and is secured to plate 101 by lock nuts 68′ to prevent displacement. The lower end of pipe 68 communicates with the interior of chamber 56. The screen material 101 provides an outlet for the air in chamber 56 and prevents granular material from entering the screened compartment 79.

In Fig. 7 the internal structure of the pump 48 is shown. Pipes 46 and 54 extend into the opposite ends of the hollow cylindrical shell 49 of the pump 48. Shaft 51 extends axially through the shell. Twisted vanes or blades 53 are mounted on the shaft and serve to drive air through the shell from inlet pipe 54 to outlet pipe 46 when the shaft 51 is rotated by motor 50.

In operation of the apparatus, the air is drawn out of the chamber 56 by pump 48 through suction chamber 97 and conduit 54, and returned through conduits 46, 37, 58, 60, 62, and conduit 65 into the chamber 56. In this operation, a cyclonic air stream is created which in turn creates a syphon or suction in branch line 34 leading to hopper 24 which contains the material such as cocoa powder. The cocoa powder has a tendency to sweat in transit so that branch line 41 with flexible hose 43 will be clear to be used on other granulated material for the next operation. If the next operation involves processing beans or nuts, it will be necessary to remove closure member 52 and replace it with the cutting device shown in Fig. 5 having the cutting knives 67. Cutting knives of different sizes are used, to wit, cutting knives arranged in squares ½′′, ¾′′ and 1½′′ so that by recirculating the material, such as beans, nuts and the like, such material may be recut into smaller particles to serve the particular purpose desired.

The cyclone type pump 48 is driven at very high speed by motor 50. By reason of the high velocity imparted to the movement of the air in pipes 46, 68, a syphon or suction is created in pipes 34, 38 and 41. A syphon or suction is created in pipes 34, 38 and 41 which is adapted to draw material from a receptacle and lead said material to the cyclonic air stream of the fitting 36 and from there to the receiving chamber 56, where it is deposited and subsequently conveyed to a receptacle to be used or conveyed to any desired point.

Because of the intensity of the cyclonic air stream, a syphon-like action is obtained in which the material is drawn from hopper 24 through pipe 34, fitting 36 and pipe 60 to box 61. During passage through this box, if the material is in bean form or the like the grid knife 67 or 67′ cuts the rapidly moving material into finer particles. If the material coming to box 61 is pulverized material, the closure member 62′ shown in Fig. 8 is inserted in place of the cutter 67 or 67′. From box 61 the material passes through pipe 68 to the receiving chamber 56. Some of the flying powdered material is liable to accumulate against the screen material 101′ as air passes therethrough to conduit 54 whereupon the rotating brushes 104 sweep the accumulated material down to the bottom of the receiving chamber. The rotating helical blade 88 acts as a screw feeding member to maintain a continuous guided flow of pulverized material down into the spout 94. The opening 70′ in conduit 70 may be closed by a slideable and pivoted closing plate 94′ normally sealing a slot 85′ in the spout 94. Plate 94′ has an opening similar to opening 32 of plate 30 to permit material to pass therethrough. Plate 94′ has a handle 94′. The rotating vanes 95 keep the material moving through an opening 70′ into conduit 70 where the material is continuously conveyed by the screw feeding blade 96 to bin 73. From bin 73 the pulverized material may be transferred to a suitable storage place.

When it is desired to recirculate the material in bin 73 to reduce the size of the material, such as beans or nuts, the end of hose 43 can be slipped over nipple 69 of the bin after removing cap 71. The suction developed in hose 43 and pipe 41 will carry the material from the bin back through the fitting member 56. A cutting device 62 having knives of successively finer cutting arrangement is inserted into the cutter box 61 each time a load of material is recirculated from bin 73 for the purpose of reducing the size of the material, such as beans or nuts.

Thus, the load of material from the storage bin or receptacle to the bin 73 may be in bean form. When the load is all conveyed to the bin, the hose 43 can be used to recirculate the contents of the bin after the cutting device 62 is replaced with one having finer cutting knives.

If the material fed into the hopper 24 is already powdered or pulverized, the cutting devices 61, 61′ are not used by the closure member 62′ is inserted in place thereof. The opening 100 in member 62′ permits passage of the material, yet the closure member seals the box 61 against escape of powdered material into or outside the box.

The pipe 38 is utilized when pulverized cocoa powder from a pulverizing room is being handled. Such cocoa powder has a tendency to sweat and to eliminate this tendency provision is made to provide air in the system which is of the same temperature as the temperature of the air in the pulverizing room. The air is recirculated by placing the air intake device 38 on the end of pipe 38 and placing said air intake device in the pulverizing room. The air coming through the pipe 38 will condition the air in the system and maintain it at the same temperature as the temperature of the air in the pulverizing room. Passage of air through the pipe 38 is controlled by the valve 40.

The bin 73 is preferably equipped with suitable rollers 76 for moving the bin 73 to various locations. It will be understood that the motors 50, 80 and 91 are speed controlled.

While I have illustrated and described the preferred embodiments of my invention, it is to be understood that I do not limit myself to the precise constructions herein disclosed and that various changes and modifications may be made within the scope of the invention as defined in the appended claims.
Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent is:

1. An apparatus for continuously conveying pulverized material, comprising an open top hopper for said material, a first conduit connected to said hopper for receiving and passing said material therefrom, a fitting having a plurality of branches, said fitting being connected to one of said branches, an air pump, a second conduit connected between said pump and another of said branches for maintaining a flow of air under pressure through said fitting and for maintaining a suction from said hopper to said fitting in the first conduit, a substantially closed shell, a semicylindrical screen forming a wall of a suction chamber in said shell, a third conduit connected between said shell and said hopper for delivering said pulverized material to the shell outside of said suction chamber, a bin for receiving pulverized material from said shell, a fourth conduit connected between said shell and bin for conveying the pulverized material thereto, a fifth conduit connected between said shell and said pump and opening into said suction chamber for exhausting air through said screen from said shell, and material dividing means disposed in said third conduit for reducing the large size material delivered to the shell.

2. An apparatus for continuously conveying pulverized material, comprising an open top hopper for said material, a first conduit connected to said hopper for receiving and passing said material therefrom, a fitting having a plurality of branches, said conduit being connected to one of said branches, an air pump, a second conduit connected between said pump and another of said branches for maintaining a flow of air under pressure through said fitting and for maintaining a suction from said hopper to said fitting in the first conduit, a substantially closed shell, a semicylindrical screen forming a wall of a suction chamber in said shell, a third conduit connected between another of said branches and said shell for delivering said pulverized material to the shell outside of said suction chamber, a bin for receiving pulverized material from said shell, and material dividing means disposed in said third conduit for reducing the large size material delivered to the shell.

3. In an apparatus for continuously conveying pulverized material, comprising a substantially closed shell, a conduit connected to said shell for delivering said pulverized material into said shell in an air stream, a suction chamber having a cylindrical at least partially screened wall disposed in said shell, another conduit connected to said shell for exhausting air from the shell, said other conduit opening into said suction chamber so that said screened wall clears the air passing therethrough from pulverized material, brush means mounted for rotation in contact with an outer side of said screened wall to clear interstices thereof of accumulated pulverized material deposited thereon by the air passing through the screen, there being a helical blade member mounted for rotation in the shell to drive said pulverized material therethrough, and a shaft carrying said helical blade member and said brush means for simultaneous rotation in the shell.

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