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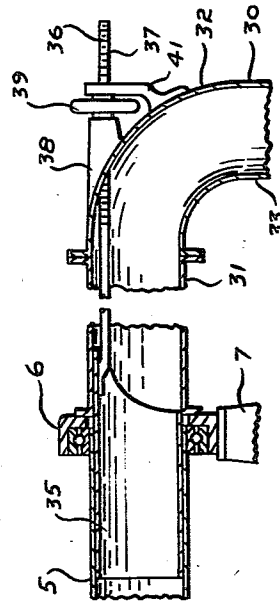
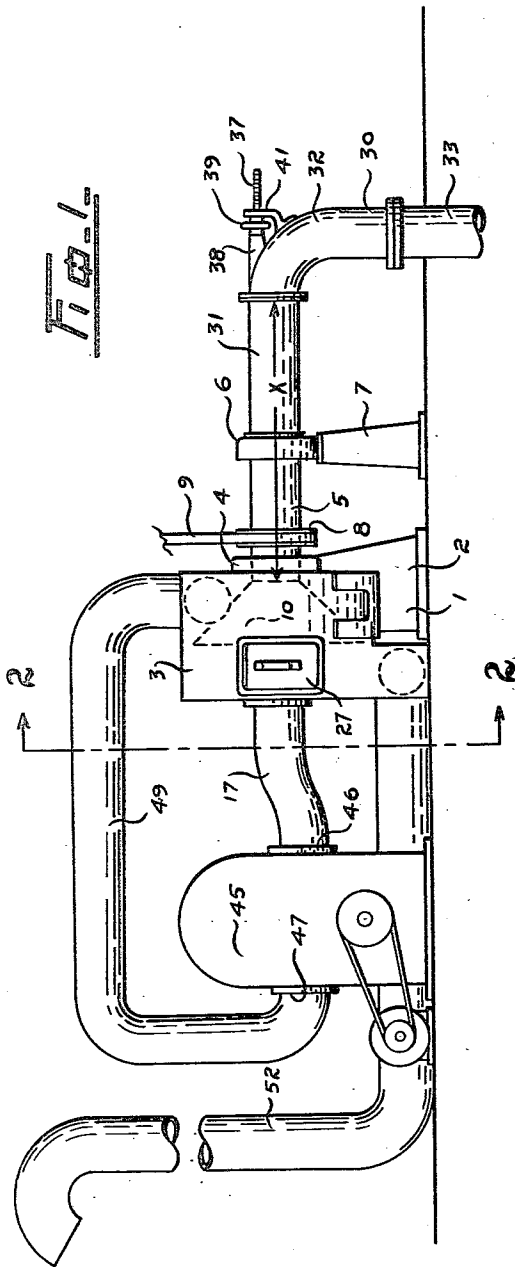
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PNEUMATIC CONVEYER MACHINE FOR HANDLING COMMUNUTED MATERIALS

Filed May 25, 1951

2 Sheets-Sheet 1



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Fig. 5-

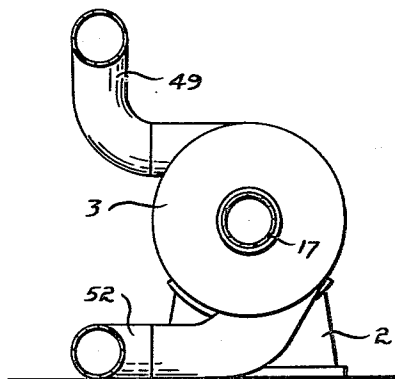
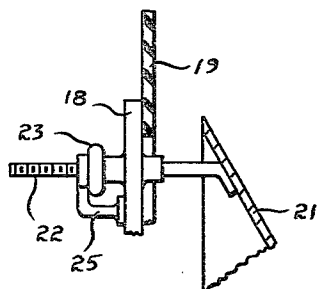


Fig. 2-

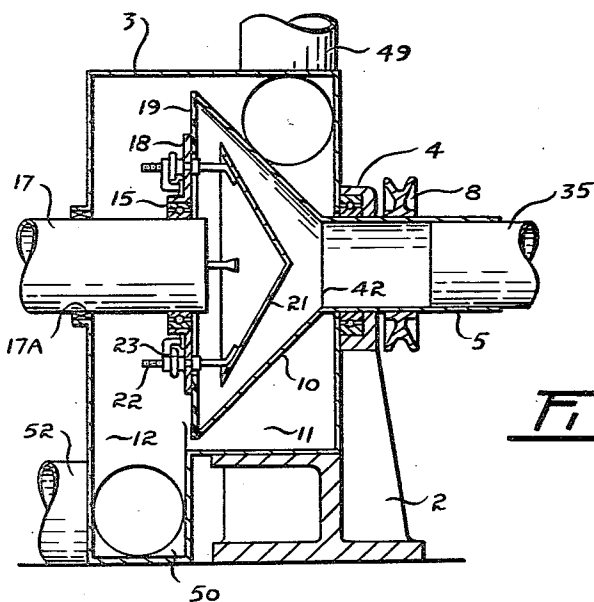


Fig. 3-

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PNEUMATIC CONVEYER MACHINE FOR HANDLING COMMINUTED MATERIALS

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9 Claims. (Cl. 302-17)

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My invention relates to improvements in pneumatic conveyor machines for handling comminuted materials.

The objects of the invention are to provide means whereby material may be moved through pipes with a minimum of air and with air at relatively low pressure; to provide means whereby the material may be raised from a point below the conveyor machine by suction and raised above said device by air pressure. A further object is to provide a blower element in the conveyor machine which will provide both the suction to elevate the material up to a given elevation and to provide the air pressure to force the material beyond the point to which it was elevated by suction. Still further objects are to provide means for intermittently delivering the material from a suction zone into the air pressure zone for conveyance through a pipe to a point of discharge, and also to reduce the air pressure flowing to the said pipe at the moment of delivery of the material into the air pressure zone, whereby the air entering the pipe is pulsating and the material is substantially entrained in spaced slugs for a portion of its flow through the discharge pipe.

Referring to the drawings:

Figure 1 is a side elevational view of the invention.

Figure 2 is a transverse sectional view taken on the line 2-2 of Figure 1.

Figure 3 is an enlarged longitudinal sectional view of the feed cone and the air chambers.

Figure 4 is an enlarged sectional view of the suction pipe and feed regulating sleeve therein.

Figure 5 is an enlarged detail view of the means for supporting and adjusting the baffle cone.

In the drawings like characters of reference indicate corresponding parts in each figure.

The numeral 1 indicates generally a conveyor machine having a frame 2 which supports a housing 3 and a main bearing 4. Journalled in the bearing 4 is a rotating sleeve 5 which is supported at one end in an outboard bearing 6, which outboard bearing is carried upon a pedestal 7, see Figures 1 and 4. The sleeve is preferably fitted with a drive pulley 8 and is adapted to be driven through a belt 9 from a suitable source of power, not shown. At the inner end of the rotating sleeve 5 a feed cone 10 is provided, see Figure 3, which cone is rotatable inside a cylindrical air inlet chamber 11 forming one end of the housing 3. The air inlet chamber is open on one side to an air outlet chamber 12, which too forms part of the housing.

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A seal type bearing 15 is provided in the housing 3 between the chambers 11 and 12 and is preferably supported adjacent the inner end of an air suction pipe 17, which pipe extends through a suitably sealed opening 17A formed in the housing 3. A disk 18 is rotatable upon the bearing 15 and is fitted with a relatively heavy rubber flap valve 19 which frictionally engages the outer periphery of the feed cone to be normally driven thereby. The disk 18 and the rubber flap valve 19 form a base for said cone and normally close off said feed cone from the interior of the chambers 12 and 11.

A baffle 21, which is preferably conical in form, is supported from the disk 18 upon legs 22, as particularly shown in Figure 5. The legs 22 extend through the disk 18 and are threaded at their free ends to receive small hand wheels 23. These hand wheels are held against endwise movement by brackets 25 mounted on the disk 18. Each bracket forms one abutment for its hand wheel and the face of the disk forms the other abutment, so that by adjusting said hand wheels uniformly the baffle can be adjusted axially to provide an annular gap at any desired distance between the periphery of the baffle and the valve 19. Access to the hand wheels 23 is obtained through a door 27 provided in the housing 3.

A material suction pipe 30 is connected to the sleeve 5 at the bearing 6, which pipe normally consists of a horizontal member 31, a bend 32 and a vertical member 33. The horizontal member is aligned with the rotating sleeve 5 and slidably mounted in said member to project into the rotating sleeve is a sliding sleeve 35 through which the material entering the suction pipe 30 must flow in order to reach the rotating cone 10. The sleeve 35 is fitted with a push pull rod 36 which is threaded at its outer end as at 37 and extends through a boss 38 formed on the bend 32. An internally threaded hand wheel 39 engages the projecting end of the rod 37 and is held in close proximity to the boss 38 by a keeper 41, so that by adjustment of the wheel 39 the left end of the sliding sleeve 35 may be moved towards or away from the entering lip or inner periphery 42 of the rotating cone 10.

The numeral 45 indicates a blower of any desired type having a suction inlet 46 and an outlet 47. The suction pipe 17 is connected to the inlet 46 and an air pressure pipe 49 extends from the outlet 47 to the wall of the chamber 11 to the rear of the rotating cone 10.

The material delivered into the chamber 12

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drops into a boot 50 at the bottom of the housing 3, which is in effect at the base of the chamber 12 and passes into a delivery pipe 52 leading to any desired point of discharge.

The operation of the device is as follows:

Starting from an initial condition in which no material is within the rotating cone 10, actuation of the blower 45 will tend to evacuate the space within the cone, and simultaneously to deliver air under pressure to chambers 11 and 12. Since the lower end of suction pipe 30 is immersed in the material to be raised, the partial vacuum within the cone will cause the comminuted material, entrained in air, to be drawn into the cone, where it will impinge upon the baffle plate 21. It will be understood that due to the engagement of the annular flap valve 19 with the base of the cone 10, the flap valve and therefore the baffle plate 21 will be rotating at the same speed as the cone. Due to the deflecting action of the baffle plate as well as its rotational movement, the air and the entrained particles will be driven outwardly toward the interior surface of the cone, and under the action of centrifugal force the material will accumulate at the juncture of the cone and the flap valve 19. At the same time, the air in which the particles are entrained will be drawn radially inwardly past the wide end of the baffle plate and into blower suction pipe 17, and the air entering the blower will thus be substantially free of particles. During this action, a definite pressure differential will be created across the flap valve 19 due to the partial vacuum within the cone 10 and the pressurized air within chambers 11 and 12. This pressure differential will hold the flap valve closed despite the thrust action of the accumulating material against the valve. As the accumulation of material progresses the thickness of the annular ring of material will become enlarged in an axial direction, and will finally block the annular passageway or gap between the baffle plate 21 and the cone 10. The actual amount of material which will be accumulated before this blocking action occurs will depend of course upon the axial adjustment of the baffle plate, as determined by the positioning of hand wheels 23. It will be understood however that the pressure differential which holds the valve 19 closed is such that it cannot be overcome merely by the thrust effect of the accumulated material alone, no matter how much material accumulates before the annular passageway is blocked.

Upon the blocking of the annular passageway, there will be no subsequent flow of air into the blower suction pipe 17, hence no substantial delivery of air to chambers 11 and 12, and the pressure in the latter chambers will thus drop. At the same time, the air pressure within cone 10 which acts against the flap valve will remain substantially the same or will rise slightly, since the suction pipe 30 in effect connects the interior of the cone to atmosphere, and since there is no longer any flow of air to create a partial vacuum. The pressure differential tending to hold the valve 19 closed will therefore be reduced sufficiently to allow the thrust effect of the rotating material to overcome this differential. The valve 19 will therefore be forced open, and the material will drop into the boot 50 of chamber 12.

As the material moves out of cone 10, the annular passageway between the baffle plate 21 and the cone will again be unblocked, allowing a resumption of flow of air into the suction pipe 17. This air will be delivered to chamber 12 and will

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thus force the material accumulated in the boot 50 into the delivery pipe 52, in the form of a relatively dense slug of material. At the same time, the pressure differential across the valve 19 will again be built up to its former level, forcing the valve closed, and the cycle will be repeated.

It is important to observe that the event which triggers the opening of the valve 19 is the rather abrupt reduction of the pressure differential across the valve, and not the gradual attainment of a predetermined thrust force due to the accumulated rotating material. This will result in a positive and rapid dumping of the material into the boot, and will avoid a "trickling" effect which might otherwise occur. Furthermore, since the amount of material which will accumulate before this drop in pressure differential takes place can be pre-selected by axial adjustment of baffle plate 21, it follows that slugs of material of any predetermined size may be delivered at determined rates by means of this device.

The adjustment of the sliding sleeve 35 in relation to the rotating sleeve 5 will depend to some extent on the nature of the material being drawn from the source of supply, the speed at which the rotating cone 10 is being driven and the suction developed by the blower. If the rotating sleeve 5 is rotating at a speed high enough to cause the material to be carried around on its inner wall, the feed will increase if the sliding sleeve is moved to the left to decrease the horizontal length of the material body restrained in its movement by centrifugal force. The adjustment may need to be varied if the suction is raised or lowered and if the speed of rotation is raised or lowered.

What I claim as my invention is:

1. A pneumatic conveyor for comminuted material comprising a housing having a suction zone and an air pressure zone, said suction zone having a suction pipe leading to a source of material supply, said air pressure zone having a material delivery pipe, a driven pump having its suction connection communicating with the suction zone and its delivery connection communicating with the pressure zone, a rotating cone connected to the inner end of the suction pipe, the interior of the cone being included in the suction zone, and a valve at the base of the cone to seal its interior from the air pressure zone, said valve being adapted when opened in response to material bearing against it to drop the material from said cone into the air pressure zone, and adjustable means within the cone to regulate the flow of material in the suction zone to the valve at the base of the cone.

2. A pneumatic conveyor for comminuted material comprising a housing having a suction zone and a pressure zone, said suction zone having a suction pipe leading to a source of material supply, and said air pressure zone having a material delivery pipe, a pump having its suction connection communicating with an open ended passage extending through the housing and its delivery connection communicating with the air pressure zone adjacent the material delivery pipe, said suction zone including a rotating cone having its apex end communicating with the suction pipe and its base end adjacent the air pressure zone, an annular valve normally closing off the base end of the cone from the pressure zone, said open ended passage extending through said annular valve and communicating with the interior of said cone, and a baffle carried concentrically with-

in the cone adapted to deflect material flowing from the suction pipe onto the surfaces of the cone.

3. A pneumatic conveyor for comminuted material as claimed in claim 2 and an endwise movable non-rotating sleeve terminating adjacent the apex end of the rotating cone.

4. A pneumatic conveyor for comminuted material according to claim 2, further provided with a sleeve extending from the apex end of said cone and rotatable therewith, a non-rotatable sleeve in telescopic relation with said cone sleeve, and means for moving said non-rotatable sleeve in an endwise direction, whereby the amount of exposed interior surface of said cone sleeve may be varied.

5. A pneumatic conveyor for comminuted material comprising a housing having a suction zone and a pressure zone, said suction zone having a suction pipe leading to a source of material supply and said air pressure zone having a material delivery pipe, a pump having its suction connection communicating with an open ended passage extending through the housing, and its delivery connection communicating with the air pressure zone adjacent the material delivery pipe, said suction zone including a rotating cone having its apex end communicating with the suction pipe and its base end adjacent the air pressure zone, an annular valve normally closing off the base end of the cone from the pressure zone, said open ended passage extending through said annular valve and communicating with the interior of said cone, a baffle carried concentrically within the cone adapted to deflect material flowing from the material suction pipe onto the surface of the cone, and means for adjusting the baffle lengthwise of the cone.

6. A pneumatic conveyor for comminuted material comprising a housing having a suction zone and a pressure zone, said suction zone having a suction pipe leading to a source of material supply and said air pressure zone having a material delivery pipe, a pump having its suction connection communicating with an open ended passage extending through the housing, and its delivery connection communicating with the air pressure zone adjacent the material delivery pipe, said suction zone including a rotating cone having its apex end communicating with the suction pipe and its base end adjacent the air pressure zone, an annular valve normally closing off the base end of the cone from the pressure zone, said open ended passage extending through said annular valve and communicating with the interior of said cone, a baffle carried concentrically within the cone, the outer edge of said baffle being spaced inwardly from said cone so as to leave a relatively small annular passage for the flow of material from said suction pipe toward said valve, and means for adjusting the axial distance between the outer edge of said baffle and said annular valve.

7. A pneumatic conveyor for comminuted material comprising a housing having a suction zone and a pressure zone, said suction zone having a suction pipe leading to a source of material supply, and said air pressure zone having a material delivery pipe, a pump having its suction connection communicating with an open ended passage

extending through the housing and its delivery connection communicating with the air pressure zone adjacent the material delivery pipe, said suction zone including a rotating cone having its apex end communicating with the suction pipe and its base end adjacent the air pressure zone, an annular valve normally closing off the base end of the cone from the pressure zone, said open ended passage extending through said annular valve and communicating with the interior of said cone, and a baffle carried concentrically within the cone adapted to deflect material flowing from the suction pipe onto the surfaces of the cone to accumulate an annular body of material between the baffle and the cone and to cause the differential pressure between the suction zone and the pump to be reduced allowing said valve to open and discharge the accumulated material, said material discharge through the valve serving to restore communication between the suction side of the pump and the suction zone whereby the pressure in the air pressure zone will be restored and drive said material through the material delivery pipe.

8. A pneumatic conveyor for comminuted material as claimed in claim 7 and an endwise movable non-rotating sleeve terminating adjacent the apex end of the cone.

9. A pneumatic conveyor for comminuted material comprising a housing having a suction zone and pressure zone, said suction zone having a suction pipe leading to a source of material supply and said air pressure zone having a material delivery pipe, a pump having its suction connection communicating with an open ended passage extending through the housing, and its delivery connection communicating with the air pressure zone adjacent the material delivery pipe, said suction zone including a rotating cone having its apex end communicating with the suction pipe and its base end adjacent the air pressure zone, an annular valve normally closing off the base end of the cone from the pressure zone, said open ended passage extending through said annular valve and communicating with the interior of said cone, a baffle carried concentrically within the cone adapted to deflect material flowing from the material suction pipe onto the surface of the cone, and means for adjusting the baffle lengthwise of the cone and to accumulate a body of material to restrict the flow of air from the suction zone to the suction side of the pump whereby to create a pressure reduction in the differential between said suction zone and the pump allowing the valve to open and discharge the accumulated material, said material discharge through the valve serving to restore the pressure between the suction side of the pump and the air pressure zone and cause the material to be driven through the material delivery pipe.

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