

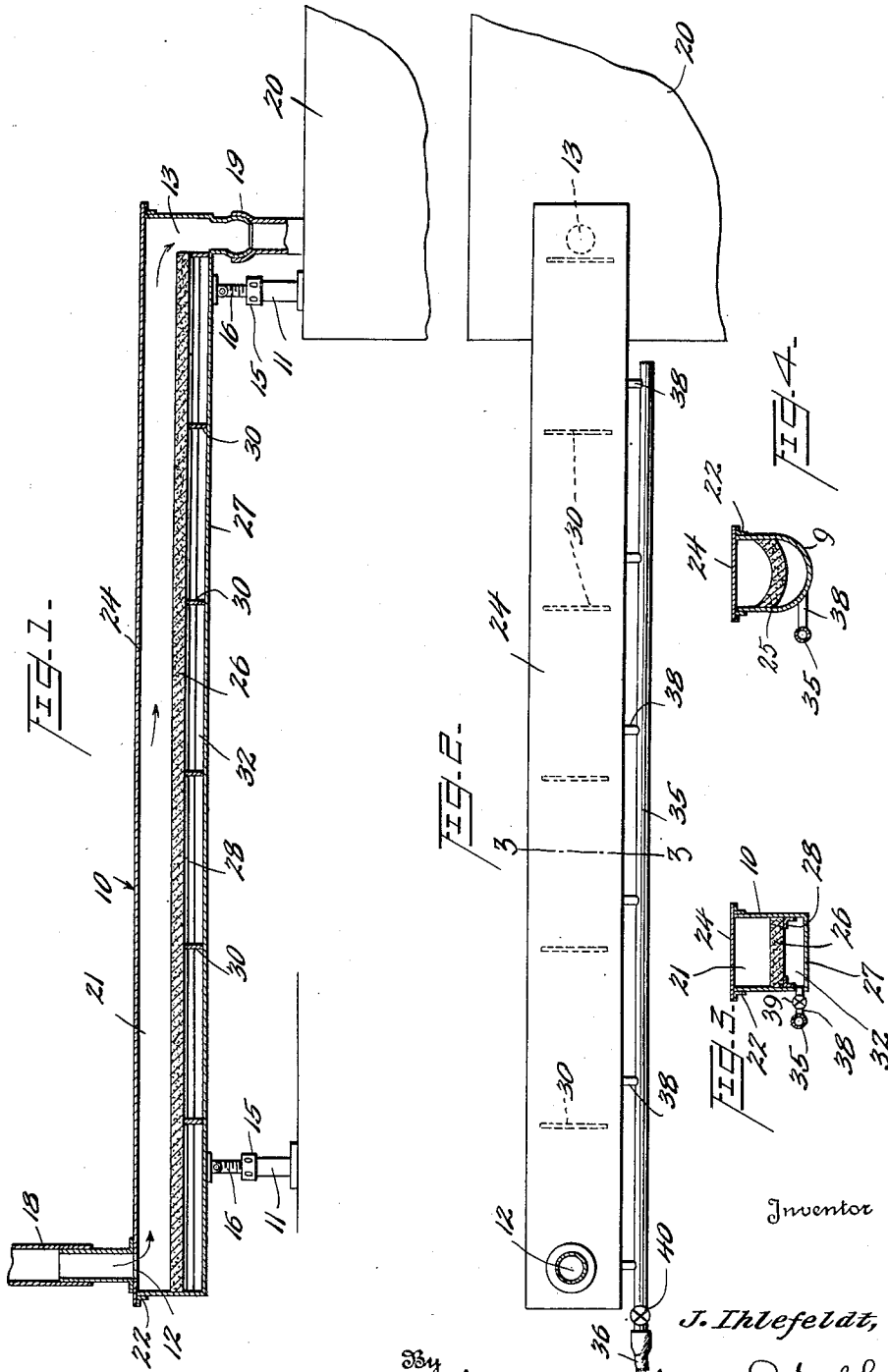
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APPARATUS FOR CONVEYING POWDERED MATERIAL

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APPARATUS FOR CONVEYING POWDERED MATERIAL

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9 Claims. (Cl. 302—29)

This invention relates to a process of and apparatus for the conveying of material in pulverulent or finely divided form, for instance cement, coal dust, or farinaceous material. It is the principal object of the invention to provide a simple and effective means whereby the material can be rapidly conveyed and whereby resistance to flow of the material may be reduced to a minimum.

It is a feature of the invention that the material is thoroughly mixed and agitated during the process of conveying the same. Thus in the preferred form of the invention a conveying trough or conduit is provided which consists at least in part of a support for the material formed of a porous or gas pervious substance, and a gaseous medium under pressure is forced through this support to maintain the material being conveyed in a suspended state approximating a fluid condition. It is in fact possible to form in this manner a blanket of air adjacent the upper surface of the support on which the finely divided material is carried along so that little or no resistance is offered to the movement of the material.

More specifically, it is an object of the invention to provide a conveying conduit, which may be generally horizontally disposed, having an inlet for the material to be conveyed and a discharge outlet, this conduit having a lower wall formed of porous or gas pervious material through which gas may be forced under pressure in a finely divided state and in an upward direction, whereby the material to be conveyed is maintained in a condition analogous to that of an emulsion and may flow freely through the conduit, being discharged with the gaseous medium at the conduit outlet.

It is a further feature of the invention that the construction is such as to permit variation of the pressure with which the gaseous medium is forced through the porous material at different points in the length of the conveyor, it having been found by experimentation that most efficient operation may be effected by gradually reducing this pressure in the direction of movement of the material to be conveyed.

The invention also contemplates the subjection of the gaseous medium to various temperatures differing substantially from that of the material to be conveyed or the inclusion in the gaseous medium of a gas capable of reacting with the material to be conveyed whereby a change in the temperature of the material may be effected or a chemical reaction produced concurrently

with the feeding of the material. For instance, in the event cement is being conveyed, carbonic acid gas may form a part or all of the gaseous medium so that the ripening of the cement can be partially or wholly completed as the cement is conveyed, this process ensuring a prompt physical or chemical reaction as the result of the intimate commingling of the gaseous medium and the powdered material.

Further objects and features of the invention will be apparent from the following description taken in connection with the accompanying drawing, in which

Figure 1 is a longitudinal vertical sectional view of apparatus constructed in accordance with the principles of the invention;

Figure 2 is a plan view of the structure shown in Figure 1;

Figure 3 is a transverse sectional view taken substantially on the line 3—3 of Figure 2; and

Figure 4 is a corresponding view illustrating a slightly modified form of conveyor.

In order to facilitate an understanding of the invention reference is made herein to the specific forms thereof illustrated in the drawing and detailed descriptive language is employed. It will nevertheless be understood that no limitation of the invention is thereby intended and that various alterations and changes in the structure shown may be made without departing from the principles of the invention as defined in the appended claims.

In Figure 1 of the drawing the elongated conveying trough or conduit indicated generally at 10 is illustrated as carried on a plurality of supports 11 and as provided with an inlet port 12 and an outlet port 13. While the conduit 10 is generally horizontal and is shown for convenience as substantially straight, it will be understood that conduits of other configuration may be employed if desired, and that the inclination of the conduit may be altered to facilitate the conveying of materials of different characteristics. Thus the supports 11 are each represented as comprising cooperating threaded elements 15 and 16 which may be relatively rotated to alter the angular disposition of the conduit with respect to the horizontal. To facilitate such adjustment the material is preferably delivered through the inlet port 12 by means of a telescoping supply duct 18, and the discharge duct 19 leading from the outlet port 13 is preferably constructed as shown in Figure 1 to provide a rocking connection between the separate parts thereof so that communication of the duct with

a storage bin or receptacle 20 into which the material is delivered is not disturbed by manipulation of the supports 11. These details of the construction whereby the inclination of the conduit 10 may be altered are not important and form no essential part of the present invention.

The conduit 10 may be open at its upper side, but in the preferred form of the invention affords a closed passage 21 which is sealed to prevent escape of the powdered material. Thus as shown more particularly in Figures 1 and 3 of the drawing, the conduit may be substantially rectangular in cross-section, longitudinally extending structural members 22 being provided, one leg of each member being secured to the associated side wall of the conduit and the other leg serving as a support to which a cover 24 may be applied and secured. It will be understood that the transverse shape of the conduit is not an essential element of the invention, and while the construction shown herein is preferred, it is possible to employ a cylindrical conduit.

A support 26 for the material to be conveyed extends laterally between the side walls of the conduit and longitudinally of the latter, this support being spaced from the bottom wall 27 of the conduit to provide a gas passage 32 therebetween. In the form of the invention shown in Figure 3 of the drawing the support 26 is illustrated as carried by the structural L-shaped members 28 secured to the side walls of the conduit, but the support 26 may be carried solely by partitions 30 extending transversely of the conduit and arranged in spaced relation longitudinally thereof, these partitions separating the passage 32 into a plurality of isolated compartments for a purpose hereinafter explained.

The support 26 is formed of gas pervious material for instance filter stones, porous brick, porous rubber, porous porcelain, or similar substances, the nature of the material preferably being such that gas may flow upwardly through the support and may emerge therefrom in a finely divided state, the development of individual jets or streams of gas being preferably avoided.

The gaseous medium under pressure is supplied to the passage 32 by means of a gas conduit 35 extending longitudinally of the conduit 10, a pump or other suitable gas pressure device delivering the gas to the conduit 35 through the flexible pipe 36, the latter permitting adjustment of the inclination of the conduit 10 as hereinbefore explained without interruption of the supply of gas. In the preferred form of the invention the conduit 35 is connected with the passage 32 by means of pipes 38, the latter affording communication between the conduit 35 and each of the separate compartments formed by the partitions 30 in the passage 32. The purpose of this construction is to permit variation in the pressure under which gas is supplied to the passage 32 longitudinally of the conduit 10, the conveyor functioning in a more efficient manner when a pressure gradient is established so that the pressure is less at the discharge than at the inlet end of the conduit.

A valve 40 in the conduit 35 controls the flow of gas through the latter and if desired separate valves as indicated at 39 in Figure 3 may be inserted in each of the pipes 38 to effect control of the pressure in the several compartments beneath the support 26. Alternatively, the difference in pressure in the several compartments may be controlled by proper design of the conduit 35 and the pipes 38, reduction in pressure

longitudinally of the conduit 10 taking place for instance as the result of variation in cross-sectional area and consequent frictional resistance to flow of gas within the conduit 35 and the pipes 38.

The support 26 may be either flat as shown in Figure 3 or curved laterally as shown at 25 in the conveyor 9 of Figure 4, it being possible under some conditions to provide a support of sufficient curvature to permit the elimination of the side walls and cover of the conduit, the material flowing readily along the trough-shaped support by the maintenance of the material in a substantially fluid condition.

The operation of the device will now be understood from the foregoing description. The material to be conveyed is discharged downwardly through the duct 18 and passes along the support 26, the gaseous medium under pressure supplied in the passage 32 beneath the latter being forced upwardly through the support and maintaining the material to be conveyed in such condition that it assumes the characteristics of a fluid emulsion. Obviously the nature of the support 26 is such that a blanket of gas is established on the upper surface thereof which effectively prevents clogging of the material and reduces resistance of flow of the material to a minimum.

In its broadest aspect the invention contemplates the provision of a porous support on which the material to be conveyed may rest, together with means for forcing a gaseous medium such as air upwardly through the support with sufficient pressure to maintain the material to be conveyed in a condition of fluidity, the material being thus simultaneously conveyed and agitated. The apparatus is particularly useful in the event a mixture of different materials is conveyed, the suspension of the particles of the mixture in the gas facilitating a uniform distribution of the several materials.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In apparatus for conveying finely divided material, the combination with a generally horizontally disposed conduit having an inlet for the material and a discharge outlet, of a support for said material disposed within said conduit in the lower portion thereof, said support being formed of porous material, and means for forcing a gaseous medium upwardly through said support.

2. In apparatus for conveying finely divided material, the combination with a generally horizontally disposed conduit having an inlet for the material and a discharge outlet, of a support for said material disposed within said conduit in the lower portion thereof, said support being formed of porous material, and means for introducing a gaseous medium into said conduit and beneath said support, whereby the gaseous medium may pass through said support and cause the finely divided material to flow along the conduit.

3. In apparatus for conveying finely divided material, the combination with a generally horizontally disposed conduit having an inlet for the material and a discharge outlet, of a support for said material disposed within said conduit in the lower portion thereof, said support being formed of porous material, and means for forcing a gaseous medium upwardly through said support, a support for said conduit adjustable vertically to vary the inclination of the conduit to facilitate

the conveying of material of different characteristics.

4. In apparatus for conveying finely divided material, the combination with a generally horizontally disposed trough, having a lower wall of a porous substance, of means for introducing a gaseous medium under pressure through said lower wall into said trough, said trough having an inlet for the material to be conveyed and an outlet through which the material and the gaseous medium may be discharged, whereby the material may be conveyed through said trough from the inlet to the outlet and simultaneously agitated.

5. In apparatus for conveying finely divided material, the combination with a generally horizontally disposed conduit having an inlet for the material and a discharge outlet, of a support for said material disposed within said conduit in the lower portion thereof, said support being formed of porous material, and means for introducing a gaseous medium beneath said support and establishing a pressure gradient decreasing from the inlet to the outlet therein, whereby the latter will be forced through said support to maintain the finely divided material in a state of suspension and flow.

6. In apparatus for conveying finely divided material, the combination with a generally horizontally disposed conduit having an inlet for the material and a discharge outlet, of a support for said material disposed within said conduit in the lower portion thereof, said support being formed of porous material, and extending laterally across

and longitudinally of said conduit to form isolated upper and lower chambers therein, and means for introducing a gaseous medium under pressure into said lower chamber.

7. In apparatus for conveying finely divided material, the combination with a generally horizontally disposed conduit having an inlet for the material and a discharge outlet, of a support for said material disposed within said conduit in the lower portion thereof, said support being formed of porous material, and extending laterally across and longitudinally of said conduit to form isolated upper and lower chambers therein, partitions in said lower chamber spaced longitudinally thereof to form a plurality of isolated compartments therein, and separate means for introducing air under pressure into the several compartments.

8. In apparatus for conveying finely divided material, the combination with means affording a passage for the material having a lower wall of gas pervious material, and means for forcing a gaseous medium under pressure through said wall, the degree of pressure being lessened in the direction of movement of the finely divided material.

9. In apparatus for conveying finely divided material, the combination with a generally horizontal elongated support formed of gas pervious material, of means for forcing gas under sufficient pressure through said support to maintain the finely divided material thereon in a substantially fluid condition.

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45	120
50	125
55	130
60	135
65	140
70	145
75	150