

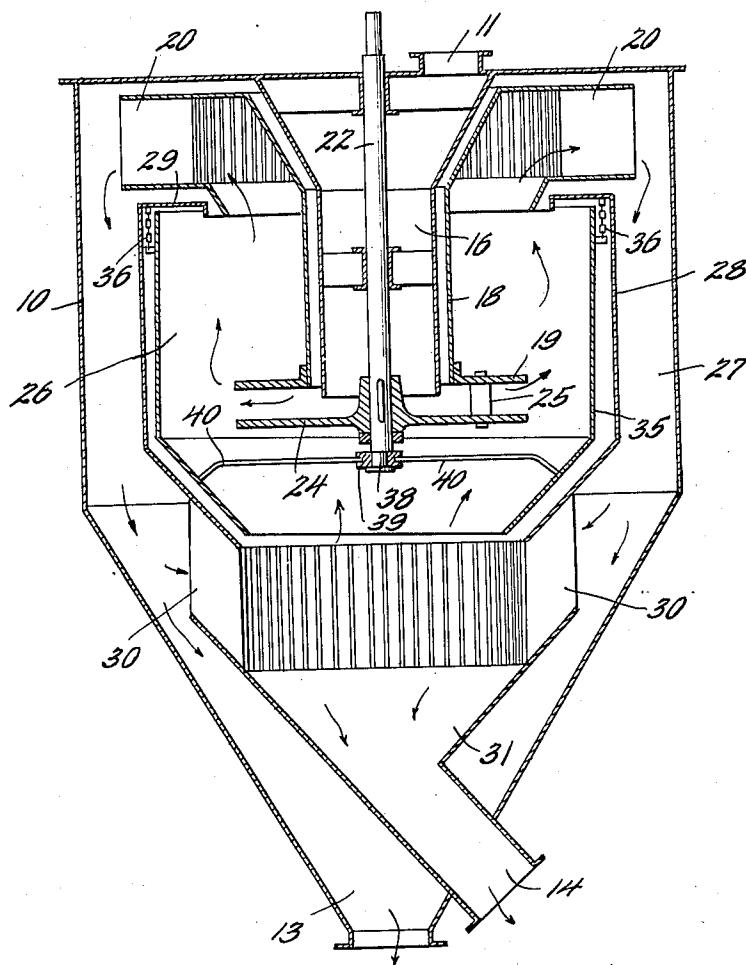
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This invention relates to centrifugal separators and more particularly to improvements in apparatus for separating and classifying finely divided or pulverulent solid material, for instance coal dust, cement material, lime, or the like.

The separation of materials of this character is commonly effected by circulating air laden with the material in a closed chamber in such manner as to cause the air to follow a generally circular path, whereby the heavier particles of the material are thrown outwardly of the chamber by centrifugal force, and are discharged downwardly from the chamber, the finer particles being subsequently released from suspension by continued circulation and separately discharged. It is to this general class of apparatus that the present invention relates and an important object of the invention is to reduce to a minimum the adherence of fine particles to the various elements of the separating apparatus within the chamber and to promote the discharge of such particles in the desired manner.

It is a more specific object of the invention to provide, in apparatus of the general type referred to, means disposed in or adjacent to the path in which the material-laden air circulates and affording a surface of substantial area, the surface being so located with reference to such path of circulatory motion that the settling of the finer particles tends to occur principally on such surface, in combination with mechanism for agitating such means to dislodge the particles therefrom or to prevent adherence of the particles thereto.

It is a feature of the invention that the agitated means is of relatively light construction, forming a small part only of the total weight of the separating mechanism, and is so supported that it can be very easily displaced by the agitating mechanism, whereby power consumption by the latter is minimized and excessive wear of the driving parts is avoided. It is a further feature of the invention that the agitated means is so formed and so simply supported and operated as to lend itself readily to installation in existing conventional types of separator, whereby the advantages of the invention can be realized in apparatus which is already built and in operation.

Further objects and features of the invention will be apparent from the following description taken in connection with the accompanying drawings, in which the single figure is a vertical sectional view of a separator constructed in accordance with the principles of the invention.

For convenience in describing the invention, reference is made to the preferred embodiment thereof illustrated in the accompanying drawing, and specific language is used. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, but that various modifications and alterations of the illustrated structure are contemplated such as would occur to one skilled in the art to which the invention relates.

The separating and classifying apparatus selected for the purpose of illustration includes an outer housing 10 which is preferably closed with the exception of the inlet 11 at the upper end thereof, and discharge conduits 13 and 14 at the lower end thereof. At its upper end, and in communication with the inlet 11, is formed a downwardly directed inlet passage 16 which is open at its lower end. Surrounding this inlet passage and journaled for rotation thereon is a generally cylindrical member 18 which is provided at its lower end with a driving flange 19 and at its upper end with fan blades 20. A drive shaft 22, vertically disposed within the inlet passage 16, and suitably journaled for rotation therein, carries at its lower end a disk 24 which is rotatively coupled to the flange 19 as indicated at 25, whereby rotation of the drive shaft 22 is transmitted to the fan blades 20.

The interior of the housing 10 may be divided roughly into a saturation chamber indicated generally at 26, and a separating chamber indicated generally at 27, by means of a stationary annular member 28, the latter being illustrated as formed to provide a generally cylindrical upper portion and a downwardly tapered, generally frusto-conical lower portion, the member 28 being further formed to provide at its upper end an inwardly directed annular flange 29. At the lower end of the member 28 are disposed a plurality of vanes 30 which are immovable except to the extent which may be required for minor angular adjustment to control the circulatory movement of the air, these vanes extending between the member 28 and the upper end of a downwardly directed discharge spout 31 leading to the discharge conduit 14.

The operation of the apparatus thus far described is substantially as follows. The material-laden air or other gaseous medium entering the housing 10 at the inlet 11 moves downwardly through the inlet passage 16, being drawn in by the rotation of the fan blades 20. The disk 24, disposed at the lower end of this inlet passage, deflects the air laterally to distribute the same

about and within the saturation chamber 26 and from thence the air is drawn upwardly and outwardly through the fan blades 20 and downwardly in the annular separating chamber 27. A portion of this air is then returned to the saturation chamber 26, passing through the vanes 30, which vanes are so angularly disposed as to impart to this air such direction of movement as to maintain the desired degree of rotation of the air within the saturation chamber 26, excess air corresponding to the amount entering through the inlet opening 11 being exhausted downwardly through the discharge conduits 13 and 14. It will be appreciated that the coarser particles of material in suspension in the air are thrown outwardly by centrifugal force and by the action of the rotating disk 24, and fall downwardly through the discharge conduit 14. Finer particles which are carried upwardly with the ascending air are separated out on passage through the annular chamber 27, and are discharged downwardly through the discharge conduit 13, the air thus relieved of the principal portion of its material in suspension being recirculated for further treatment. If desired, baffles or other suitable means may be disposed in the annular chamber 27 to retard the rotational movement of the air therein and to facilitate separation out of the finer particles of the suspended material.

It will be appreciated that it is highly desirable to avoid any settling of fine particles in the saturation chamber 26 and it is therefore proposed to introduce in this chamber the means, hereinbefore referred to, having a stationary surface so disposed as to receive the major portion of the fine material which may tend to separate out at this point, together with mechanism for agitating the means in question so as to dislodge such material and maintain the same in suspension in the ascending current of air. In the form of the invention shown in the drawing, this means is constituted by an annular member 35 which is disposed within and conforms largely to the shape of the annular member 28. The member 35 may be supported on the member 28 by means of flexible elements such as chains 36; alternatively, springs or other elastic as well as flexible means may be employed. At its lower end the drive shaft 22 may be formed to provide an eccentric portion 38 on which is journaled a hub 39 carrying radial spokes 40, the latter being secured at their outer ends to the lower portion of the member 35. As the drive shaft 22 is rotated, the member 35 will be vigorously oscillated and agitated so as to continuously dislodge therefrom or prevent the depositing thereon of fine particles of the suspended material. It will be appreciated that these fine particles normally tend to deposit on the inner surface of the member 35 by reason of the fact that it defines the periphery of the saturation chamber 26, toward which all of the particles are urged by centrifugal force. Furthermore, there is a certain amount of eddying of the ascending air adjacent this surface by reason of the pressure of the annular flange 29 at the upper end of the chamber 26, this flange being provided to prevent the carrying out of coarse particles through the upper end of the saturation chamber. Again, the boundary of the saturation chamber is normally afforded by a stationary rather than a rotatable annulus, and a layer of relatively stagnant air may frequently be found adjacent this surface.

It will also be noted that an annular channel

is formed between the members 28 and 35, through which coarse material which is thrown outwardly and upwardly may fall, being discharged through the conduit 14. In this respect the construction illustrated herein functions similarly to that shown in the prior application for U. S. Letters Patent of Theo Schmidt, Serial No. 38,879½, filed September 3, 1935, and offers the further advantages outlined hereinbefore.

It is of course possible to similarly support and agitate the member 28, which defines the boundary of the saturation chamber, dispensing with the member 35, but I prefer the construction illustrated in the drawing since it offers a simple method of correcting improper operation of existing separators by the introduction therein of the member 35 or its equivalent and the association with the usual drive shaft of simple and inexpensive agitating mechanism for imparting vibration to the member 35.

Preferably the eccentricity of the portion 38 of the drive shaft 22 may be adjusted in order that the throw of the member 35 may be correspondingly varied to afford the maximum efficiency in operation. The length of the flexible supporting means for the member 35 may also readily be altered to suit operating conditions.

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

1. In apparatus for separating and classifying solid material suspended in a gaseous medium, the combination with a housing, of means within said housing forming therein a saturation zone, in which the coarse material is removed, and a separating zone, in which the fine material is removed, means for circulating the material laden gaseous medium through the said saturation and separating zones in succession, and a member supported within said saturation zone, said member having a surface of substantial area disposed in contiguous relation to the path of circulation of said medium, and mechanism for imparting a continuous lateral vibration of relatively high frequency and substantial amplitude to said member.

2. In apparatus for separating and classifying solid materials, the combination with a housing, of an annular member disposed within said housing in spaced relation to the latter so as to form between said member and the housing wall an annular chamber, means for causing a gaseous medium containing solid material in suspension to flow within said annular member and said annular chamber in succession, means for effecting outward and downward discharge of heavier particles of the solid material within said annular member, and means for imparting a continuous lateral vibration of relatively high frequency and substantial amplitude to said annular member to minimize the settling and accumulation thereon of relatively fine particles of the solid material.

3. In apparatus for separating and classifying solid materials, the combination with a housing, of an annular member disposed within said housing in spaced relation to the latter so as to form between said member and the housing wall an annular chamber, means for causing a gaseous medium containing solid material in suspension to flow within said annular member and said annular chamber in succession, means for effecting outward and downward discharge of heavier particles of the solid material within said annular member, an annular member disposed

within and having a surface of substantial area in close proximity to said first named annular member, and means for imparting a continuous lateral vibration of relatively high frequency and substantial amplitude to said last named annular member only to minimize the settling and accumulation of finer particles of the solid material prior to the passage of the gaseous medium through said annular chamber.

4. In apparatus for separating and classifying solid materials, the combination with a housing, of an annular member disposed within said housing in spaced relation to the latter so as to form between said member and the housing wall an annular chamber, means for causing a gaseous medium containing solid material in suspension to flow within said annular member and said annular chamber in succession, means for effecting outward and downward discharge of heavier particles of the solid material within said annular member, an annular member disposed within and in close proximity to said first named annular member, and means for agitating said last named annular member only to minimize the settling and accumulation of finer particles of the solid material prior to the passage of the gaseous medium through said annular chamber, said last named means including a centrally disposed rotatable shaft having an eccentric connection with said last named annular member.

5. In apparatus for separating and classifying solid material suspended in a gaseous medium, the combination with a housing, of means within said housing forming therein a saturation zone, in which the coarse material is removed, and a separating zone, in which the fine material is removed, means for circulating the material laden gaseous medium through the said saturation and separating zones in succession, vibrating means associated with said saturation zone for preventing the settling of fine material therein, said vibrating means comprising an annular member having a surface of substantial area, flexible means supporting said annular member within said saturation zone, and mechanism for imparting a continuous lateral vibration of relatively high frequency and substantial amplitude to said annular member.

6. In apparatus for separating and classifying solid materials, the combination with a housing, of an annular member disposed within said housing in spaced relation to the latter so as to form between said member and the housing wall an annular chamber, means for causing a gaseous medium containing solid material in suspension to flow within said annular member and said annular chamber in succession, means for effecting outward and downward discharge of heavier particles of the solid material within said annular member, an annular member disposed within and having a surface of substantial area in close

proximity to said first named annular member, means supporting said last named annular member within said first named annular member for lateral displacement with respect thereto, and operating means for imparting a continuous lateral vibration of relatively high frequency and substantial amplitude to said last named annular member.

7. In apparatus for separating and classifying solid materials, the combination with a housing, of an annular member disposed within said housing in spaced relation to the latter so as to form between said member and the housing wall an annular chamber, means for causing a gaseous medium containing solid material in suspension to flow within said annular member and said annular chamber in succession, means for effecting outward and downward discharge of heavier particles of the solid material within said annular member, an annular member disposed within and in close proximity to said first named annular member, means supporting said last named annular member within said first named annular member for lateral displacement with respect thereto, and operating means for imparting such lateral movement to said last named annular member, said operating means including a rotatable shaft generally coaxial with said last named annular member and having an adjustable eccentric connection therewith.

8. An attachment for use in separating and classifying apparatus of the type including a housing formed to provide a central saturation chamber and an outer annular separation chamber through which a gaseous medium laden with solid particles is successively conducted, said attachment comprising an annular member having a surface of substantial area, means supporting said member for lateral displacement within said saturation chamber, and means for imparting a continuous lateral vibration of relatively high frequency and substantial amplitude to said member to agitate the same and thereby minimize the settling and accumulation of finer particles within said saturation chamber.

9. An attachment for use in separating and classifying apparatus of the type including a housing formed to provide a central saturation chamber and an outer annular separation chamber through which a gaseous medium laden with solid particles is successively conducted, said attachment comprising an annular member, means including suspension chains supporting said member for lateral displacement within said saturation chamber, and means including a rotatable shaft having an eccentric connection with said member for effecting rapid lateral displacement of said member to agitate the same and thereby minimize the settling and accumulation of finer particles within said saturation chamber.

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