

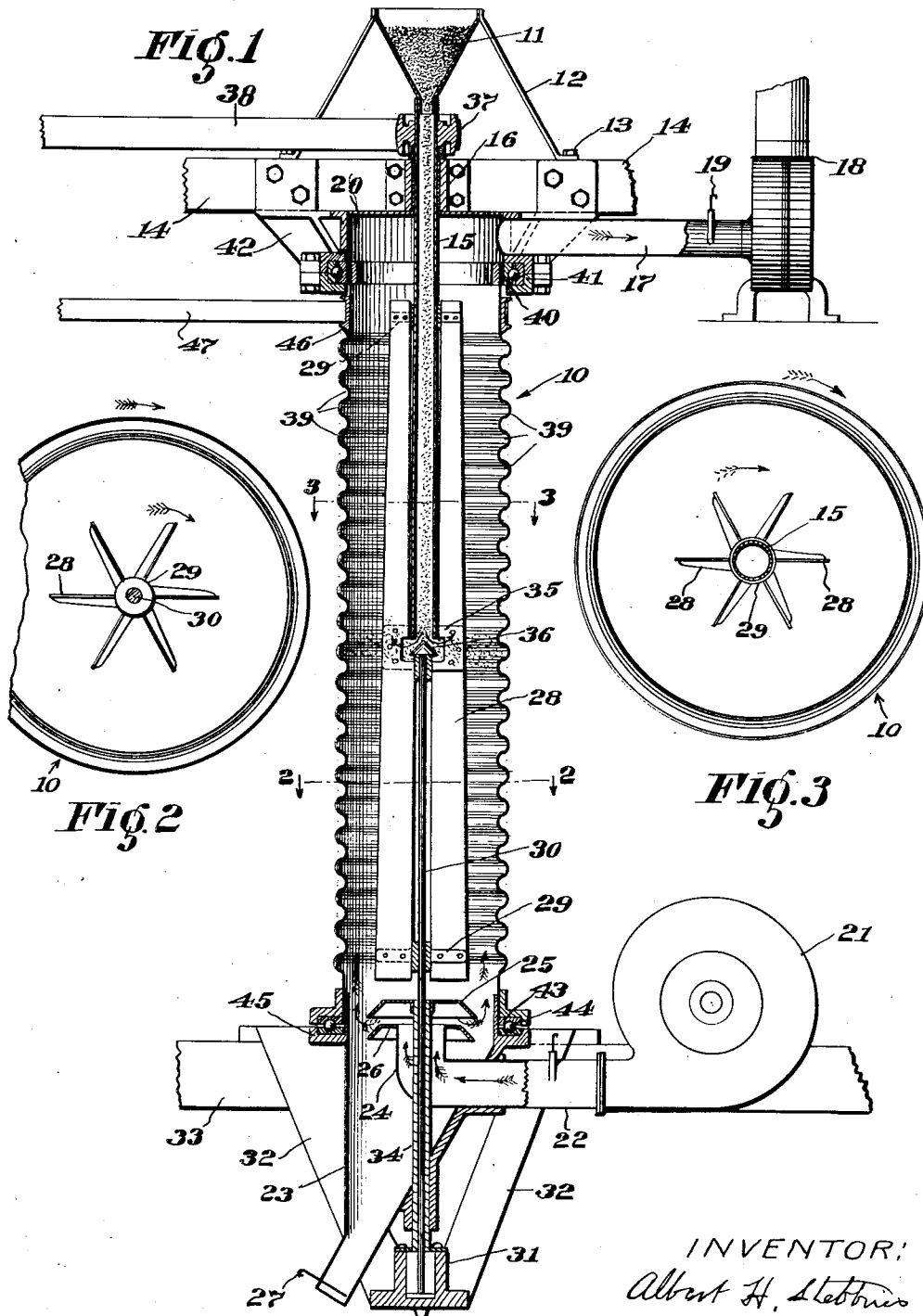
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AIR CLASSIFIER

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AIR CLASSIFIER.

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This invention relates to air classifiers of the type in which separation of the materials is effected by employing air currents that are strong enough to carry off the lighter particles but which are not strong enough to carry off the heavier particles.

In carrying out the present invention air currents are produced that travel lengthwise of the treatment chamber and the materials to be separated are delivered into the treatment chamber so that the lighter particles will be picked up by the air.

If the materials to be separated differ only slightly in size and specific gravity it is difficult to adjust the strength of the air so that the lighter but not the heavier particles will be carried off by the air currents.

An important feature of the present invention therefore resides in the construction whereby a rotative movement is imparted to the air in the treatment chamber so that the heavier particles are thrown outward by centrifugal force against the walls of the treatment chamber. In this manner the heavier particles are removed from the direct path of the rising air currents with the result that they are less likely to be carried off by the air with the finer particles.

Another feature of the invention resides in the construction of the classifying receptacle whereby annular grooves or recesses are formed in the walls thereof in which the heavier particles may enter so that they will be entirely out of the path of the rising air currents.

Another feature of the invention resides in the construction of the classifying receptacle and fan whereby a pronounced rotative movement is imparted to the entire volume of air within the receptacle so that the centrifugal force thus produced holds the heavier particles against the walls of the receptacle as they pass downwardly therein.

Other features of the invention and novel combination of parts in addition to the above will be hereinafter described in connection with the accompanying drawings which illustrate one good practical form of the invention.

In the drawings:—

Fig. 1 is a vertical sectional view through a classifier constructed in accordance with the present invention;

Fig. 2 on an enlarged scale is a sectional view taken on the line 2—2 of Fig. 1; and

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 1.

In carrying out the present invention the separation of the materials is effected in the receptacle 10 which preferably is cylindrical or substantially cylindrical in shape and the length of this receptacle may be much greater than its diameter so as to provide a relatively long receptacle which affords the air passing therethrough ample opportunity to remove the finer from the coarser particles. The receptacle 10 is preferably supported in a vertical or substantially vertical position, but this is not essential in all embodiments of the invention.

The materials to be treated, in the construction shown, are supplied to the casing 10 by a feed hopper 11 which may be supported by the inclined braces 12 the lower ends of which are secured by bolts 13 to a supporting beam 14. In the construction shown the materials supplied by the hopper 11 pass downwardly through the hollow shaft 15 into the receptacle 10. This shaft is rotatably mounted in a bearing 16 which is secured to the supporting beam 14 and the shaft 15 serves to rotatably support the upper portion of a fan which is mounted within the casing 10. The classification of the materials being treated is effected by producing rising air currents within the receptacle 10 so that the finer particles will be picked up by the rising air while the heavier particles will move downwardly under the influence of gravity in opposition to the rising air currents. These rising air currents may be produced by exhausting air from the upper portion of the receptacle, or by delivering air under pressure to the lower portion of this receptacle. In the construction shown air is exhausted from the upper portion of the receptacle 10 by the exhaust pipe 17 which leads to the suction fan 18 and the amount of air exhausted from the receptacle 10 may be controlled by adjusting the valve of sliding gate 19 provided in the pipe 17. The upper end of the receptacle 10 is closed by the head or cover plate 20.

In the construction shown air is supplied to the lower end of the receptacle 10 under pressure by a blast fan 21 having the air supply pipe 22 which extends inwardly through an opening formed in the material receiving hopper 23 provided at the lower

end of the receptacle. The discharge end of the pipe 22 is bent upwardly as at 24 and preferably has the deflector plates 25 and 26 which serve to direct the air currents outwardly towards the walls of the receptacle, the arrangement being such that the heavier particles moving downwardly within the receptacle 10 must pass through the restricted annular space provided between the walls of the receptacle and the outer periphery of the deflector plate 25, in opposition to the rising air currents, before they can enter the receptacle 23. The lower end of the hopper 23 may be closed by a valve or sliding gate 27 which may be opened from time to time to draw off the heavier particles. While in the construction shown both suction and blast means are provided for producing the rising currents of air within the receptacle 10, in most cases either the suction fan or the blast fan may be omitted, as suction means alone, or blast means alone will suffice to provide the desired rising air currents within the receptacle.

If the materials being treated in the present classifier differ only slightly in size or specific gravity it may be difficult to regulate the strength of the air rising within the receptacle so that the air will carry off the lighter particles, but will not carry off the slightly heavier particles. One of the features of the present invention therefore reside in means for imparting a pronounced rotative movement to the volume of air within the receptacle 10 so that the heavier particles within the receptacle will be thrown outwardly against the walls thereof. The centrifugal force imparted to these heavier particles will cause them to lie close to the walls of the receptacle where they will be out of the direct path of the rising air currents. The lighter particles are less susceptible to the action of centrifugal force than the heavier particles and will therefore hug the walls of the receptacle to a less extent with the result that they will lie more directly within the path of the rising air currents, it being understood that the air moving upwardly within the receptacle 10 close to the side walls of the receptacle will be of less strength than the air which is spaced slightly from these side walls.

In the construction shown rotation of the volume of air within the receptacle is effected by providing a relatively long fan therein having the fan blades 28 which are secured to the spiders or blade supporting castings 29. The upper casting 29 is rigidly secured to the hollow shaft 15 and the lower casting 29 is rigidly secured to the shaft 30 which extends downwardly through an inclined wall of the hopper 23, and the lower end of this shaft is journaled in a bearing

block 31 which is supported by the frame 32 that is rigidly secured to the lower supporting beam 33. The shaft 30 rotates within a tube 34 which extends upwardly from the bearing block 31, and this tube constitutes a support for the deflector plate 25. In the construction shown the hollow shaft 15 extends downwardly to the blade supporting casting 35 which is disposed intermediate the ends of the fan, and directly below the discharge end of this shaft 15 is provided the deflector cap or spreader 36 which directs the materials outwardly towards the side walls of the receptacle. The fan just described may be rotated rapidly by the pulley 37 secured to the upper end of the hollow shaft 15 and provided with the driving belt 38.

It is desirable that the whirling air currents produced within the receptacle 10 by the rotating fan be strongest near the lower end of the receptacle. This desired result is produced in the construction shown by decreasing the width of the fan blades 28 in an upward direction so that the upper end of the fan is smaller in diameter than the lower end of this fan; the same result might be accomplished however by providing the receptacle 10 with walls that flare outwardly slightly in an upward direction. The effect of decreasing the strength of the whirling currents of air towards the upper end of the receptacle 10 is to give the heavier particles an increased opportunity to settle out of the rising air currents as they approach the upper end of the receptacle.

The tendency of the larger particles within the receptacle to be carried upwardly by the rising air currents may be further reduced by giving the side walls of the receptacle 10 the corrugated or ribbed construction shown. As a result of this ribbed construction the annular grooves 39 are formed, into which the heavier particles will be thrown by centrifugal force out of the path of the rising air currents. As these heavier particles move downwardly under the influence of gravity from one groove 39 to another they will move into the path of the rising air currents for further treatment. This corrugated or grooved construction of the side walls of the receptacle 10 is not an essential feature of the present invention since the walls of the receptacle may be made smooth, but the annular groove shown in the drawing help to promote the separation of the finer from the coarser particles.

In some embodiments of the invention it may be desirable to rotate the receptacle 10, as this will promote rotation of the air within the receptacle to cause the heavier particles to be thrown outwardly by centrifugal force. The receptacle 10 is therefore shown as supported for rotative movement and the upper end of this receptacle is provided

with a bearing ring 40 which rotates within a fixed ring 41 that is supported from the beam 14 by the downwardly extending brackets 42. The lower end of the receptacle 10 is provided with the bearing ring 43 in which is mounted the thrust bearing 44, and the lower portion of this bearing is supported by the annular flange plate 45 which is secured to the lower beam 33. The receptacle 10 is provided with a pulley 46 and this pulley is rotated by the belt 47.

It will be seen from the foregoing that through the use of centrifugal force the larger particles are kept out of the direct path of the rising air currents, and as a result rising air currents may be employed which are strong enough to completely remove the lighter particles from the receptacle while the slightly heavier particles which are kept out of the direct path of the rising air will move downwardly adjacent the wall of the receptacle under the influence of gravity. These heavier particles will collect in the hopper 33 while the lighter particles will be carried off by the air through the pipe 17.

What is claimed is:—

1. An air classifier, comprising in combination, a long annular receptacle supported in an upright position and having a length that far exceeds its diameter, a fan rotatably mounted in the receptacle and having fan blades that extend throughout approximately the entire length of the long receptacle, means for producing rising air currents within the receptacle, means for delivering the materials to be treated into the receptacle so that the lighter particles will be picked up by the air, and means for rotating the fan to impart a rotative movement to the volume of air within the receptacle which will serve to throw the heavier particles outwardly by centrifugal force throughout the length of the receptacle and keep them close to the walls of the receptacle as they move downwardly therein.

2. An air classifier, comprising in combination, an approximately cylindrical receptacle that is supported in an upright position and the length of which exceeds its diameter, a fan rotatably mounted in the receptacle and having fan blades that extend lengthwise of the receptacle a substantial distance and arranged to lie closer to the surrounding walls of the receptacle at their lower ends than at their upper ends to produce the strongest rotating air currents near their lower ends, means for producing rising air currents within the receptacle, means for delivering the materials to be treated into the receptacle so that the lighter particles will be picked up by the traveling air, and means for rotating the fan to impart a pronounced rotative movement to the volume of air within the receptacle which will serve to

throw the heavier particles outwardly and keep them close to the walls of the receptacle as they move downwardly therein.

3. An air classifier, comprising in combination, an annular receptacle that is supported in an upright position and having annular ribs arranged to form material receiving spaces between them which are protected from the rising air currents, means for producing rising air currents within the receptacle, means for delivering the materials to be treated into the receptacle so that the lighter particles will be picked up by the traveling air, a fan within the receptacle, and means for rotating the fan to impart a whirling movement to the air that throws the heavier particles outwardly by centrifugal force.

4. An air classifier, comprising in combination, an annular receptacle that is supported in an upright position and having corrugated walls constructed to form annular material receiving spaces between the corrugations and which spaces are protected from the rising air currents, means for producing rising air currents within the receptacle, means for delivering the materials to be treated into the receptacle so that the lighter particles will be picked up by the traveling air, a fan within the receptacle, and means for rotating the fan to impart a whirling movement to the air that throws the heavier particles outwardly by centrifugal force.

5. An air classifier, comprising in combination, a relatively long annular receptacle that is supported in an upright position, means for producing rising air currents within the receptacle, a fan rotatably mounted within the receptacle and having fan blades that extend lengthwise of the greater portion of the receptacle, a feed pipe mounted centrally within the receptacle and constructed to extend downwardly from the upper end of the receptacle between the fan blades and adapted to deliver the materials to be treated into the receptacle at a point intermediate the ends of the fan blades, and means for rotating the fan to impart a whirling movement to the air that throws the heavier particles outwardly by centrifugal force.

6. An air classifier, comprising in combination, an annular receptacle that is rotatably supported in an upright position, a fan mounted to rotate within the receptacle, means for producing rising air currents within the receptacle, means for delivering the materials to be treated into the receptacle so that the lighter particles will be picked up by the air, and means for rotating the fan and receptacle to impart to the air therein a whirling movement which serves to throw the heavier particles outwardly against the walls of the receptacle.

7. An air classifier, comprising in combination, an annular receptacle that is rotatably supported in an upright position, a fan rotatably mounted within the receptacle, means for producing rising air currents within the receptacle, means for delivering the materials to be treated into the receptacle so that the lighter particles will be picked up by the air, and means for rotating the fan at one speed and the receptacle at a different speed to impart to the air within the receptacle a whirling movement which serves to throw the heavier particles outwardly against the walls of the receptacle.

8. An air classifier, comprising in combination, an annular receptacle that is supported in an upright position and having corrugated walls constructed to form annular material receiving spaces between the corrugations and which spaces are protected from the rising air currents, means for delivering the materials to be treated into the receptacle so that the lighter particles will be picked up by the rising air currents, means including a fan for producing rising air currents in the receptacle that rotate as they travel upwardly through the receptacle, and means for rotating the fan to impart a whirling movement to the air that throws the heavier particles outwardly by centrifugal force into the annular spaces formed by the corrugations.

9. An air classifier, comprising in combination, an approximately cylindrical receptacle that is supported in an upright posi-

tion, means for producing rising air currents within the receptacle that rotate as they travel upwardly therein including a fan rotatably mounted in the receptacle and having fan blades extending lengthwise of the receptacle and arranged to lie closer to the surrounding walls of the receptacle at their lower ends than at their upper ends to produce the strongest rotating air currents near their lower ends, and means for delivering the materials to be treated into the path of the air currents rising within the receptacle.

10. An air classifier, comprising in combination, a long annular receptacle that is supported in an upright position and having a length that far exceeds its diameter, means for producing rising air currents within the receptacle that rotate as they travel upwardly therein, including a fan rotatably mounted in the receptacle and provided with fan blades that extend throughout approximately the entire length of the long receptacle, means for delivering the materials to be treated into the receptacle so that the lighter particles will be picked up by the air, and means for rotating the fan to impart a rotative movement to the volume of air within the receptacle which will serve to throw the heavier particles outwardly by centrifugal force throughout the length of the receptacle.

In testimony whereof, I have signed my name to this specification.

ALBERT H. STEBBINS.