May 24, 1927. **1,629,594**

A. H. STEBBINS

AIR CLASSIFIER

Filed Jan. 5, 1926 2 Sheets-Sheet 1

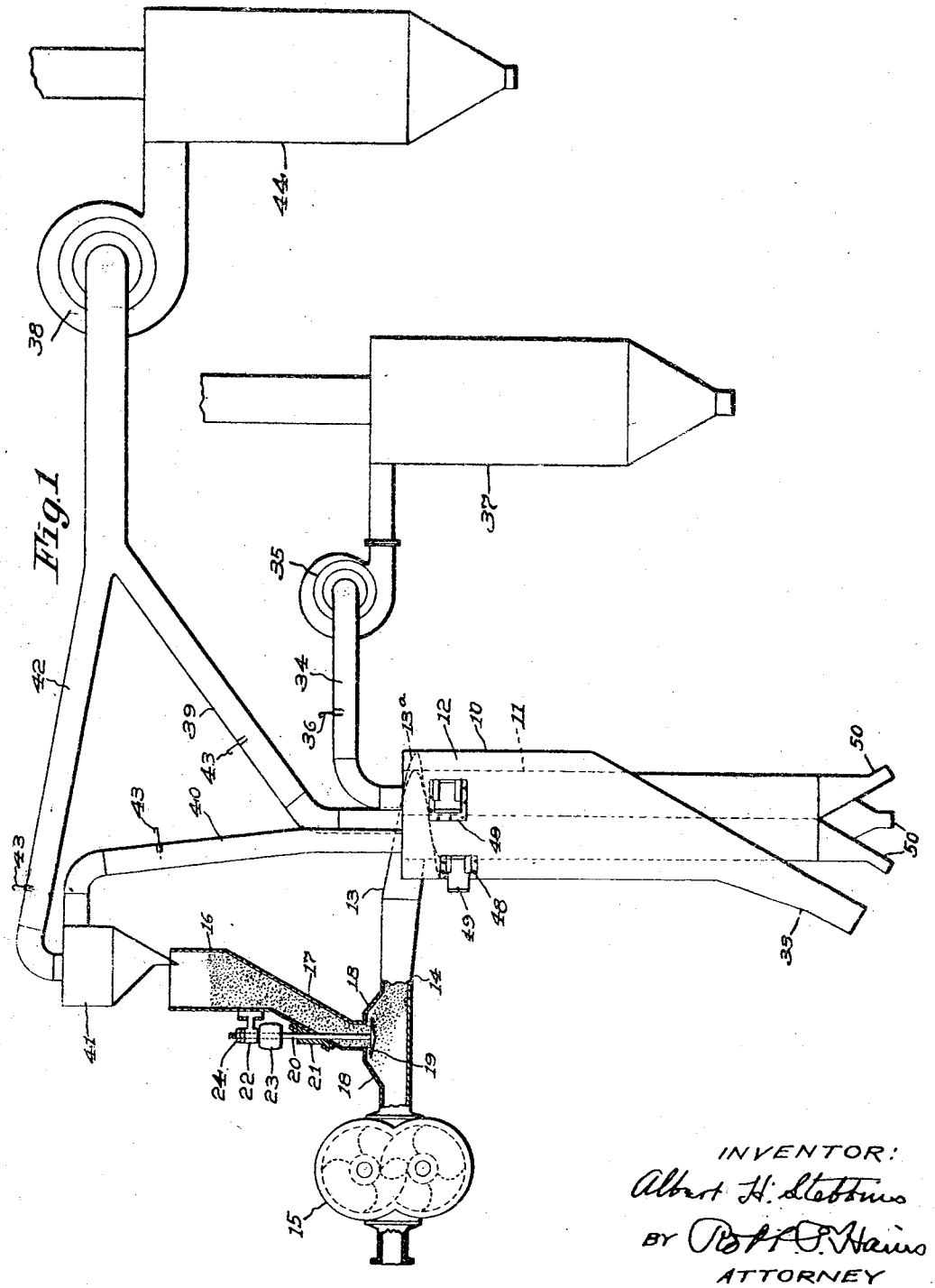


Fig. 1

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Fig. 4

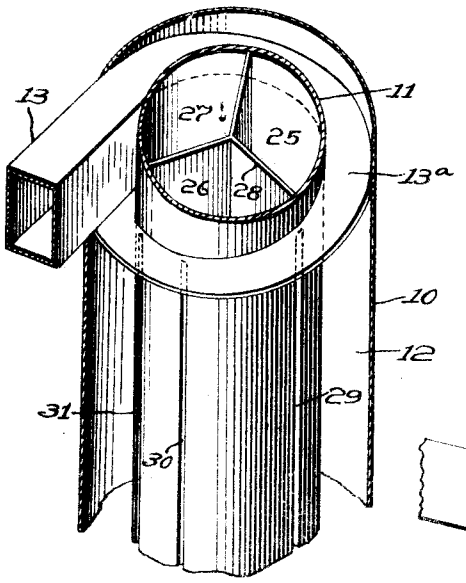
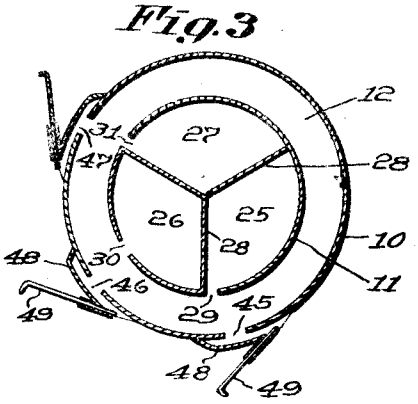


Fig. 3



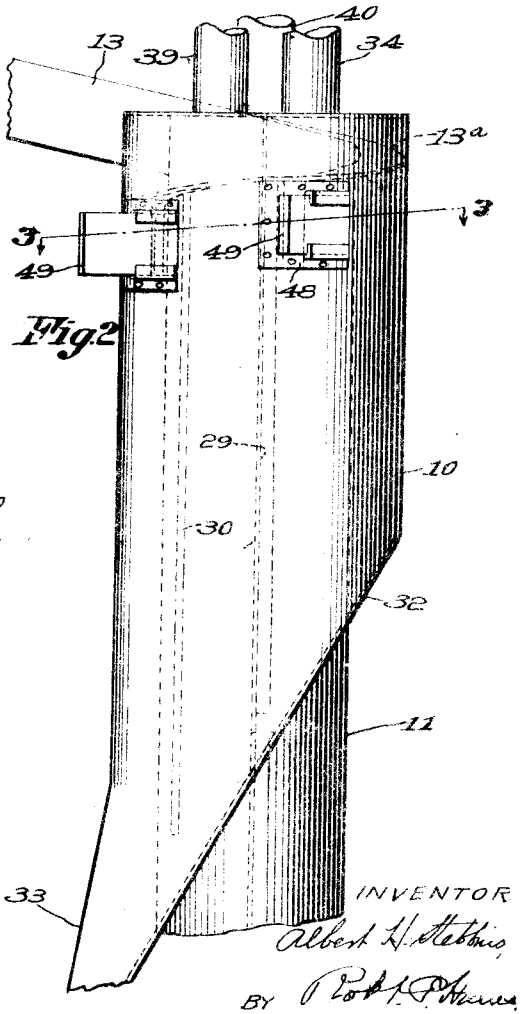


Fig. 5

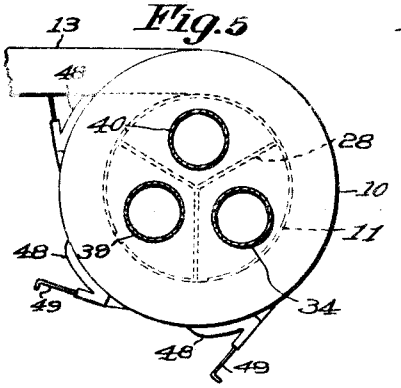


Fig. 2

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UNITED STATES PATENT OFFICE.

ALBERT H. STEBBINS, OF LOS ANGELES, CALIFORNIA.

AIR CLASSIFIER.

Application filed January 5, 1926. Serial No. 79,459.

This invention relates to air classifiers of the type in which the materials to be treated are caused to whirl in an annular chamber, that both momentum and centrifugal force may be employed in effecting the separation.

The classifier of the present invention is designed more particularly for use in treating fine, dust-like materials, but it is difficult to remove the very fine particles without also removing the slightly larger particles, and it is therefore desirable that the materials being treated be repeatedly subjected to the separating action.

One important feature of the present invention therefore resides in an air classifier having an annular passage in which air bearing the materials to be treated is caused to whirl, and in means for extracting air from the annular passage at a plurality of points about its axis to remove from the passage the finer particles whirling therein.

Another feature of the invention resides in the construction whereby air from the exterior of the classifier is drawn inwardly across the annular passage to carry off the lighter particles whirling in the passage.

Another feature of the invention resides in the construction whereby the strength of the air which is withdrawn from the annular passage at different points about its axis may be varied as desired to vary the operation at each point of withdrawal.

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 side elevation with parts in section of a classifier constructed in accordance with the present invention;

Fig. 2 on an enlarged scale is a side elevation of the separating casing of Fig. 1;

Fig. 3 is a sectional view taken on tne line 3—3 of Fig. 2;

Fig. 4 is a perspective view of the interior structure of the casing of Fig. 2; and

Fig. 5 is a top plan view of the casing of Fig. 2.

The classifier of the present invention is designed more particularly for the treatment of fine, dust-like materials and the receptacle in which the separating action takes place preferably consists of an outer casing 10 and an inner casing 11 arranged to form the annular air passage 12 between them in which air bearing the materials to be treated may whirl. The material laden air in the construction shown is delivered into the upper portion of the annular passage 12 by the pipe 13 which preferably slopes downwardly as shown, and extends spirally around the upper portion of the inner casing 11, as indicated by 13^a to impart a downwardly whirling movement to the air and materials delivered into the passage 12.

The inclined pipe 13 is connected with the air supply conduit 14, and air under pressure may be delivered to this conduit by a fan or blower 15, and since the air is preferably forced into the annular passage 12 in the form of a strong air blast, the fan or blower 15 should be constructed so that it will supply air to the conduit 14 under relatively high pressure.

The fine, dust-like materials to be separated are carried into the air passage 12 by the blast of air, and means is therefore shown in the present case for delivering the materials to be treated into the conduit 14. This means consists of a hopper 16 having a relatively long, downwardly extending neck 17, the lower end of which is connected to an enlargement 18 formed upon the conduit 14. It is desirable to provide means for regulating the flow of the materials from the hopper 16 into the conduit 14, and while various means might be provided to this end, in the present case a rotating disk or spreader 19 is provided which is supported adjacent the lower end of the neck 17 so that it rotates in a horizontal plane. This disk is secured to the operating shaft 20 journaled in the brackets 21 and 22 and the shaft may be rotated by the driving pulley 23. The opening between the upper face of the disk and the lower end of the neck 17 may be varied as desired by adjusting the nuts 24 which serve to raise and lower the shaft 20. The arrangement is such that as the disk rotates the materials that are delivered upon the upper face of the disk by the feed hopper will be thrown outwardly into the air passing thru the conduit 14. Due to the relatively high pressure of the air within the conduit 14 it will tend to force its way up thru the materials within the hopper 16; this hopper is therefore

made relatively tall, or is provided with a long neck 17 so that air will not be able to pass up thru the entire mass of materials.

As stated, in treating fine, dust-like materials it is difficult to completely separate the very fine particles from the slightly heavier particles, and in accordance with the present invention means is provided for extracting air from the annular passage 12 at a plurality of points about the axis of the classifier. To this end the inner casing 11 is divided longitudinally into a plurality of separate compartments (three being shown in the present case) which are designated by 25, 26 and 27, and are formed by the partitions 28 within the casing 11. The compartments 25, 26 and 27 are provided with the inlet openings or slots 29, 30 and 31, which preferably extend lengthwise of the casing 11 a substantial distance, as will be apparent from Figs. 2 and 4. As the air bearing the materials to be treated is delivered into the annular passage 12 by the pipe 13 it successively passes the slots 29, 30 and 31, thru each of which slots currents of air are drawn into the respective compartments by suction means to be described, and these currents of air serve to draw into these compartments the lighter particles within the annular passage 12. The heavier particles whirling within this passage will be thrown outwardly by centrifugal force against the wall of the outer casing 10 and this will prevent them from being drawn into the compartments 25, 26 and 27 with the lighter particles. The momentum of these heavier particles will also help to keep them from being drawn inwardly thru the slots just mentioned. The heavier particles as they continue to whirl in the annular passage 12 will move downwardly therein until they settle upon the inclined floor 32 of the casing 10, and slide downwardly upon this floor into the discharge hopper 33.

Various means might be provided for exhausting air from the separate compartments 25, 26 and 27, and in the construction shown air is withdrawn from the first compartment 25 thru the pipe 34 leading to the suction side of the fan 35, and the volume of air traveling thru this pipe may be controlled by adjusting the valve 36. The fine particles which pass thru the fan 35 may be delivered to the dust collector 37 of any desired construction for further treatment. In the construction shown air is exhausted from the compartments 26 and 27 by the fan 38, and the pipe 39 connected to the upper end of the third compartment 27 leads directly to the fan 38 while the pipe 40 leading from the suction compartment 26 carries its materials to the suction dust extractor 41 to remove the heavier particles within the air before the air passes on to the fan 38 thru the pipe 42. The heavier materials separated out of the air by the dust extractor 41 may be delivered by this dust extractor to the feed hopper 16 for retreatment, and the strength of the air within the various pipes just mentioned may be controlled as desired by adjusting the valves 43. The air delivered by the fan 38 and which contains very fine dust may be delivered to a dust extractor 44 for further treatment.

It may be desirable to admit air from the atmosphere into the annular passage 12 at points approximately opposite the slots 29, 30 and 31, and to this end, in the present case, the casing 10 is provided with the inlet slots or openings 45, 46 and 47 formed to admit air into the passage 12 near its upper end, where the force of the air blast is greatest. Each of the slots just mentioned as formed in the outer casing 10, is preferably provided with a housing such as designated by 48 which may be riveted or otherwise secured to the outer face of the casing over the air inlet slot. Each of these housings 48 is provided with an opening the size of which may be varied by adjusting the sliding gate 49. As a result of this construction a regulated amount of air may enter each of the slots 45, 46 and 47 near the upper end of the annular passage 12, to pass across the path of the air whirling within this passage to carry the lighter particles thru the respective slots 29, 30 and 31.

From the foregoing description, when read in connection with the drawings, it will be seen that the dust laden air whirling within the annular passage 12 is successively subjected to the separating action of the air drawn inwardly thru the slots 29, 30 and 31 so that some of the fine particles within the whirling air will pass inwardly thru each of these slots, and since these slots extend downwardly thruout substantially the entire length of the casing 10, they will serve to extract some of the finer particles from the air each time the air passes these slots in moving spirally downwardly within the annular passage. The separating operation effected by the chambers 25, 26 and 27 may be varied as desired by adjusting the air inlet gates 49 and by adjusting the air valves 36 and 43 to control the suction action in each of these receptacles A small amount of the lighter materials may settle within the lower portion of the compartments 25, 26 and 27 and these compartments may be cleaned out from time to time by drawing these materials out thru the hoppers 50 at the lower end of the compartments.

What is claimed is:

1. An air classifier, comprising in combination, an inner casing divided longitudinally into different compartments and hav-

ing slots formed in the side walls of the casing and leading into each compartment, an outer casing surrounding the inner casing and forming an annular air passage between the outer and inner casing, means for delivering air bearing the materials to be treated into the annular passage with a whirling movement, separate means for exhausting air from each of said compartments to draw inwardly through said slots the lighter particles within the annular passage, and means for independently regulating the strength of the air exhaust for each compartment to thereby vary the size of the particles that will be drawn into a particular compartment.

2. An air classifier, comprising in combination, an outer casing and an inner casing having an annular air passage between them and the inner casing having a plurality of longitudinally extending slots formed through its side walls in angularly spaced relation to each other, means for introducing air into the annular passage through the wall of the outer casing at points opposite said slots, means for delivering air bearing the materials to be treated into said annular passage with a whirling movement, and suction means for drawing air from the openings in the outer wall of the casing across the passage into said slots at right angles to the path of the air traveling in said passage to thereby draw into the inner casing the lighter particles whirling in the annular passage.

3. An air classifier, comprising in combination, an inner casing divided longitudinally into different noncommunicating compartments and having slots formed in the side walls of the casing and leading into each compartment, an outer casing surrounding the inner casing and forming an annular air passage between the outer and inner casing, means for delivering air bearing the materials to be treated into the annular passage with a whirling movement so that the air will successively pass the angularly disposed slots as it travels around said passage, means for exhausting air from each of said compartments to draw inwardly through said slots the lighter particles and the construction being such that a different grade of the lighter particles will be collected in each compartment as a result of the positioning of the inlet slots around the passage different distances from said air delivering means.

4. An air classifier, comprising in combination, an inner circular casing having slots provided in its side walls in angular spaced relation to each other, an outer casing surrounding the inner casing to form an annular passage therebetween and having air inlet openings in its outer walls opposite said slots and arranged so that the air thus introduced may travel directly across the annular passage into the adjacent slot, means for delivering air bearing the materials to be treated into the annular passage with a whirling movement, means for drawing air inward through said slots from said inlets to produce air currents passing transversely through the whirling air currents within the passage to draw the lighter particles into said slot, and independently adjustable means for controlling the amount of air admitted to the annular passage through each of said openings in the outer casing.

5. An air classifier, comprising in combination, an inner casing divided into different compartments and having slots formed through the side walls of the casing and leading into each compartment, an outer casing surrounding the inner casing and forming an annular passage between them, means for delivering a blast of air bearing the materials to be treated into the passage to whirl therein, means for exhausting air from said compartments to draw inwardly thru said slots the lighter particles in the annular passage, and separate means for varying the strength of the air in each compartment.

6. An air classifier, comprising in combination, an inner circular casing having a longitudinal slot provided in its annular wall, an outer casing surrounding the inner casing and forming an annular passage therebetween, means for delivering air bearing the materials to be treated into the annular passage with a whirling movement, means for introducing air into the passage thru the outer wall of the casing at a point opposite said slot and arranged so that the air thus introduced may travel directly across the annular passage into said slot, and means for drawing air inward thru said slot from the opening in the outer wall to produce air currents passing transversely thru the whirling air currents within the passage to draw the lighter particles into said slot.

7. An air classifier, comprising in combination, an inner circular casing having slots provided in its annular wall in spaced relation about its axis, an outer casing surrounding the inner casing to form an annular passage therebetween and having air inlet openings in its outer wall opposite said slots and arranged so that the air thus introduced may travel directly across the annular path into the adjacent slot, means for delivering air bearing the materials to be treated into the annular passage with a whirling movement, and means for drawing air inward thru said slots from said inlets to produce air currents passing transversely thru the whirling air currents within the passage to draw the lighter particles into said slots.

8. In combination with an air classifier having a casing in which the separation of the materials is effected, a conduit for forcing air under pressure into the casing, a feed hopper for delivering materials to the conduit so that they are carried into the casing by the air, and a rotating disk adapted to regulate the flow of the materials from the hopper into the conduit and positioned above the path of the air traveling within said conduit and just sufficient distance from a fixed portion of the feed hopper to provide a material discharge opening the size of which regulates the rate of feed.

9. In combination with an air classifier having a casing in which the separation of the materials is effected, a conduit for forcing air under pressure into the casing, a feed hopper for delivering materials to the conduit so that they are carried into the casing by the air, a rotating disk disposed at the lower end of the hopper to rotate in a horizontal plane for controlling the feed of the materials to the conduit, said disk being positioned above the path of the air traveling within said conduit and just sufficient distance from the lower end of the hopper to provide a material discharge opening the size of which regulates the rate of feed, and means for rotating the disk to feed the materials to the conduit.

10. In combination with an air classifier having a casing in which the separation of the materials is effected, a conduit for forcing air under pressure into the casing, a feed hopper for delivering materials to the conduit so that they are carried into the casing by the air, a rotating disk disposed at the lower end of the hopper to rotate in a horizontal plane for controlling the feed of the materials to the conduit, means for supporting the disk different distances from the end of the hopper and for adjusting it relatively to the hopper to vary the size of the opening between the disk and hopper and thereby regulate the feed, and means for rotating the disk to feed the materials to the conduit.

11. An air classifier, comprising in combination, an inner circular casing divided into different compartments and having a slot leading into each compartment, an outer casing surrounding the inner casing and forming an air passage therebetween, means for delivering a blast of air bearing the materials to be treated into the passage to whirl therein, means for exhausting air from each of said compartments to draw inwardly thru said slots the lighter particles in the annular passage, dust extractors connected to said compartments for removing the dust from the air that enters said compartments, and means for exhausting the dust laden air from said compartments and passing it through the dust extractors.

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

ALBERT H. STEBBINS.