Aug. 10, 1926. 1,595,259

A. H. STEBBINS

CYCLONE CLASSIFIER

Filed Oct. 3, 1925 2 Sheets-Sheet 1

Fig. 1

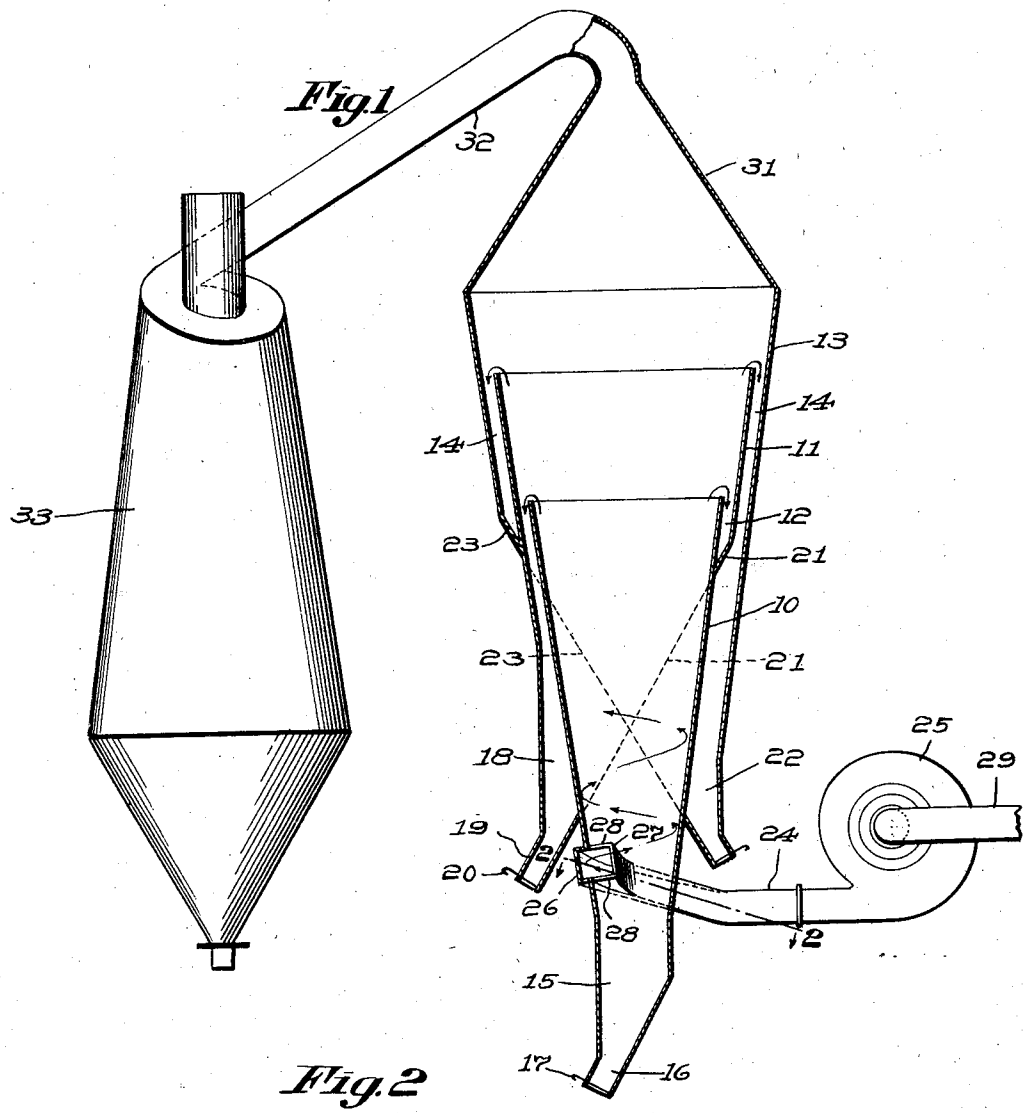
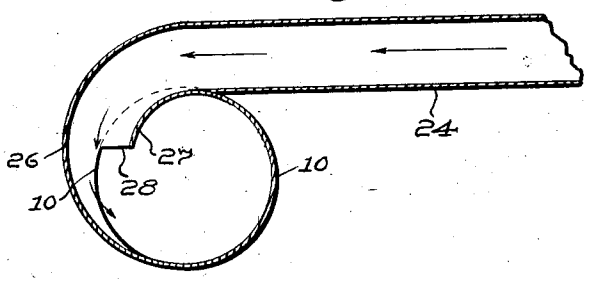


Fig. 2



INVENTOR
Albert H. Stebbins
BY Robert P. Harris.
ATTORNEY

Aug. 10, 1926. 1,595,259

A. H. STEBBINS

CYCLONE CLASSIFIER

Filed Oct. 3, 1925 2 Sheets-Sheet 2

Fig. 3

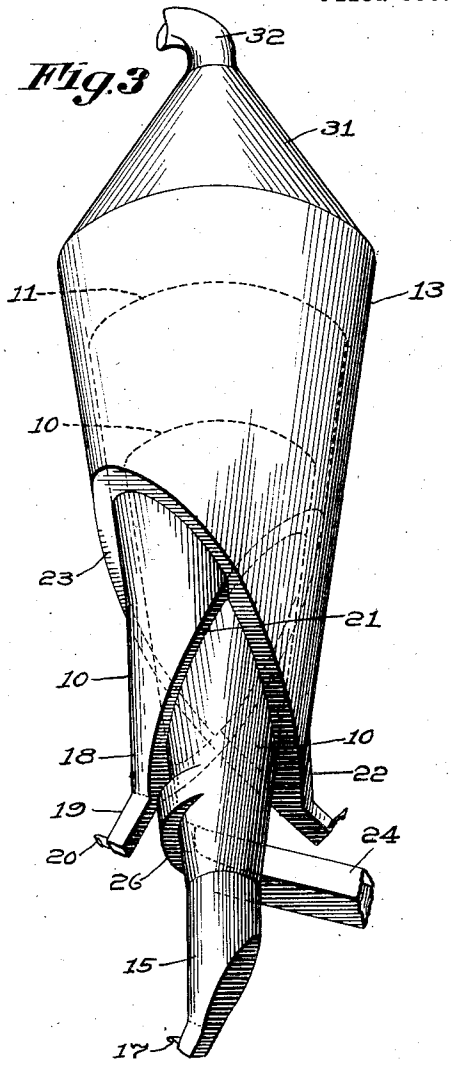


Fig. 4

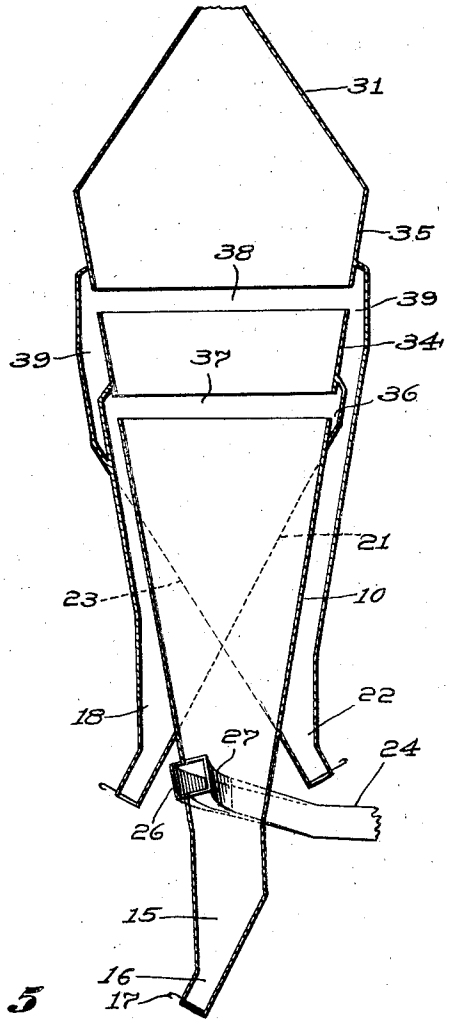
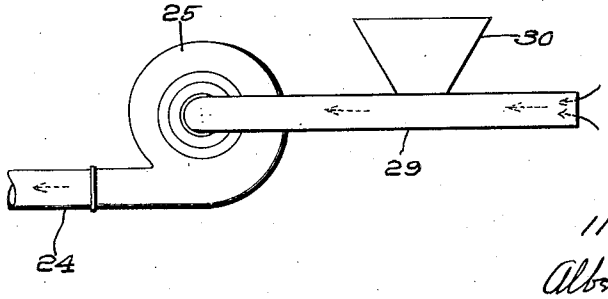


Fig. 5



INVENTOR:
Albert H. Stebbins
BY Robt. P. Stebbins
ATTORNEY

Patented Aug. 10, 1926. 1,595,259

UNITED STATES PATENT OFFICE.

ALBERT H. STEBBINS, OF LOS ANGELES, CALIFORNIA.

CYCLONE CLASSIFIER.

Application filed October 3, 1925. Serial No. 60,358.

This invention relates to air classifiers and more particularly to a construction in which the materials carried upwardly by air are thrown outwardly by centrifugal force to effect their separation.

In treating pulverized ores and other fine materials it is frequently desirable to separate the materials into different grades or classes, and various means have been proposed heretofore for employing the lifting effect of air to classify the materials. In many of these devices the construction is such that materials differing in size and specific gravity are carried upwardly to different heights by the air so that they will enter different chambers.

While fine materials may be classified fairly satisfactorily in this manner, they can be separated more rapidly by employing centrifugal force in connection with the lifting force of the air so that the heavier particles are thrown outwardly by the centrifugal force.

The present invention is therefore directed to a cyclone classifier of the type in which the materials to be treated are carried upwardly within a receptacle by spirally whirling air currents that throw the different materials outwardly by centrifugal force so that they will enter different material receiving chambers.

The various features of the invention and novel combination of parts will be best understood from the following description when read in connection with the acocmpanying drawings of good practical forms showing the invention.

In the drawings:—

Fig. 1 is a vertical sectional view thru a cyclone classifier constructed in accordance with the present invention and having associated therewith a dust collector which is shown in front elevation;

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

Fig. 3 is a perspective view of the cyclone classifier of Fig. 1, the same being viewed from a position below the classifier.

Fig. 4 is a vertical sectional view of a modification of the classifier of Fig. 1; and

Fig. 5 is a side view showing a feed hopper associated with the fan that delivers a blast of air to the lower portion of the classifier.

In the embodiment of the invention shown in Figs. 1 and 3 the cyclone classifier is provided with a receptacle 10 which is more or less conical in shape and flares outwardly in an upward direction. Near the upper end of the receptacle 10 is mounted a casing-like section 11 frusto-conical in shape which surrounds the upper end of the receptacle 10 and forms a material receiving space 12 between the receptacle and section, and this section 11 is surrounded by a second casing-like section 13 of frusto-conical shape and is spaced from the section 11 sufficiently to form the material receiving space 14 therebetween.

The construction is such that the heavier materials in the air whirling within the receptacle 10 will move downwardly within the receptacle under the force of gravity and will collect in the hopper 15 formed at the lower end of this receptacle, and which is provided with a discharge spout 16 having the sliding gate 17. The materials that enter the space 12 at the left-hand side of tht cyclone classifier, as shown in Fig. 1, will travel downwardly under the force of gravity into the hopper 18, from which they may be discharged thru the outlet pipe 19 controlled by the gate 20, while the materials which enter this space 12 at other points around the upper end of the receptacle 10 will move downwardly within the space 12 until they lodge upon the sloping floor 21 of the section 11 and will then slide downwardly upon this floor into the hopper 18.

Likewise the materials that enter the upper material receiving space 14 at the right hand side of the construction shown in Fig. 1 will move directly down into the material receiving hopper 22 at the lower end of the section 13, whereas the materials which enter the space 14 at points other than the right-hand side thereof (viewing Fig. 1) will move downwardly until they settle upon the inclined floor 23; whereupon they will slide upon this inclined floor into the hopper 22.

A blast of air bearing the materials to be treated is delivered into the lower portion of the receptacle 10 with an upwardly whirlign movement so that it will travel upwardly within this chamber with a spiral movement. The means shown for imparting the desired spiral movement to the material laden air consists of a pipe or conduit 24 which may be connected to the discharge side of a fan 25 and the discharge portion of this pipe is constructed so that it curves part way

around the lower portion of the receptacle 10 and inclines upwardly, as clearly shown in Figs. 1 and 3.

The portion 26 of this pipe which is bent around the receptacle 10 enters the receptacle thru an opening therein so that the outer curved wall of the bent portion gradually merges into the curved wall of the receptacle 10, as will be apparent from Fig. 3, and an inner curved portion or lip 27 of this pipe (see Figs. 1 and 2) extends within the receptacle 10 to help direct the air upwardly with the desired spiral movement, and the upper and lower walls 28 of this pipe which extend between the outer curved portion 26 and the lip 27 help to direct the air upwardly in the desired manner. The air that is forced into the cyclone classifier is led into the fan 25 by the inlet pipe 29 and this pipe may draw the materials bearing air to be treated directly from some other machine, or, if desired, the inlet end of this pipe may be open, as in Fig. 5, and the materials may be delivered to the air as it passes thru this pipe by the hopper 30.

The upper portion of the cyclone classifier is shown as closed by the casing 31 which is conveniently made cone-shaped and the base of which cone is secured to or may be formed integral with the upper frusto-conical section 13, and the air within the classifier may be conducted from the upper end of the casing 31 by a pipe 32 which may discharge into the atmosphere, or may lead to a dust collector 33 of any well known or preferred construction.

As a result of the construction described, a blast of air carrying the materials to be separated will be delivered into the lower portion of the receptacle 10 by the pipe 24 with an upwardly spiral movement, as indicated by the arrows. Since the receptacle 10 and the sections 11 and 13 flare outwardly in an upward direction, the whirling currents of air may spread out laterally as they move upwardly within the classifier, and the heavier particles which are thrown against the walls of the receptacle 10 by centrifugal force will move downwardly therein to the discharge hopper 15. The finer materials that are carried upwardly into the section 11 are thrown outwardly against its walls by centrifugal force and settle within the space 12 so that they pass downwardly into the hopper 18, while the still finer materials that are carried upwardly into the section 13 are thrown against its walls and will pass downwardly into the discharge hopper 22. The very light materials which are not thrown against the walls of the classifier by centrifugal force will pass out of the classifier thru the opening in the upper end of the casing 31.

The construction shown in Fig. 4 differs from that shown in Figs. 1 and 3 in that in Fig. 4 the intermediate and upper casing like sections 34 and 35 do not surround the lower receptacle 10, as in Fig. 1, but lie in alignment with the inclined or upwardly flaring walls of this receptacle. In this modified construction the materials to be treated are carried into the receptacle 10 by a blast of air thru the pipe 24, as in Fig. 1, and the air is directed upwardly with a spiral movement, as above described. In fact the operation of the modification of Fig. 4 is substantially the same as that in Fig. 1, except that the materials which enter the space 36 which corresponds to the space 12 of Fig. 1 are required to pass outwardly thru the slot or opening 37 formed between the upper end of the receptacle 10 and the lower end of the section 34. In this construction the lower end of the intermediate section 34 forms a cutting edge which serves to some extent to cut out the heavier materials carried upwardly by the air and to direct them into the chamber 36 to settle therein, whereupon they will pass downwardly into the discharge hopper 18. Likewise the materials that are thrown outwardly by centrifugal force thru the space 38 formed between the lower end of the upper section 35 and the upper end of the intermediate section 34 will enter the material receiving space 39 which corresponds to the space 14 of Fig. 1, and these materials will pass downwardly into the hopper 22.

In the construction shown in Figs. 1 and 3 and also in the modification in Fig. 4 the whirling movement imparted to the air and materials suspended therein serves to throw these materials outwardly by centrifugal force so that they will be separated out of the rising air more quickly and more effectively than would be the case if the air were simply directed vertically upwardly within the classifiers without having the whirling movement imparted thereto.

The cyclone classifier of the present invention may be conveniently formed of sheet metal, in which case the parts thereof will be relatively light in weight and the inclined floors 21 and 23 will serve to hold one receptacle within the other in spaced relation, as shown.

What is claimed is:

1. A cyclone classifier, comprising in combination, a closed container having a free end and unobstructed air chamber that permits air to rise vertically therein from the lower to the upper part of the container, and including a conical receptacle constructed to flare outwardly in an upward direction, a casing-like section surrounding the upper part of the receptacle and forming a material receiving passage about the upper end of said receptacle, means for delivering a blast of air bearing the materials to be classified into the receptacle through a side

wall thereof with a rising spiral movement to throw the heavier particles outwardly by centrifugal force to enter said passage while the lighter particles that are crowded inwardly toward the centre of the container may rise vertically therein.

2. A cyclone classifier, comprising in combination, a closed container having a free and obstructed air chamber that permits air to rise vertically therein from the lower to the upper part of the container, and including a conical receptacle constructed to flare outwardly in an upward direction, a section surrounding the upper part of said receptacle and forming a material receiving passage about the upper end of the receptacle, a second section surrounding said first section and forming a material receiving passage between said sections, means for delivering a blast of air bearing the materials to be classified into the receptacle through a side wall thereof with a rising spiral movement to throw the heavier particles outwardly by centrifugal force to enter said passages while the lighter particles that are crowded inwardly toward the centre of the container may rise vertically therein.

3. A cyclone classifier, comprising in combination, a closed container that flares outwardly in an upward direction and has a free and unobstructed air chamber the length of which exceeds its diameter and in which air is free to rise vertically from the lower to the upper part of the container and including a conical receptacle that flares outwardly in an upward direction, a section surrounding the upper part of the receptacle and forming a material receiving passage about the upper end of said receptacle, means for delivering a blast of air into the receptacle thru a side wall thereof to carry the materials being treated upwardly adjacent the walls of the receptacle with a rising spiral movement to throw the heavier particles outwardly by centrifugal force to enter said passage while the lighter particles that are crowded inwardly toward the center of the container may rise vertically therein.

4. A cyclone classifier, comprising in combination, a conical receptacle constructed to flare outwardly in an upward direction, a casing-like section enclosing the upper end portion of the receptacle and formed to provide a material receiving chamber surrounding the upper end of the receptacle, a conduit for delivering a blast of air bearing the materials to be treated into the receptacle thru a side wall thereof and having an end portion that extends spirally around the receptacle to direct the air upwardly along the flaring walls of the receptacle with a spiral movement that throws the heavier particles outwardly so that they will enter said chamber.

5. A cyclone classifier, comprising in combination, a closed container constructed to provide a relatively long air chamber in which air may rise from the lower to the upper part of the container and including a conical receptacle constructed to flare outwardly in an upward direction, a casing-like section surrounding the upper part of the receptacle and forming a material receiving space between the section and receptacle, means for delivering a blast of air bearing the materials to be classified into the receptacle thru a side wall thereof with a rising spiral movement adjacent the walls of the receptacle to throw the heavier particles outwardly by centrifugal force to enter said passage while the lighter particles that are crowded inwardly toward the centre of the container move upwardly to escape from the upper end of the container.

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

ALBERT H. STEBBINS.