

Feb. 28, 1928.

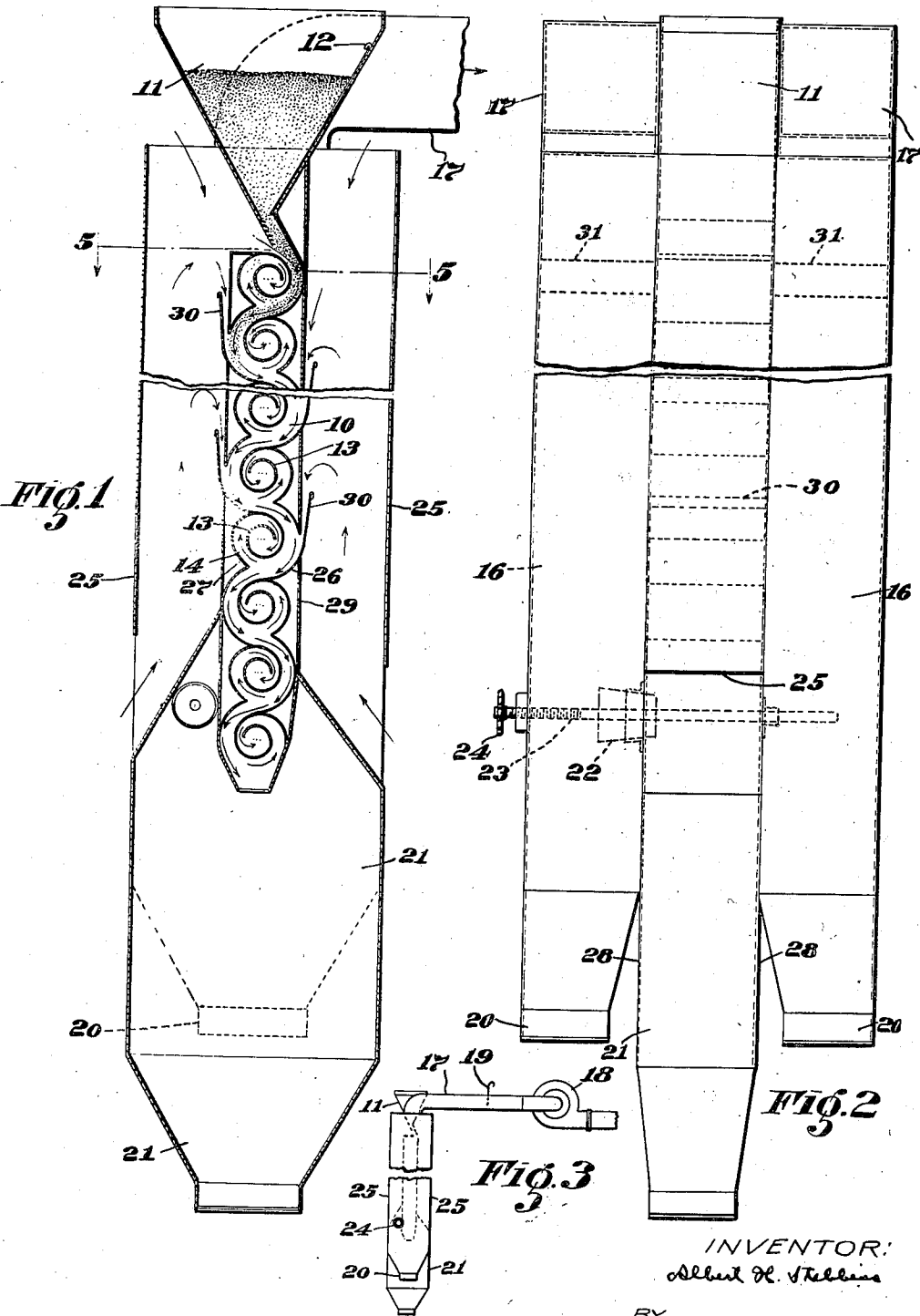
1,660,685

A. H. STEBBINS

AIR CLASSIFIER

Filed Jan. 29, 1927

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 4

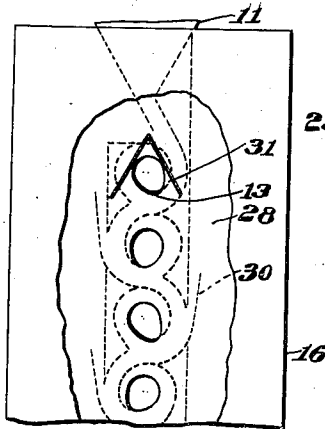
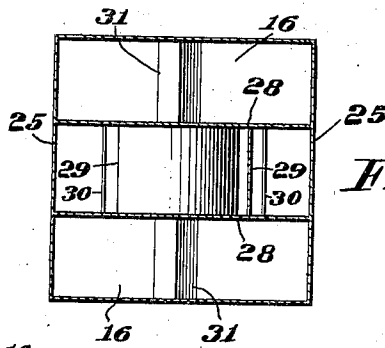


Fig. 5

Fig. 6

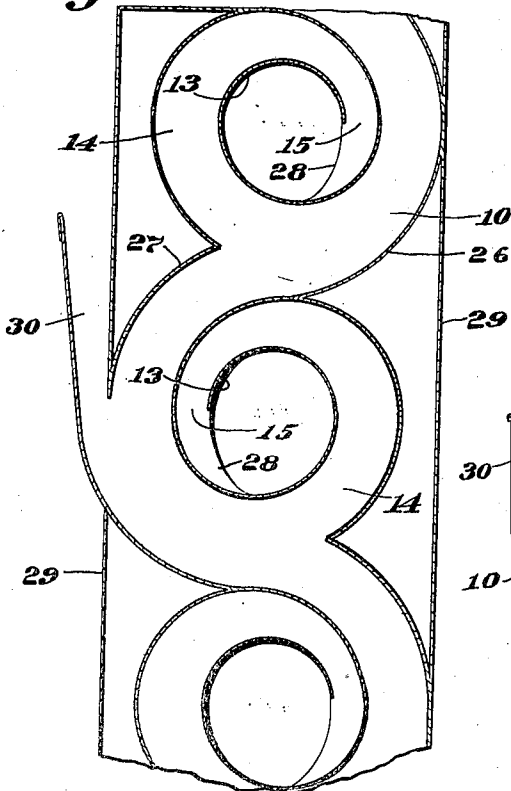


Fig. 7

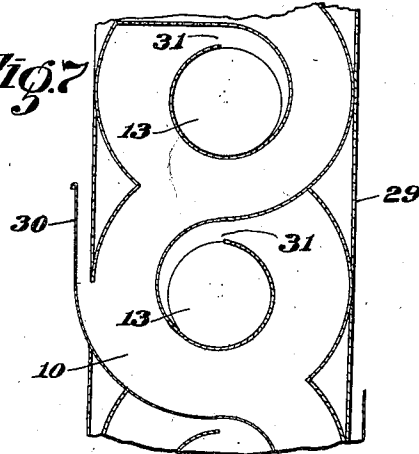
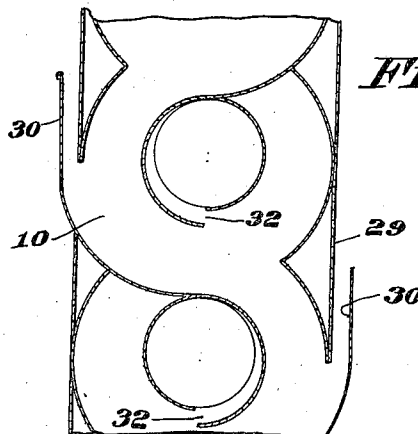


Fig. 8



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UNITED STATES PATENT OFFICE.

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AIR CLASSIFIER.

Application filed January 29, 1927. Serial No. 164,464.

This invention relates to multiple treatment air classifiers designed more particularly for use in separating fine dust-like materials.

5 These very fine materials are hard to separate because they cling together and will not settle rapidly but float or remain suspended in the air in which they are carried. It is therefore desirable to employ centrifugal force rather than gravity or in combination with gravity to promote the separation of the fine, dust-like particles, and in order to effect a complete classification the materials should be subjected time and
15 time again to the separating forces.

The present invention is therefore directed to a novel form of air classifier which is so constructed that as air bearing the materials to be treated travels along a predetermined path the finer particles are gradually withdrawn from this path while the larger particles are thrown outwardly away from the withdrawing means by centrifugal force.

25 In carrying out the present invention the air bearing the materials to be classified is introduced into a tortuous or serpentine conduit having a multiplicity of bends or loops, and the air is caused to travel along this
30 conduit at high speed so that the heavier particles in the air will be thrown outwardly by centrifugal force toward the outer portion of the loops or bends. This removes the heavier particles from the inner portion
35 of the bends of the conduit with the result that the lighter particles may be removed from the conduit by providing openings in the conduit at the inside of said bends and through which the air bearing the lighter
40 particles but not the heavier particles is removed.

An air classifier for removing the finer from the coarser particles in the manner just pointed out may be extremely simple and
45 compact in construction, since the bends or loops of the serpentine conduit may be small and lie close together, and as each loop affords means for withdrawing some of the finer particles from the conduit it will be
50 seen that a large number of successive treatments may be effected in a classifier of moderate height. Furthermore, since the air travels through the conduit at high speed to impart the desired centrifugal force to
55 the heavier particles, even a small conduit

will have a large capacity as a result of the continuous and rapid flow of air through the same, and this high speed of the air prevents fine particles from lodging in the conduit to clog the same.

60 Either a suction or blast may be employed in operating the present classifier, or both suction and blast may be used, but suction alone is preferable in most cases because its use will reduce the wear and cutting action of the particles upon the walls of the conduit.

The removal of air from the tortuous conduit at a multiplicity of points along its length to remove the finer particles may unduly reduce the air pressure within the conduit unless means is provided for admitting additional air into the conduit. The present invention therefore further contemplates means for introducing air into the tortuous conduit at successive points along its length, and this air is preferably introduced at such points that it will have to cross the air passage within the conduit in order to reach the air discharge openings.

70 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 accompanying drawings illustrating good practical forms 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 is a front view of the classifier of Fig. 1;

Fig. 3 on a much reduced scale is a side view of this classifier;

Fig. 4 is a side view of portion of the classifier the outer wall being partly broken away;

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 1;

Fig. 6 is a sectional view showing parts disclosed in Fig. 1 on an enlarged scale;

Fig. 7 is a vertical sectional view of a modified construction; and

Fig. 8 is a similar view of a second modified construction.

The underlying feature of the present invention resides in the construction whereby an air or gas bearing the material to be classified is caused to travel along a tortuous or serpentine path with sufficient speed to

cause the heavier particles to be thrown outwardly by centrifugal force to the outer portion of the loops or bends in the path of travel.

Various constructions may be employed in carrying out the present invention and one good form to this end is shown in Figs. 1 to 6 inclusive, wherein it will be seen that the tortuous conduit or passage 10 in which the separation of the material is effected is supported in an upright position. The materials to be treated are delivered to the upper end of the conduit 10 by the hopper 11 which is provided with the sliding gate 12 for regulating the flow of the materials to the conduit 10.

In the construction shown the entire operation of the classifier is effected by exhausting air from the conduit 10 at various points along its length. This serves to draw the air and materials into the conduit and to advance them along the same. The means shown for exhausting the air from the conduit consists of transversely extending pipes 13 which are disposed within the loops or bends of the tortuous conduit. The conduit 10 in the construction illustrated extends back and forth in a zigzag manner between the successive pipes, but other constructions may obviously be employed.

Each pipe 13 has an opening or passage 14 that communicates with the inner curved wall of the portion of the conduit which embraces the pipe, and in the construction shown in Figs. 1 to 6 inclusive the passage 14 curves upwardly about the pipe to which it leads and converges in an upwardly direction. This construction helps to promote settling of the coarser particles that may enter a passage 14. The air bearing the lighter materials enters the pipes 13 through long narrow slots 15 that extend lengthwise of the pipes. The exhaust pipes 13 cause the air within the conduit 10 to travel lengthwise of the same at high speed so that the heavier particles carried by the air are thrown outwardly by centrifugal force away from the exhaust opening, with the result that only the finer particles escape through the openings 14.

It is desirable to exhaust air from each end of the pipes 13 in order to produce a uniform suction throughout the length of each slot 15, and to this end the suction chambers 16 are provided at the opposite sides of the tortuous conduit 10. These chambers are preferably made relatively large as shown so that the heavier particles may settle therein, and air is exhausted from the upper end of each chamber 16 by the exhaust pipes 17 that lead to the suction fan 18. The force of the suction in each chamber 16 may be controlled by adjusting the air valves or gates 19. The materials that settle in the chambers 16 may be

withdrawn through the discharge openings 20.

At the lower end of the tortuous conduit 10 is provided a relatively large chamber 21 adapted to receive the heavier materials, and since some air will enter this chamber with the materials, an exhaust opening is provided between the upper portion of this chamber and one of the exhaust chambers 16. The size of this opening may be varied by adjusting the valve 22 mounted upon the threaded post 23 which may be adjusted by turning the hand wheel 24.

The various parts of the casing described may conveniently be formed of sheet metal, and the stiffness of the casing may be increased by providing the walls or partitions 25 between the opposite chambers to form braces therebetween.

The serpentine passage 10 is conveniently formed by providing the curved walls 26 and 27 which are secured at their opposite edges to the vertical side walls 28 of the chambers 16, the construction being such that the passage 10 is rectangular in cross-section. The exhaust pipes 13 may have their ends secured to the walls 28, and the coils or loops of the conduit 10 may be held in spaced relation by providing the side walls 29 that are secured to these coils.

As above stated it is desirable to introduce air into the conduit 10 at different points along the same to prevent the air pressure therein from being unduly reduced. This is accomplished in the construction shown by providing the air inlet passages 30 which are preferably located at the outer side of the tortuous conduit so that the fresh air entering the inlets 30 will have to cross the path of air to reach the exhaust openings 14. These inlet passages 30 are preferably omitted from the lower portion of the conduit 10 as will be apparent from Fig. 1, this being desirable in order to reduce the volume of air that is discharged into the receptacle 21 with the heavier particles. Within each exhaust chamber 16 may be mounted a baffle 31 for preventing the air from the upper pipe 13 from flowing directly to the exhaust pipe 17.

The modified construction shown in Figs. 7 and 8 differ from the construction shown in Figs. 1 to 6 inclusive, only in that the location of the slots leading into the exhaust pipe 10 is different, as is also the shape of the air passage leading to these slots. In Fig. 7 the entrance 31 to the pipe 10 is located above the pipe, whereas in Fig. 8 the entrance 32 is located below the pipe 10.

The loops or coils of the tortuous conduit are preferably small in diameter so that the successive coils will be close together to permit a large number of treatments to be effected in a relatively small classifier. The distance between successive coils or between

the exhaust pipes need not be more than two inches so that the materials may be subjected to six treatments within each vertical foot of the classifier. It will therefore be seen that the present device is extremely small and compact in construction and that one hundred treatments or more may be effected in a classifier which is not excessively tall.

The present classifier has an enormous capacity considering its size, due to the high speed at which the air passes through the same, and it employs centrifugal force to a high degree having in mind the small size of the loops or curves of the conduit. Furthermore, it requires practically no attention on the part of the operator, and an increase in the length of the classifier and in the number of its treatment units, does not materially increase the air force required to operate the same.

While the multiple treatment classifier of the present invention is designed more particularly for the use of air as the carrying medium for the particles to be separated, and the specification and claims are directed to the air treatment, nevertheless water may be successfully employed as the carrying medium in a classifier having the novel construction of the present invention. When water constitutes the carrying medium the stream of water and ore pulp will pass downwardly in the tortuous passage 10, and if this relatively heavy carrying medium exercises a substantial floating or semi-floating effect on the lighter materials to be separated from heavier materials, then the water lying at the upper surface of the stream traveling within the passage and the floating particles may be removed through the discharge slots 15 while the heavier particles which do not rise to the surface will be delivered as tailings into the hopper 21.

The present form of classifier may also be used in flotation work by adding oil to the stream of water and ore pulp, and air under pressure may be forced into the passage 10 through the inlet passages 30 to cooperate with the oil in forming a froth which will pick up and float the mineral products. This mineral bearing froth and the accompanying air and water may be removed from the passage 10 through the discharge slots 15, whereupon the froth may be separated from the water for further treatment.

What is claimed is:—

1. A multiple treatment classifier, comprising in combination, a receptacle having a serpentine air passage, means for introducing air and the materials to be classified into said passage to travel along the same so that the heavier particles will be thrown outwardly toward the outer curved wall of the passage by centrifugal force,

means for exhausting at successive points along said passage the air traveling adjacent the inside of the bends in the serpentine passage, and means for introducing additional air into the air passage at opposite sides thereof to replace the air exhausted therefrom.

2. A multiple treatment classifier, comprising in combination, a receptacle having a serpentine air passage, means for introducing air and the materials to be classified into said passage to travel along the same so that the heavier particles will be thrown outwardly toward the outer curved wall of the passage by centrifugal force, means for exhausting at successive points along said passage the air traveling near the inside of the bends in the serpentine passage, and means for introducing into the passage at successive points along the same additional air to replace the air that is removed from the passage.

3. A multiple treatment classifier, comprising in combination, a relatively long receptacle constructed to form a serpentine air passage through which air may travel at high speed, means for introducing air and the materials to be classified into said passage to travel therein so that the heavier particles will be thrown outwardly toward the outer curved wall of the passage by centrifugal force, means provided adjacent the inner walls of the bends of the serpentine passage for removing from said passage the air traveling near said inner wall, and means for introducing additional air into the air passage at successive points along the same but at the opposite sides of the stream of air from said air removing means so that the air introduced at the successive points is required to cross the stream of air to reach the air removing means.

4. A multiple treatment classifier, comprising in combination, a relatively long receptacle constructed to form a serpentine air passage through which air may travel at high speed, means for introducing air and the materials to be classified into said passage to travel therein so that the heavier particles will be thrown outwardly toward the outer curved wall of the passage by centrifugal force, a series of air exhaust pipes arranged transversely of said passage within the looped portions of the serpentine bends and each pipe having a slot extending lengthwise thereof but positioned to face away from the main path of the air passage and through which the air traveling near the inner wall of the looped portion of the conduit is exhausted, and means for exhausting air from said pipes.

5. A multiple treatment classifier, comprising in combination, a receptacle constructed to form a four-sided serpentine air passage through which air may travel at

high speed, means for introducing air and the materials to be classified into said passage to travel therein so that the heavier particles will be thrown outwardly toward the outer curved wall of the passage by centrifugal force, and exhaust means located within the loops of the serpentine passage and having upwardly converging throats extending across the inner curved walls of the loops for removing from the passage the air traveling adjacent said inner wall.

6. A multiple treatment classifier, comprising in combination, a supporting structure, a series of air exhaust pipes arranged transversely of said structure and supported thereby in spaced relation to each other and each pipe having a slot extending lengthwise thereof through which air may pass from the tortuous conduit, a tortuous air conduit supported by said structure and arranged so that successive portions of the conduit partially embrace and communicate with the successive air exhaust pipes, means for introducing air and the materials to be treated into said passage, and means for exhausting air from said pipes to exhaust from the conduit through said slots the air traveling adjacent its inner curved walls.

7. A multiple treatment classifier, comprising in combination, a supporting structure, a series of air exhaust pipes arranged transversely of the supporting structure in a row one above the other, a tortuous air conduit bent around the successive pipes and communicating therewith, means for supplying air and the materials to be treated to said conduit to travel along the same at high speed to cause the heavier particles to be thrown outwardly by centrifugal force away from said pipes, each pipe having a longitudinally extending slot through which air is exhausted from the conduit and which slots are positioned to face away from the main path of the air passage, and means for exhausting air from said pipes to remove from the conduit the air traveling adjacent its inner curved wall.

8. A multiple treatment classifier, comprising in combination, a supporting structure, a series of air exhaust pipes arranged transversely of the supporting structure in spaced relation to each other, a tortuous air conduit bent about the pipes so that it passes back and forth between the successive pipes and communicates with said pipes, means for supplying air and the materials to be treated to said conduit to travel lengthwise of the same to cause the heavier particles to be thrown outwardly toward the outer curved wall of the conduit, means for exhausting air from the opposite ends of each pipe to thereby draw off through said pipes the air traveling adjacent the inner curved wall of the conduit, and means for introducing into the conduit at successive points

along the same additional air to replace the air that is removed from the conduit.

9. A multiple treatment classifier, comprising in combination, a serpentine conduit having a large number of bends or loops and a continuous air passage, means for introducing air and the materials to be treated into said conduit to travel along the passage at high speed so that the heavier particles will be thrown outwardly by centrifugal force toward the outer wall of the loops of the conduit, means for removing from the conduit the air and light particles traveling near the inner wall of the loops while the heavier particles which are thrown to the outer portion of said loops will remain in the conduit throughout the classifying operation, and means for introducing air into the conduit at successive points to replace the air that is removed.

10. A multiple treatment classifier, comprising in combination, a serpentine conduit having a multiplicity of bends or loops and constructed to form a continuous air passage, means for introducing air and the material to be treated into the conduit, means for exhausting air from the conduit at the inner wall of the successive loops to produce a rapid flow of the material laden air along the conduit so that the heavier particles will be thrown outwardly by centrifugal force to the outer side of the loops while the air bearing the finer particles is removed at the inner side of the loops, and means for introducing air into the conduit at successive points adjacent the outer bend of the loops to replace the air that is removed and so that the replacing air is required to cross the air passage within the conduit before it can reach said exhaust means.

11. A multiple treatment classifier, comprising in combination, a serpentine conduit having a series of bends or loops and constructed to provide a continuous air passage, means for introducing air and the materials to be treated into the conduit, exhaust pipes for exhausting air from the conduit at the inner wall of the loops to remove the air bearing the lighter particles while the heavier particles are thrown to the outer portion of the loops by centrifugal force, and each exhaust pipe being provided with a curved converging passage leading from the conduit to the pipe.

12. A multiple treatment classifier, comprising in combination, an upright receptacle having a serpentine air passage provided with a series of loops or bends, means for introducing air and the materials to be treated into the upper end of said passage, means for exhausting air from the passage at the inner wall of the successive loops to promote a rapid flow of the air within the passage to cause the heavier particles to be thrown toward the outer portion of the loops

by centrifugal force while the air bearing the lighter materials is removed at the inside of the loops, and a settling chamber extending lengthwise of the serpentine passage and adapted to receive the air exhausted from said passage so that the coarser particles may settle therein.

13. A multiple treatment classifier, comprising in combination, an upright receptacle having a central tortuous air conduit provided with a series of loops or bends and provided with a pair of air exhaust chambers one being disposed at each side of said conduit, means for exhausting air

from said pair of chambers, means for introducing air and the materials to be treated into the upper portion of the tortuous conduit, and exhaust pipes extending between said exhaust chambers and communicating with the tortuous conduit at the inner portion of said bends to remove therefrom the air and lighter particles traveling at the inner side of the bends while the heavier particles are thrown to the outer portion of the bends by centrifugal force.

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

ALBERT H. STEBBINS.