

Nov. 17, 1931.

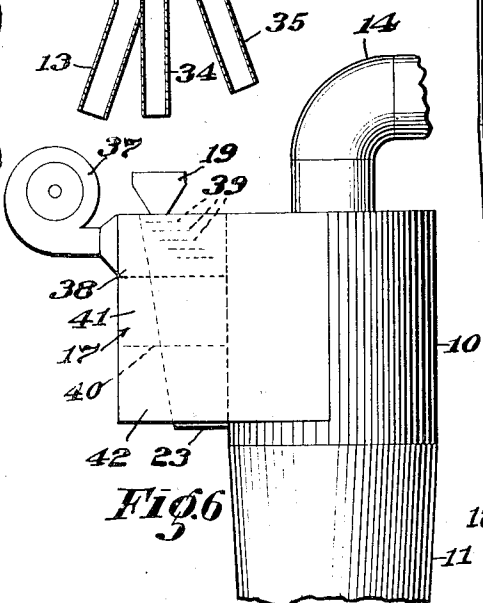
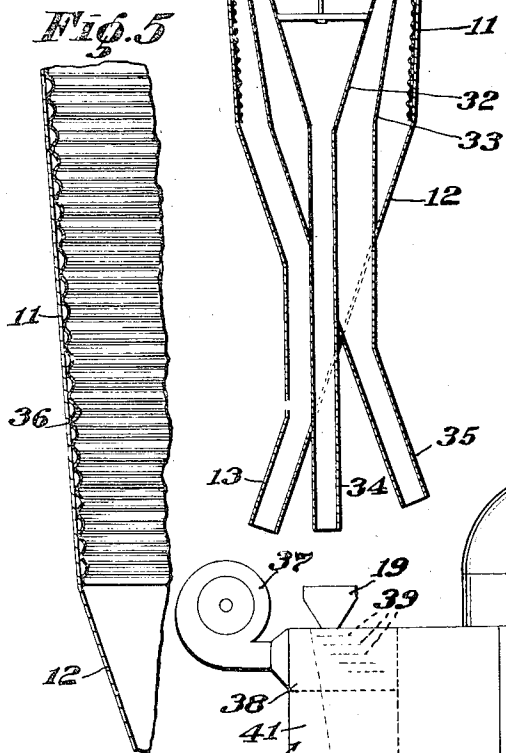
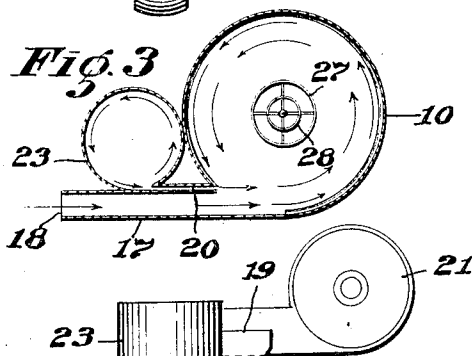
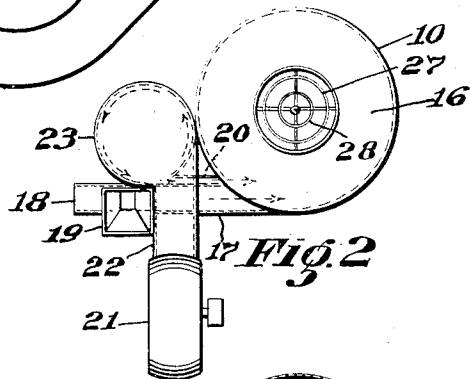
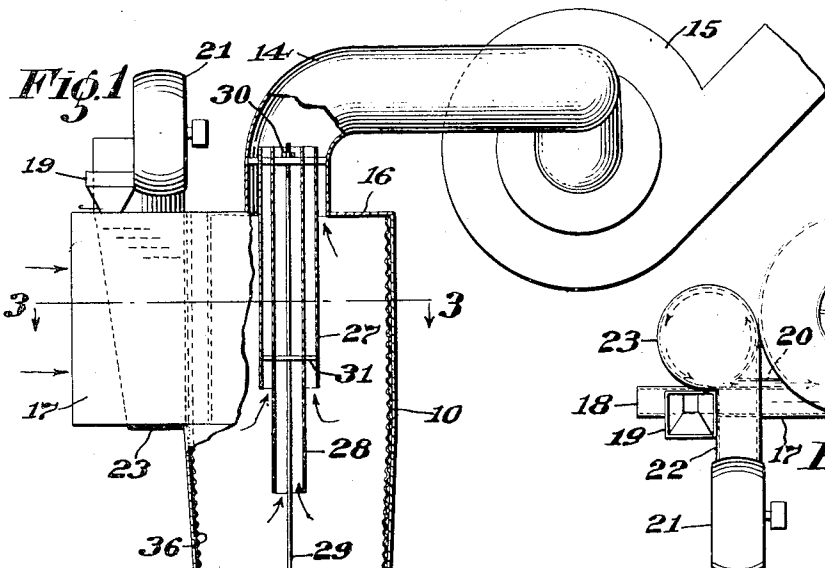
A. H. STEBBINS

1,832,256

AIR CLASSIFIER

Filed May 24, 1929

2 Sheets-Sheet 1



INVENTOR:
Albert H. Stebbins
BY *Robert H. Stebbins*
ATTORNEY

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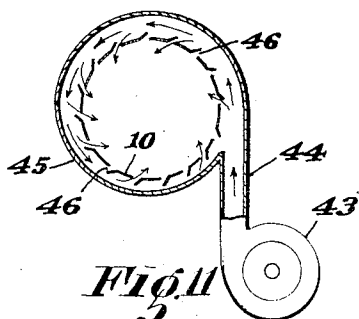
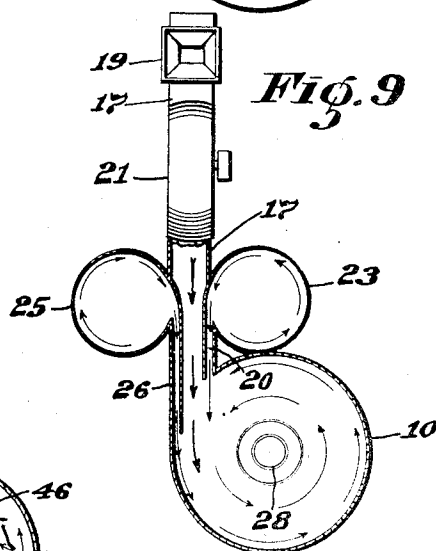
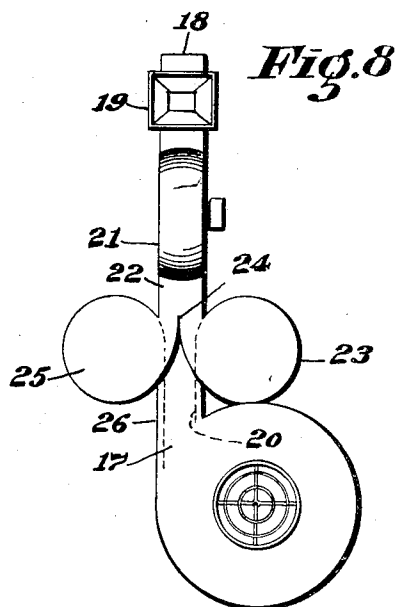
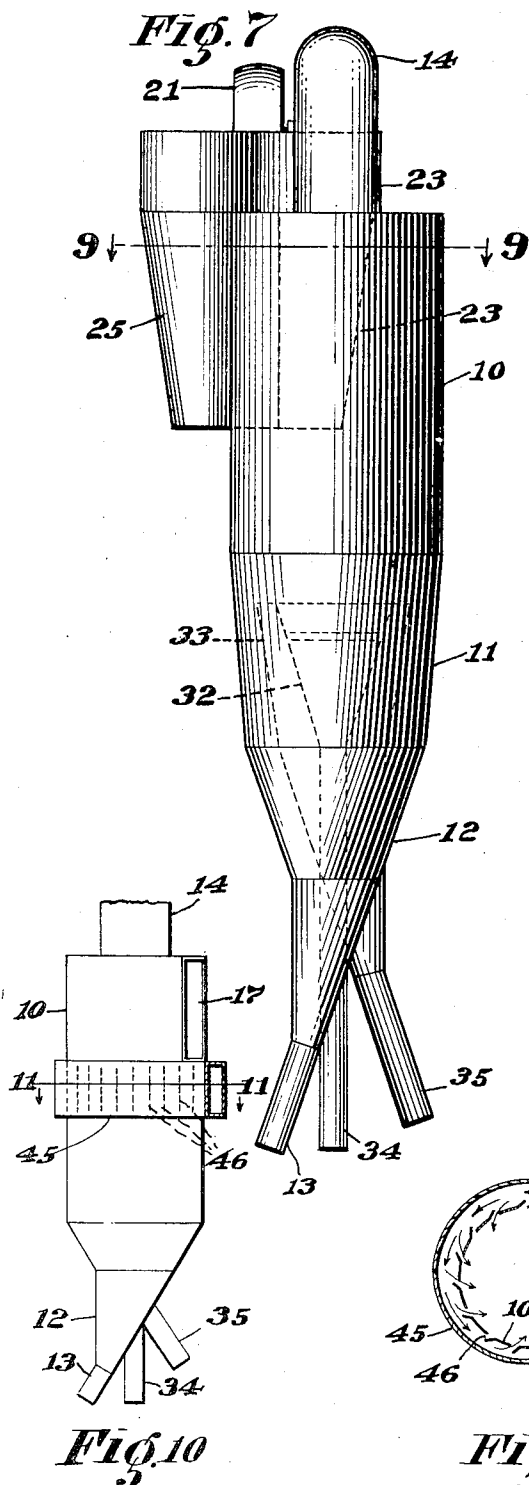
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INVENTOR:
Albert H. Stebbins
 BY *Robert H. Stebbins*
 ATTORNEY

UNITED STATES PATENT OFFICE

ALBERT H. STEBBINS, OF LOS ANGELES, CALIFORNIA

AIR CLASSIFIER

Application filed May 24, 1929. Serial No. 365,746.

This invention relates to air classifiers of the type in which a rotative movement is imparted to the material laden air to cause the heavier particles to be thrown outward by centrifugal force against the walls of the classifying receptacle.

In carrying out the present invention the material laden air is directed tangentially into the classifying receptacle and the air from which the heavier particles have been removed is withdrawn from the upper portion of the receptacle.

One of the features of the present invention resides in means for directing a separate and distinct air blast into the receptacle adjacent the point at which the material laden air enters the receptacle so that such blasts of air will perform the double function of imparting a whirling movement to the air within the receptacle and also of retarding the travel of this volume of air inward toward the central discharge opening.

In carrying this feature of the invention into effect an air blast in the form of a narrow sheet of air is directed into the classifying receptacle at either the inner or outer, or at both the inner and outer sides of the volume of material laden air entering the receptacle. These thin sheets of air are preferably delivered into the receptacle with considerable force so that they will exert a strong initial whirling action upon the larger volume of material laden air but their energy will be quickly absorbed by the larger mass of air, and it is found in practice that this serves to impart a smooth and satisfactory rotative movement to the volume of air within the receptacle.

The outer sheet of air which travels between the wall of the receptacle and the volume of material laden air will insure rotation of the air lying close to this wall and will to some degree delay the flow of the volume of air toward the central exhaust. The inner sheet of air disposed at the opposite side of the stream of material laden air entering the receptacle will form an air wall or screen between the "drawn in" air and the more central portion of the classifier for such time as it takes for this sheet of rapidly traveling air to

be absorbed by the larger volume of slower traveling air, and during this time the drawn in air is held away from the central axis of the classifier.

It is desirable to prevent the material laden air from flowing directly from the air inlet to the central exhaust means in order to give the heavier particles an opportunity to separate out of the air, and the inner and outer sheets of air employed in accordance with the present invention help to hold the air away from the central discharge opening in a very satisfactory manner.

Another feature of the present invention resides in mechanism for removing the air from the central portion of the receptacle at a plurality of different zones or levels therein, and in collecting hoppers for separating the materials that settle in the central portion of the receptacle and adjacent the walls thereof.

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 good practical forms of the invention.

In the drawings,—

Fig. 1 is a side elevation with parts in section of an air classifier constructed in accordance with the present invention;

Fig. 2 is a top plan view of the air classifier of Fig. 1;

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

Fig. 4 is a front elevation of the air classifier of Fig. 1;

Fig. 5 is a sectional view on an enlarged scale through a portion of the classifier wall having a corrugated lining;

Fig. 6 is a side elevation of a modified type of air classifier;

Fig. 7 is a rear elevation of a second modified type of air classifier;

Fig. 8 is a top plan view of the air classifier of Fig. 7;

Fig. 9 is a horizontal sectional view taken on the line 9—9 of Fig. 7;

Fig. 10 is a front elevation of another modified type of air classifier; and

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Fig. 11 is a horizontal sectional view taken on the line 11—11 of Fig. 10.

In the embodiment of the invention illustrated in the drawings, the classifying receptacle 10 is shown as having a substantially cylindrical construction in which the material laden air may rotate about a vertical central axis to effect a centrifugal separation of the heavier particles out of the air; it will be understood, however, that the receptacle 10 may be given constructions other than here shown so long as whirling movement may occur within the receptacle to effect the desired separation.

In the constructions shown in Figs. 1 to 7 inclusive the lower portion of the receptacle 10 is tapered slightly as indicated at 11 to direct the particles moving downwardly within the receptacle inward somewhat, and to the lower end of the portion 11 is secured the conical portion 12 which constitutes a collecting hopper adapted to direct the materials which settle within the classifier into the discharge pipe 13.

As above pointed out one of the important features of the present invention resides in means for directing an air blast into the receptacle adjacent the point at which the material laden air enters the receptacle so that such blast of air will help to impart a whirling movement to the material laden air. Various constructions may be employed for directing this blast of air into the receptacle adjacent the point at which the material laden air enters the receptacle and one construction to this end is shown in Figs. 1 to 4 inclusive. Another form of means to this end is shown in Fig. 6, whereas a third construction to this end is shown in Figs. 7 to 9, and still a fourth construction to this end is illustrated in Figs. 10 and 11.

In each of the embodiments shown in the drawings air is exhausted from the upper portion of the classifying receptacle 10 through an exhaust pipe 14 which is illustrated as leading to the suction side of a fan 15. The upper end of the receptacle 10 has a cover plate 16 in which is formed a central opening through which the exhausted air passes into the exhaust pipe 14.

In each of the constructions shown the material laden air is led tangentially into the upper portion of the receptacle 10 through an inlet pipe 17 the outer end of which is open as indicated at 18 to receive air from the atmosphere, and the materials to be treated are fed into this inlet pipe 17 from a hopper 19 mounted upon the upper portion of the pipe 17, it will be apparent, however, that if desired the feed pipe 17 may lead direct from any dust producing machine.

The suction produced within the classifying receptacle 10 by the exhaust pipe 14 will serve to draw air into the receptacle through the feed pipe 17 as indicated by the arrows,

and since this air is directed tangentially into the receptacle it will impart more or less of a whirling movement to the volume of air within the receptacle, but it may be desirable to increase this whirling movement of the air within the receptacle so that the heavier particles will be thrown outwardly by greater centrifugal force against the surrounding wall 10. This increased whirling movement is imparted to the air in the construction shown in Figs. 1 to 4 inclusive by providing an auxiliary pipe 20 which extends along the inlet pipe 17 and this auxiliary pipe 20 is constructed to direct a blast of air in the form of a wide thin sheet into the receptacle between the volume of air entering through the pipe 17 and the central axis of the classifier. In the construction shown this blast of air is supplied by a booster fan 21 which serves to force air through the pipe 22 into the drum or receptacle 23 and this drum preferably extends downwardly a distance substantially equal to the vertical height of the inlet pipe 17, as will be apparent from Fig. 1. This is desirable in order that air may be supplied under substantially uniform pressure to the auxiliary pipe 20 throughout the height of this pipe which preferably has a vertical height substantially equal to that of the inlet pipe 17. The drum or receptacle 23 is preferably given the tapered construction shown so that its area decreases from its upper to its lower end in conformity with the volume of air that passes from the drum 23 into different portions of the auxiliary pipe 20.

The thin sheet of air which is delivered into the receptacle 10 under relatively high pressure serves not only to impart an increased whirling movement to the air within the receptacle, but also to form a screen or wall which will prevent the material laden air from passing directly from the inlet pipe 17 to the discharge pipe 14, so that the heavier particles will have an opportunity to separate out of the air before the air reaches the exhaust pipe 14. The volume of air entering the classifying receptacle 10 through the pipe 20 is much smaller than the volume of material laden air entering this receptacle through the inlet pipe 17 and as a result the energy of the blast of air supplied by the pipe 20 will be soon absorbed by the much greater volume of air entering through the pipe 17. But the thin sheet of air supplied by the pipe 20 will retain its higher velocity for a sufficient length of time to constitute the desired wall or screen above mentioned which will prevent the material laden air from passing too rapidly to the exhaust pipe 14.

In some cases it may be desirable to provide sheet-like blasts of air at each side of the inlet pipe 17 and such a construction is illustrated in the modified type of classifier shown in Figs. 7, 8 and 9 of the drawings. In

this modified construction the booster fan 21 forces air into the pipe 22 the outer end of which has the branched construction indicated by 24 in Fig. 8, the construction being such that part of the air from the booster fan 21 is forced into a drum or receptacle 23 similar to that above described and the rest of the air is forced into a drum or receptacle 25. Air under pressure flows from the receptacle 23 through the auxiliary pipe 20 into the air classifier at the inner side of the feed pipe 17, while a similar blast of air is supplied by the drum 25 to the auxiliary pipe 26 disposed at the outer side of the pipe 17.

The sheet like blast of air delivered to the receptacle 10 by the auxiliary pipe 26 will travel around the receptacle 10 in close proximity to the wall thereof and this will serve to increase the rotative movement of the volume of air in this receptacle and also to some extent reduce the tendency of the material laden air to move directly to the exhaust pipe 14.

It is desirable to exhaust predetermined amounts of air from different zones or levels within the classifying receptacle and this is accomplished in the embodiment of the invention shown in the drawings by providing a plurality of nested pipes 27 and 28 which extend downwardly different distances into the classifier 10, as will be apparent from Fig. 1. These pipes 27 and 28 are conveniently held in place by the centrally disposed rod 29 and by the transversely extending braces or spiders 30, 31.

Since the rotative movement of the air within the receptacle 10 is much less rapid near the central axis of the classifier than near the side walls of the receptacle, there is a tendency for the lighter particles to settle out of the air in the vicinity of the central axis of the classifier and if these lighter particles are permitted to enter the discharge hopper 12 the desired classification will not be secured. It is therefore desirable to provide a central material receiving hopper 32 within the lower portion of the classifying receptacle and in spaced relation to the side walls thereof to catch these fine materials that move downwardly within the central portion of the receptacle; and if desired a further separation of the materials that settle in the lower portion of the receptacle may be secured by providing a second collecting hopper 33 which surrounds the central hopper 32 and is disposed in spaced relation to the side walls of the receptacle 10. The materials that enter the hoppers 32 and 33 pass downwardly into the discharge pipes 34 and 35.

It is found that the lighter particles tend to cling to the heavier particles moving downwardly within the classifying receptacle and it is therefore desirable to force air through these falling particles to pick up and carry off the lighter particles that tend to cling

thereto. This air sweeping of the heavier particles may be promoted by providing the inner surface of the receptacle 10 with a roughened or corrugated lining 36 which lining will cause the particles to cascade in passing downwardly from one rib to another of the corrugated lining, thus giving the circulating air a better opportunity to surround the heavy particles and remove the dust therefrom.

The modified construction of Fig. 6 differs from that shown in Figs. 1 to 4 inclusive in that in this modified construction the auxiliary pipes 20 and 26 for directing narrow sheet-like blasts of air into the receptacle are omitted, and in place thereof a blast fan 37 is provided which is adapted to force a blast of air into the upper compartment 38 of the air inlet pipe 17. The materials to be treated are delivered to the feed pipe 17, in the construction shown in Fig. 6, by a feed hopper 19 below which are preferably provided the baffle plates 39 adapted to retard and spread the materials fed into the pipe 38. The air inlet pipe 17 is shown in Fig. 6 as having the lower portion thereof divided by a partition 40 into the air inlet pipes 41 and 42. It will therefore be seen that in this modified construction of Fig. 6 a blast of air is delivered into the receptacle 10 through the upper compartment 38 of the inlet pipe 17 and is drawn in from the atmosphere through the remaining compartments 41 and 42 of this inlet pipe. It will be apparent, however, that the fan 37 may be employed to force a blast of air into the receptacle through any one of the compartments 38, 41 or 42, but in each of the constructions just suggested it is desired that clean air from the atmosphere be directed into the receptacle 10 below the material laden air so that the materials passing downwardly within the receptacle 10 will have to pass through this volume of clean air.

In the modified construction shown in Figs. 10 and 11 air from the atmosphere enters the upper portion of the classifying receptacle 10 through the air inlet pipe 17 and air is exhausted from the upper portion of the receptacle 10 by the exhaust pipe 14. In this construction the blast of air relied upon to impart the desired whirling movement to the air within the receptacle is supplied from a fan 43 the discharge portion of which is connected by a pipe 44 to an annular chamber 45 which surrounds an intermediate portion of the receptacle 10, as will be apparent from Fig. 10, and the air which is forced into this annular chamber 45 enters the receptacle 10 through a number of inclined apertures 46 formed in the side walls of the receptacle. The construction is such that the air entering the classifying receptacle through these apertures 46 will impart a pronounced whirling movement to the volume of air within this receptacle, to thereby effect the desired cen-

trifugal separation and the air passing upwardly from the apertures 46 to the exhaust pipe 14 will serve to air-sweep the heavier particles moving downwardly within the classifying receptacle.

While the various modified constructions above described produce good results, the construction whereby a thin sheet of air is forced into the classifying receptacle at one or both sides of the inlet pipe 17 is particularly desirable because as above pointed out these sheets of air will retard the flow of the material laden air towards the exhaust pipe, thus giving the heavier particles an opportunity to separate out of the air, which is extremely important.

What is claimed is:—

1. A classifier comprising in combination, a receptacle having a collecting hopper at its lower end, means for conducting air from the upper portion of the receptacle, an inlet pipe that is rectangular in cross section for delivering material laden air tangentially into the receptacle, and a booster fan for having an air conduit extending along a side wall of said pipe delivering an independent blast of air into the receptacle in the form of a wide, thin sheet disposed parallel to the side of the receptacle for imparting a whirling movement to the air within the receptacle to promote a centrifugal separation of the heavier particles out of the whirling air.

2. A classifier comprising in combination, an annular receptacle having a collecting hopper at its lower end, means for conducting air from the upper portion of the receptacle, an inlet pipe for delivering material laden air tangentially into the receptacle, and means associated with said pipe for delivering a wide, thin sheet of air into the receptacle along the inner face of said pipe to form a wide vertical wall of air traveling rapidly between the stream of material laden air and the axis of the receptacle to retard the movement of the air from the inlet pipe towards the axis of the receptacle.

3. A classifier comprising in combination, a receptacle having a collecting hopper at its lower end, means for conducting air from the upper portion of the receptacle, an inlet pipe for delivering material laden air tangentially into the receptacle, and means associated with said pipe for delivering blasts of air in the form of wide, thin sheets into the receptacle along said pipe but at the opposite sides thereof to form wide aprons of rapidly moving air at each side of the material laden air stream for imparting a whirling movement to the air within the receptacle to promote a centrifugal separation of the heavier particles out of the whirling air.

4. A classifier comprising in combination, a vertical receptacle having a collecting hopper at its lower end, means for conducting

air from the upper portion of the receptacle, an inlet pipe for delivering material laden air tangentially into the receptacle, and means associated with said pipe for delivering a blast of air in the form of a wide thin sheet into the receptacle between a side wall of the receptacle and the discharge end of said pipe to form a wide vertical apron of air traveling close to the wall of the receptacle for imparting a whirling movement to the air within the receptacle to promote a centrifugal separation of the heavier particles out of the whirling air.

5. A classifier comprising in combination, a receptacle having a collecting hopper at its lower end, means for conducting air from the upper portion of the receptacle, an inlet pipe for delivering material laden air into the receptacle and provided with thin wide air conduits at the inner and outer sides thereof for delivering a wide blade-like blast of air into the receptacle at each side of the stream of material laden air, to promote a centrifugal separation of the heavier materials out of the air stream, air chambers disposed at each side of said pipe to supply air to said conduits and means for supplying air under pressure to said chambers.

6. A classifier comprising in combination, an upright receptacle having a collecting hopper at its lower end, means for conducting air from the upper portion of the receptacle, an inlet pipe for delivering material laden air tangentially into the receptacle and having opposite side walls disposed in approximately parallel relation to a side wall of the receptacle, and means associated with said pipe for delivering a wide, thin sheet of air into the receptacle along one of said side walls of the inlet pipe to form a wide vertical wall of air traveling rapidly along side the stream of material laden air to increase its whirling movement within the receptacle.

7. A classifier comprising in combination, an upright receptacle having a collecting hopper at its lower end, means for conducting air from the upper portion of the receptacle, an inlet pipe for delivering material laden air tangentially into the receptacle and having opposite side walls disposed in approximately parallel relation to a side wall of the receptacle, a thin wide conduit extending along one of said side walls of the inlet pipe to deliver a thin, wide, vertical wall of air rapidly into the receptacle along said pipe to increase the whirling movement of the air within the receptacle, an air receptacle at one side of said pipe to supply air to said conduit, and means for supplying air under pressure to said air receptacle.

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

ALBERT H. STEBBINS.