This invention relates to a novel fan construction whereby the fan itself serves to remove the heavier particles from the material laden air that is drawn into the fan casing.

In many industries in which the separation, crushing, and handling of fine materials takes place, air is employed to pick up, transport and carry off the fine materials and dust, but the volume of air required for this purpose is, in many cases, so great that the subsequent treatment of this vast volume of air to remove the fine particles therefrom is a serious problem.

Various forms of air classifiers are now in use for removing fine particles from material laden air, but, as above indicated, it is desirable to reduce as far as practical the total volume of material laden air it is necessary to treat, and air volume reducers have been employed to some extent heretofore to concentrate or direct the particles carried by a large volume of air into a small portion of the volume of air.

Having in mind the foregoing, the present invention relates to a novel fan construction which, in addition to performing its usual function of forcing air from one point to another, serves also to reduce the volume of air containing the larger particles by directing such particles to one outlet opening of the fan casing, while the air from which such larger or heavier particles have been removed is discharged from the fan casing through a different opening, and as a result only part of the entire volume of air passed through the fan need be delivered to a classifier for further treatment.

It will therefore be seen that the fan forming the subject-matter of the present invention serves not only as a fan but also as an air volume reducer to reduce the total volume of air it is necessary to subject to a subsequent classifying operation.

The fan forming the subject-matter of the present invention may be employed to draw off dust from concentrator tables, to transport material by air, to remove dust from various machines, and for various other purposes, and is shown in the drawings as associated with a ball mill of the air sweep type. These ball mills employ a tremendous volume of air to pick up and carry off the finely crushed particles, and all of this air must be subsequently treated to remove the finely divided materials therefrom. In accordance with the present invention, the fan will serve to air sweep the ball mill and also to reduce the volume of air in which the crushed materials are suspended, thus reducing the separating work that follows and permitting the use of smaller collectors or classifiers.

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 side elevation showing the fan forming the subject-matter of the present invention associated with a ball mill;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1, showing the fan in front elevation;

Fig. 3 is a similar view showing a modified fan construction; and

Fig. 4 is an enlarged sectional view through the fan and associated parts, the section being taken on the line 4—4 of Fig. 1.

The fan forming the subject-matter of the present invention is shown in Fig. 1 as associated with a ball mill of the air sweep type but as above stated, the present fan may be used in connection with various devices where air currents are employed to pick up and carry off fine materials.

The fan 10 as illustrated in the drawings consists of a fan casing having a front wall 11, rear wall 12 and a peripheral wall 13 which is connected at its opposite edges to the walls 11 and 12, as shown in Fig. 1. Within the fan casing just described is mounted the rotating fan, consisting of a tapered core 14 to which are secured the fan blades 15. The fan is mounted upon and is rotated by the fan shaft 16 which is journaled in bearing blocks 17 mounted upon posts 18 which extend upwardly from the fan base 19. The fan shaft 16 is shown as having a reduced end 20 which extends into the core 14 and is secured thereto by a pin or the like 21. Rotative movement is imparted to the fan and fan shaft by a pulley 22 which may be driven by a belt, not shown.

The rear wall 12 of the fan casing is shown as secured to a large disk or face plate 23 which may be mounted upon the base 19 of the fan, and the front face 11 of the fan cas-
The desired separation of the materials within the fan is promoted by giving the core 14 the construction best shown in Fig. 4, wherein it will be seen that this core tapers in a right-hand direction to a point 26 that extends through the central opening in the wall 11 into the feed pipe 24, and the core is provided adjacent the rear wall 23 of the casing with an outwardly flaring flange 27. When the fan is rotated, the suction produced thereby will serve to draw the material laden air through the feed pipe 24 into the fan casing, as indicated by the arrows, and since this air will enter the fan casing at relatively high speed, the heavier particles will be carried by their momentum against the curved surface of the core 14, the configuration of which is such that the materials that strike against this core will be directed by its curved surface outwardly into that portion of the fan casing lying adjacent the rear wall 12.

The interior of the fan casing is preferably divided into two or more separate compartments by an annular wall or walls 28, the present casing being shown as divided by the walls 28 into the material receiving compartment 29 and into the two air receiving compartments 30 and 31. The flow of air from one of these compartments to the other may be further prevented by providing the rotating fan with the curved braces 32 which are positioned to form an annular rotating wall disposed in alignment with a fixed annular partition 28.

Each of the compartments 29, 30 and 31 is provided with an outlet pipe. The compartment 29 has an outlet pipe 33 which discharges into an air classifier 34 of any well-known or preferred construction. The compartment 30 is provided with the air discharge pipe 35 which may lead to a dust collector 36 of any well-known or preferred construction, and the compartment 31 is provided with a discharge pipe 37 which may lead to a dust collector 38, similar to the dust collector 36.

It will be apparent from the foregoing that when the fan is rotated, the air which is drawn inwardly through the feed pipe 24 will be forced outwardly through the discharge pipes 33, 35 and 37, but as a result of the construction of the core of the fan, just described, the heavier materials which strike against this curved core will be directed outwardly into the material receiving chamber 29 to pass from this chamber into the classifier 34, while the air from which the heavier particles have been removed by the means just described, will pass into the compartments 30 and 31 to be discharged from these compartments into the dust collectors 36 and 38. It will therefore be seen that as a result of the present construction it will not be necessary to pass the entire volume of air discharged from the fan through an air classifier, since the air passing into the chambers 30 and 31 will have the larger particles removed therefrom and the small dust-like particles remaining in this air may be removed by passing the air through the dust collectors 36 and 38.

The heavier materials that settle within the air classifier 34 may be discharged therefrom through a pipe 39, and air may be exhausted from the upper portion of the classifier 34 by the pipe 40 which may lead to a dust collector 41. Air may be exhausted from the dust collectors 36, 38, and 41 by the pipes 42 which may lead to exhaust means not shown.

In accordance with the illustration shown in Fig. 1, the fan 10, classifier 34, and dust collectors 36, 38, and 41 are shown as supported above a ball mill 43 so that the materials that collect in the lower portion of the classifier 34 may be returned to the ball mill by the feed pipe 39.

The ball mill 43 may have any well-known construction and is supported from the base 44 for rotative movement by the upright pipes 45 and 46. Rotative movement is imparted to the cylinder-like receptacle 43 of the ball mill from the power shaft 47, the inner end of which is provided with a pinion which meshes with the ring gear 48. Materials to be crushed are delivered by a feed hopper 49 into the feed spout 50 that serves to direct these materials and air from the atmosphere through the central trunnion of the ball mill into the crushing chamber 45. Air is exhausted from the discharge of the ball mill by the pipe 51, the upper end of which is connected to the feed pipe 24 above mentioned. It may be desirable to admit air from the atmosphere into the upright pipe 51 to promote the lifting action of the air moving upwardly in this pipe. The means shown to this end consists of a sleeve 52 which is slidably mounted upon the lower end of the downwardly extending portion of the feed pipe 24 and this pipe may be raised and lowered by adjusting the bolts 53 to vary the size of the air inlet opening 54.

In the embodiment of the invention shown in Fig. 4 of the drawing, the fan casing as above pointed out is divided into three compartments, but the number of these compartments may obviously be varied, and in Fig. 3 of the drawing is shown a modified construction in which the interior of the fan is divided into only two compartments. One of these constitutes the air discharge compartment 55 having the outlet pipe 56 and the other con-
stitutes the material discharge compartment 57 having the outlet pipe 58. It will be apparent from the foregoing that the fan forming the subject matter of the present invention performs its normal function of forcing air from one point to another and in addition thereto effects a separation of the materials within the fan casing and reduces the volume of air which requires to be subjected to a further treatment to remove the heavier particles therefrom.

What is claimed is:

1. A combined fan and classifier comprising in combination, a fan casing having a central suction, air inlet opening in its front wall and separate discharge openings formed in its periphery and disposed one near the front wall and the other near the rear wall of the casing, a conduit for directing material laden air to said central opening, a fan supported to rotate within the casing and provided with fan blades and a central core having a pointed end extending toward said inlet opening and a rearward tapered portion that terminates in an outwardly flaring flange disposed adjacent the rear wall of the casing, the fan core being constructed to direct the heavier particles that are carried by their momentum against the tapered surface of the core outwardly into the discharge opening disposed near the rear wall of the casing while the air from which the heavier particles are removed is forced outwardly by the fan through the other discharge opening.

2. A combined fan and classifier comprising in combination, a fan casing having a central air inlet opening formed in its front wall and having an air discharge opening in the periphery of the fan casing near said front wall and a material discharge opening formed in the casing near the rear wall, a conduit for discharging material laden air to said central opening, a fan supported to rotate within the casing and provided with fan blades and a tapered outwardly flaring core constructed to direct the heavier particles within the air outwardly through the discharge opening adjacent said rear wall while the air from which said heavier particles are removed by momentum is forced outwardly by the fan through the discharge opening near said front wall.

3. A combined fan and classifier comprising in combination, a fan casing having a central air inlet opening formed in its front wall and having an air discharge opening in the periphery of the fan casing near said front wall and a material discharge opening formed in the casing near the rear wall, a conduit for directing material laden air to said central opening, a fan supported to rotate within the casing and provided with fan blades and a tapered outwardly flaring core constructed to direct the heavier particles within the air outwardly through the discharge opening adjacent said rear wall while the air from which the heavier particles are removed by momentum is forced outwardly by the fan through the discharge opening near said front wall.

4. A combined fan and classifier comprising in combination, a fan casing having a central air inlet opening formed in its front wall and having an air discharge opening in the periphery of the fan casing near said front wall and a material discharge opening formed in the casing near the rear wall, a conduit for directing material laden air to said central opening, a fan supported to rotate within the casing and provided with fan blades and a tapered outwardly flaring core constructed to direct the heavier particles within the air outwardly through the discharge opening adjacent said rear wall while the air from which the heavier particles are removed by momentum is forced outwardly by the fan through the discharge opening near said front wall, and an annular partition provided upon the fan between the fan blades to promote the separation of the heavier material and air.

5. A combined fan and classifier adapted to separate materials from the air within the fan casing, comprising in combination, a fan casing having a central air inlet opening formed in its front wall and having an air discharge opening in the periphery of the fan casing near said front wall and a material discharge opening formed in the casing near the rear wall, a conduit for discharging material laden air to said central opening, a fan supported to rotate within the casing and provided with fan blades and a tapered core having a pointed end near said inlet opening and an outwardly flaring flange near said rear wall, and means for rotating the fan to draw the material laden air through said conduit into the casing so that the heavier particles will be carried by their momentum against the tapered core to be directed by the outward flaring portion of the core towards the material discharge opening while the air from which the materials are removed will be forced outward through the air discharge opening.

6. A combined fan and classifier comprising in combination, a fan casing having a central air inlet opening formed in its front wall and having an air discharge opening, and a material discharge opening near the rear wall of the casing, a conduit for directing material laden air to said central opening, a fan supported to rotate within the casing and provided with fan blades and a tapered outwardly flaring core constructed so that the heavier particles sucked into the casing with the air will strike against...
the outwardly flaring core and travel along the same toward the material discharge opening while the air from which the heavier particles are removed is forced by the fan through said air discharge opening.

7. A combined fan and classifier comprising in combination, a fan casing constructed to provide an air receiving compartment and a material receiving compartment each having a discharge opening, and having an air inlet opening for supplying material laden air to the fan, a fan rotatably mounted within the casing and provided with fan blades and an annular outwardly flaring flange adapted to direct the materials into said material receiving compartment while the air from which the materials are removed is forced by the fan blades into the air receiving compartment.

8. A combined fan and classifier comprising in combination, a fan casing having an inlet opening for receiving material laden air and outlet openings, a fan rotatably mounted in said casing and provided with fan blades and with an annular outwardly flaring flange constructed to direct the materials that enter the fan casing into a predetermined portion thereof while the air from which the materials are removed is forced by the fan blades into a different portion of the casing.

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

ALBERT H. STEBBINS.