June 1, 1937. W. S. BOWEN 2,082,242

DUST COLLECTOR

Filed May 5, 1932 3 Sheets-Sheet 1

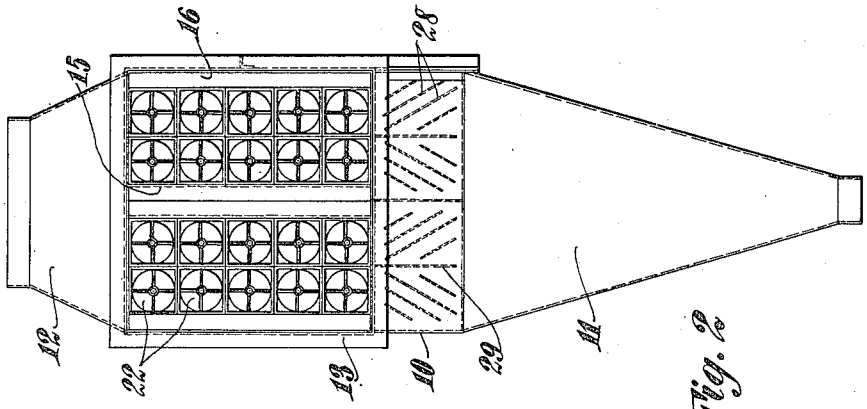


Fig. 2

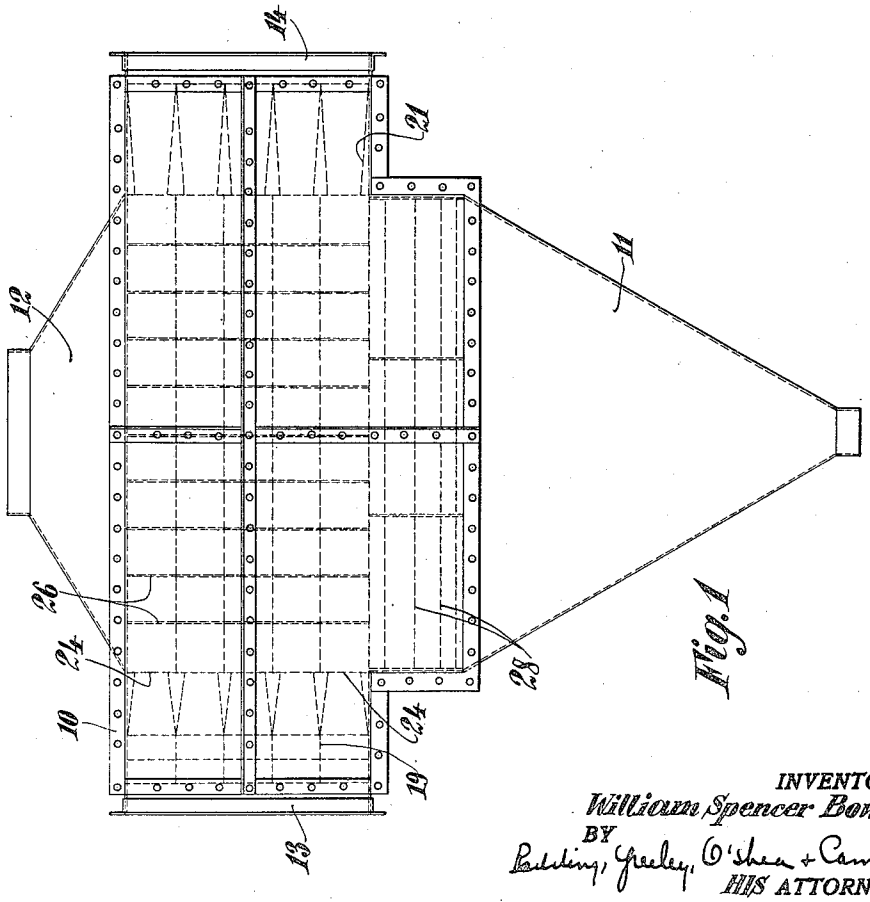


Fig. 1

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DUST COLLECTOR

Filed May 5, 1932 3 Sheets-Sheet 2

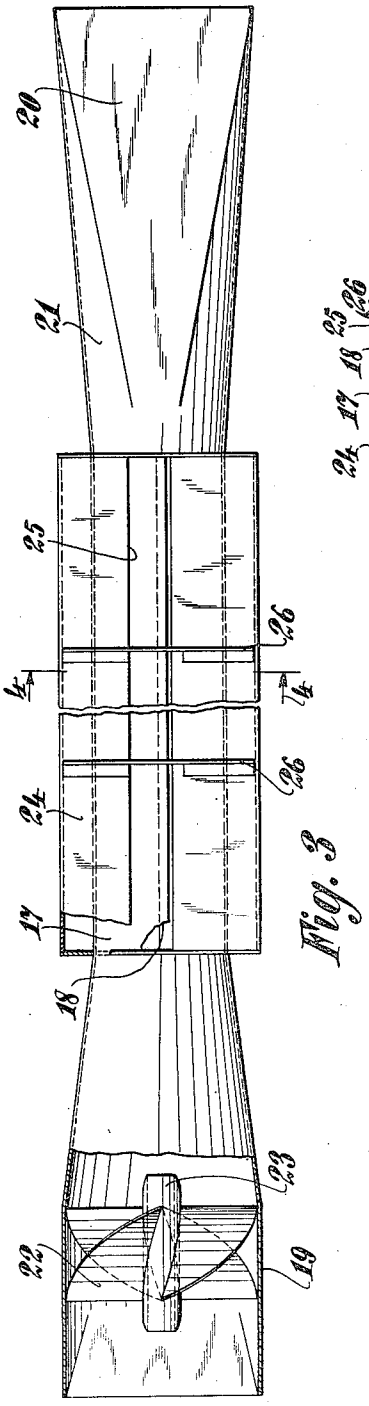


Fig. 3

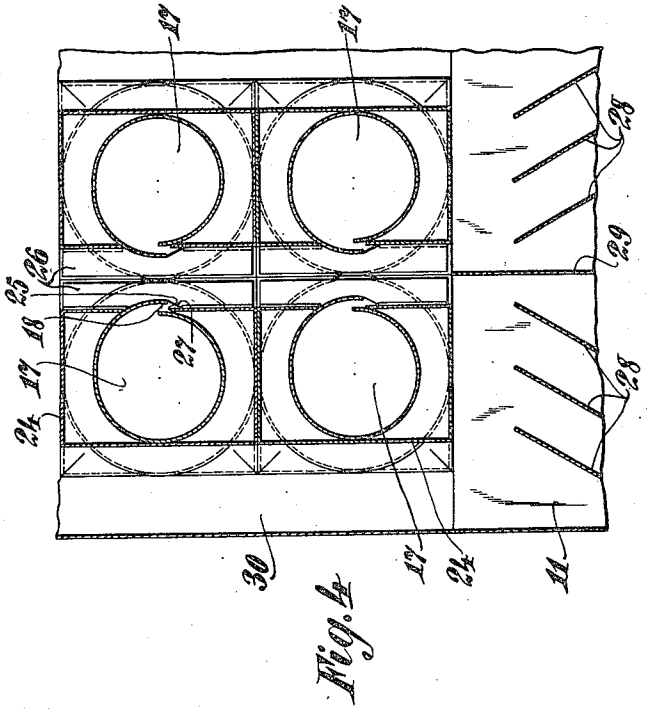


Fig. 4

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Filed May 5, 1932 3 Sheets-Sheet 3

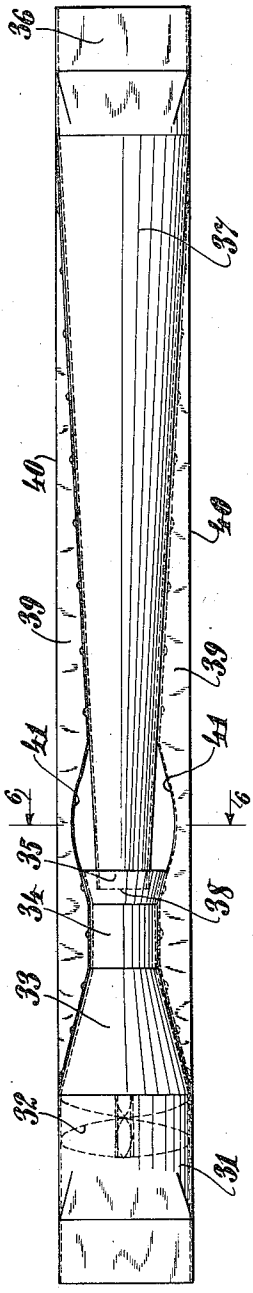


Fig. 5

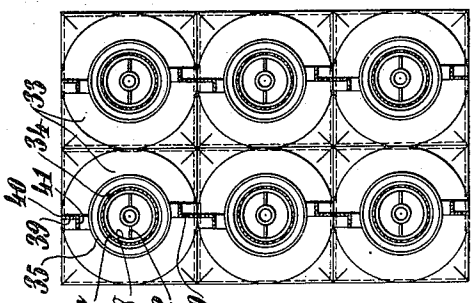


Fig. 6

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2,082,242

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2,082,242

DUST COLLECTOR

William Spencer Bowen, Westfield, N. J.

Application May 5, 1932, Serial No. 609,379

10 Claims. (Cl. 183—80)

The present invention relates to apparatus for separating bodies of different weights from one another and embodies, more specifically, an improved form of device for separating and collecting dust from air. Many forms of dust collectors are now in use embodying broadly the principle of separating one body from another by utilizing the difference in specific weights of the bodies to effect the separation, the most common form being the type commonly known as the cyclone type of collector. This collector imparts a whirling motion to the bodies which are being separated, whereby the heavier body, possessing greater centrifugal force than the lighter body, is directed outwardly from the axis of whirl with a greater force than that of the lighter body, the path of the lighter body in the direction of the axis of whirl being unobstructed, while the path of the heavier body in the direction of the axis of the whirl is obstructed, thus effecting the separation of the two bodies. Inasmuch as the known literature describes broadly mechanism embodying the foregoing characteristics, the present invention concerns itself with the details of construction including the means for effecting a substantially complete separation of the heavier body from the lighter body and an object of the invention is, accordingly, to provide a separating and collecting device of the above character wherein means is provided to separate the heavier body from the lighter body by obstructing the flow of the former in the direction of the axis of the whirl imparted to the two bodies, such obstruction being effected without interference with the flow of the lighter body in the direction of the axis of the whirl.

A further object of the invention is to provide a device of the above character, wherein the flow of the separated body, after separation from the lighter body, is directed to a desired destination in such fashion as to prevent the formation of eddy currents and other disturbing influences whereby the flow of the separated body is effectively controlled.

A further object of the invention is to provide a device for effecting the separation of one body from another by means of a plurality of independent separating elements so disposed that the body separated from all of the elements is directed into a common fluid stream and carried to a desired objective.

A further object of the invention is to provide a separating and collecting device of the above character wherein a plurality of superposed separating elements are spaced with respect to a plurality of other such elements in such fashion that the separated body from all of the elements is directed into a common fluid stream, means being provided to constrain the flow of the separated body in a uniform and substantially lamellar fashion.

Further objects, not specifically enumerated above, will be apparent as the invention is described in greater detail in connection with the accompanying drawings, wherein:

Figure 1 is a view in side elevation, showing a separating and collecting device construced in accordance with the present invention and including a plurality of individual separating elements mounted in accordance with the present invention.

Figure 2 is a view in end elevation, showing the device of Figure 1.

Figure 3 is a detail view showing one of the separating elements constructed in accordance with the present invention.

Figure 4 is a detail view in section, taken on a plane passing through an intermediate portion of a plurality of superposed and spaced separating elements mounted as shown in Figures 1 and 2.

Figure 5 is a detail view similar to Figure 3, showing a modified form of separating element.

Figure 6 is a view similar to Figure 4, showing the manner in which the elements of Figure 5 are mounted in a collector.

With reference to Figures 1, 2, 3, and 4, a separating and collecting device is illustrated as having a separating chamber 10, collecting hopper 11, and an exhaust 12 through which is discharged the quantity of the medium from which a body is to be separated, which quantity is taken from the separating devices simultaneously with the body or medium to be collected. The combined bodies are introduced through an inlet 13 formed in the housing 10 and the body from which separation is effected is discharged through the outlet 14, the path of this body thus being straight through the separating device.

Within the housing 10, a plurality of spaced vertical rows of separating elements or chambers are provided, these rows being illustrated in Figure 2. While the number of rows constitutes no part of the present invention, the device described herein is shown as embodying four vertical banks of separating elements arranged in two groups of two vertical banks each. Between the two groups of banks, a vertical passage 15 is formed, this passage being illustrated in dotted lines in Figure 2. Upon the outer side of the groups of banks, additional passages 16 are pro-

vided, these passages communicating with the outlet 12 of the device.

With reference to Figure 3, each independent separating element will be seen to include a wind tunnel 17 having one side thereof formed with a longitudinal slit 18, this slit being formed by expanding one edge of the slit to a greater radius than the other, thus affording an outlet for a body travelling about the inner periphery of the tunnel in the direction of the surface of the expanded edge. For a portion of the circumference of the tunnel 17, therefore, the contour does not follow a truly cylindrical path but diverges outwardly in a suitable spiral fashion.

The tunnel flares outwardly at either end from the substantially cylindrical section to squared sections 19 at the entering end and 20 at the exhaust end. Fluting 21 is formed therein to effect this transformation in contour of the tube. In the intake end 19 of each tube is provided a vane or vanes 22 formed about a central hub 23 and curved in such fashion that the flow of the medium entering the tube will be changed to a whirling motion having not only a component in the direction of the axis of the tube but a component in a direction transverse to the axis thereof. The pitch of the vanes 22 is such as to cause the direction of whirl to follow the direction of the expanded edge of the longitudinal slit and thus the heavier bodies carried by the entering medium are directed outwardly against the internal surface of the wind tunnels and escape through the longitudinal slits 18.

The substantially cylindrical portion 17 of each tube is formed with a rectangular housing 24 which is formed with a longitudinal slot 25 to receive the protruding portion of the expanded portion 18 of the tunnel. At spaced points along the length of the slotted side of the housing 24, vertical vanes 26 are secured, these vanes lying in planes perpendicular to the axis of the housing 24 and preferably being so spaced as to cooperate with the corresponding vanes of adjacent tubes to form substantially continuous vertical channels. The size of the vanes is such that they not only abut with cooperating vanes of tubes in the same horizontal plane but with the corresponding vanes of cooperating tubes in the vertically spaced banks of tubes. Each of the vanes 26 is formed with a cut out portion 27 to receive the expanded edge 18 of the respective tubes and it will thus be seen that the cooperating vanes form vertical channels into which the separated body from the separating tube 17 is directed downwardly (see Figure 4).

In the upper portion of the hopper 11, longitudinally extending deflector plates 28 may be provided, a partition 29 serving to separate the hopper into a plurality of sections, each provided with deflecting plates 28. The deflecting plates need not be used if the velocity of the separated medium is reduced sufficiently after emerging from the slits 18, the body separated by the separating devices being collected in the hopper 11 and air or other medium carried over with the separated and collected body being discharged upwardly through side channels 30 into the outlet 12.

With reference to the construction shown in Figures 5 and 6, the independent separating elements comprise an intake tube 31 which may be of rectangular cross section and formed with vanes 32 corresponding with the vanes 22 of the device described in connection with the construction shown in Figure 3. The tube 31 is formed with a conical converging portion 33 which terminates in a cylindrical portion 34 and an outwardly flaring skirt 35. Axially disposed with respect to the intake tube 31 is an exhaust tube formed with a squared extremity 36 and an elongated tapering tubular portion 37 having an inlet end 38 which is received within the skirt 35 and is of a diameter less than that of the cylindrical portion 34 of the tube 31. A desired overlap of the skirt and intake end 38 of tube 36 is provided, the tubes being secured together by oppositely extending vanes 39 which are riveted to the respective tubes. Vanes 39 are formed with a straight outer edge 40 and an inner edge which conforms to the contours of the adjacent portions of the tubes 31 and 36. Between the portions of the vanes secured to these tube portions, however, curved recessed portions 41 are formed to permit a limited degree of whirling motion of the separated body after it leaves the skirt 35.

In assembling the tubes shown in Figure 5, the vanes 39 are placed in vertical planes and in abutting relationship as shown in Figure 6. The vanes thus form vertical channels in combination with the adjacent sides of the tubes to which the respective vanes are connected, these vertical channels being broken only by the apertures formed by the recesses 41.

In the construction shown in Figures 5 and 6, therefore, it will be seen that the medium is introduced at 31 into the vanes 32 which impart a whirling motion thereto. The heavier body is thus directed very forcefully outwardly against the converging surface of the conical extension 33 of the tube 31 and, when it reaches the cylindrical portion 34, a vortex has been created, the outer portion of which comprises the heavier body and the inner portion of which the lighter body. As the medium passes through the cylindrical portion 34, the heavier body will thus follow the outwardly flaring skirt 35 and escape from the separating chamber, while the lighter body passes into the tube 37 to be discharged through the outlet 36.

As shown in Figure 6, the partition walls 39 of vertically adjacent separating chambers abut to define the walls of a passage through which the heavier substance is discharged from a series of horizontally and vertically spaced separating chambers. These walls break up the whirling motion of the heavier substance as it leaves the separating chamber and direct the same into well defined courses to effect the separation and collection thereof.

It will thus be seen that the separating devices above described form a venturi through which the fluid passes in a uni-directional fashion. The inlet chamber of the venturi is formed with a converging portion into which the fluid is directed with a whirling motion and the outlet chamber of the venturi is formed with a taper to provide an expansion chamber. At the throat portion of the venturi, separation of the solid particles from the gaseous or lighter particles takes place.

While the invention has been described with specific reference to the accompanying drawings, it is not to be limited, save as defined in the appended claims.

I claim as my invention:

1. Means for separating a heavier substance from a lighter one comprising an elongated cylindrical chamber, means for directing a medium

through the chamber with a whirling motion, an elongated slot in the chamber parallel to the axis thereof, a wall associated with the exterior of the housing adjacent the slot and formed with an elongated slot to receive the outwardly offset edge of the slot in the chamber, and fins secured to the wall in planes perpendicular to the axis of the housing.

2. Means for separating a heavier substance from a lighter one comprising an elongated cylindrical chamber, means for directing a medium through the chamber with a whirling motion, an elongated slot in the chamber parallel to the axis thereof and having an edge projecting outwardly, and a rectangular housing over the cylinder and formed with a slot to receive the outwardly projecting edge of the slot in the chamber.

3. Means for separating a heavier substance from a lighter one comprising an elongated cylindrical chamber, means for directing a medium through the chamber with a whirling motion, an elongated slot in the chamber parallel to the axis thereof and having an edge projecting outwardly, a rectangular housing over the cylinder and formed with a slot to receive the outwardly projecting edge of the slot in the chamber, and fins secured to the wall of the housing formed with a slot and lying in planes perpendicular to the axis of the chamber.

4. Means for separating a heavier substance from a lighter one comprising an elongated cylindrical chamber, an inlet for the chamber formed with means to impart a whirling motion to a medium introduced into the chamber, a tapering channel between the inlet and the chamber, an elongated slot in the chamber, and an outlet for the chamber.

5. Means for separating a heavier substance from a lighter one comprising a housing, spaced separating chambers in the housing, an outlet for the housing, means in the adjacent sides of the chambers to discharge a separated medium in a common direction into the outlet and parallel walls on the chambers parallel to the axes thereof to define the path of the discharging medium.

6. Means for separating a heavier substance from a lighter one comprising a housing, separating chambers spaced in horizontal and vertical rows, an outlet for the housing, apertures in the chambers, and vertical partition members on the chambers parallel to the axes thereof to define a common discharge path for medium from a plurality of the chambers.

7. Means for separating a heavier substance from a lighter one comprising a housing, spaced separating chambers in the housing, an outlet for the housing, the sides of the chambers adjacent to each other being formed with apertures to discharge a separated medium substantially tangentially thereof in a common direction into the outlet, the last named apertures in the chambers lying wholly upon the adjacent sides of the spaced chambers.

8. Means for separating and collecting a heavier substance from a lighter one comprising an elongated cylindrical chamber wall, means for directing a medium through the chamber with a whirling motion, an elongated slot in the chamber wall having inner and outer edges formed by radially spaced portions of the wall, the axis of which slot is parallel to the axis of the chamber and the edges of which are radially offset with the outer portion of the cylindrical wall increasing its radius in the direction of whirl, whereby the whirling fluid adjacent the chamber wall will pass through the slot under its whirling motion, and a wall the surface of which is at an angle to the adjacent outer surface of the chamber associated with the exterior of the chamber adjacent the slot and formed with an elongated slot to receive the outwardly offset portion of the cylindrical wall forming the outer edge of the slot in the chamber, and engaging the outer surface of the cylindrical wall upon opposite sides of the slot therein, whereby the whirling action is taken out of the fluid and collection thereof is facilitated.

9. A separating device comprising a venturi through which a whirling fluid is adapted to flow unobstructedly, said device comprising an imperforate converging Venturi portion adapted to receive a whirling fluid, a Venturi throat portion receiving the whirling fluid from the converging Venturi portion and having an outlet, and an imperforate Venturi outlet chamber diverging continuously from the portion of the inlet of the outlet chamber adjacent the outlet of the throat to receive fluid therefrom and forming the expansion chamber of the venturi, the throat portion being formed with an opening to effect a separating action upon solid particles carried by fluid directed through the device, whereby continuous unobstructed uni-directional flow of fluid through the device is effected.

10. A separating device comprising a venturi through which a whirling fluid is adapted to flow unobstructedly, said device comprising a converging Venturi portion adapted to receive a whirling fluid, an unobstructed Venturi throat portion receiving the whirling fluid from the converging Venturi portion and having an outlet, and a Venturi outlet chamber diverging continuously from the portion of the inlet of the outlet chamber adjacent the outlet of the throat to receive fluid therefrom and forming the expansion chamber of the venturi, the throat portion being formed with an opening to effect a separating action upon particles carried by fluid directed through the device, whereby continuous unobstructed uni-directional flow of fluid through the device is effected.

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