April 12, 1932. C. E. LUCKE 1,853,868

SEPARATOR

Filed Aug. 7, 1928 2 Sheets-Sheet 1

Fig 3

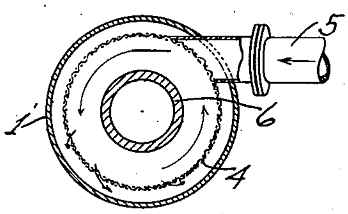


Fig 1

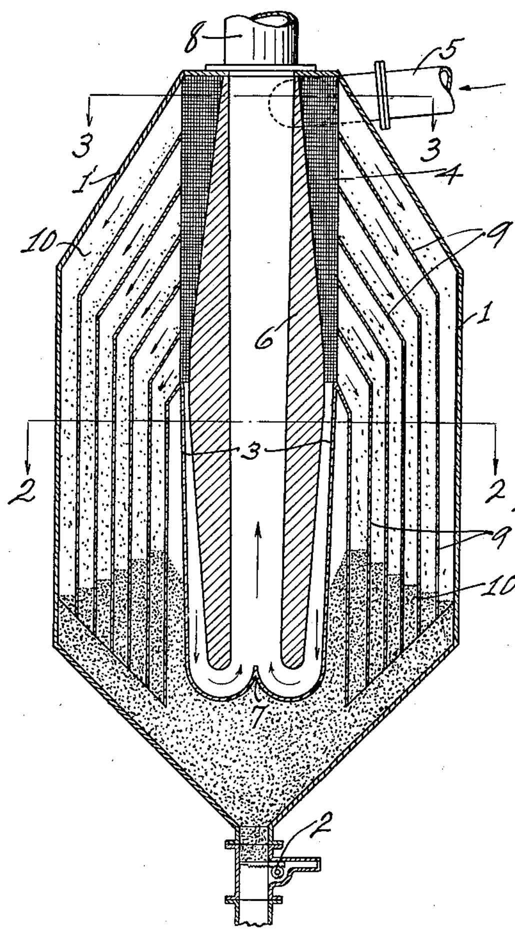


Fig 2

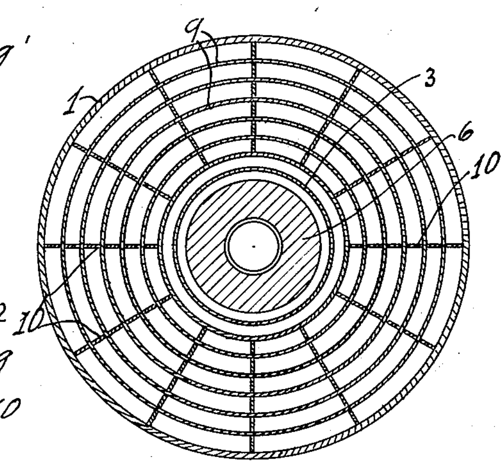


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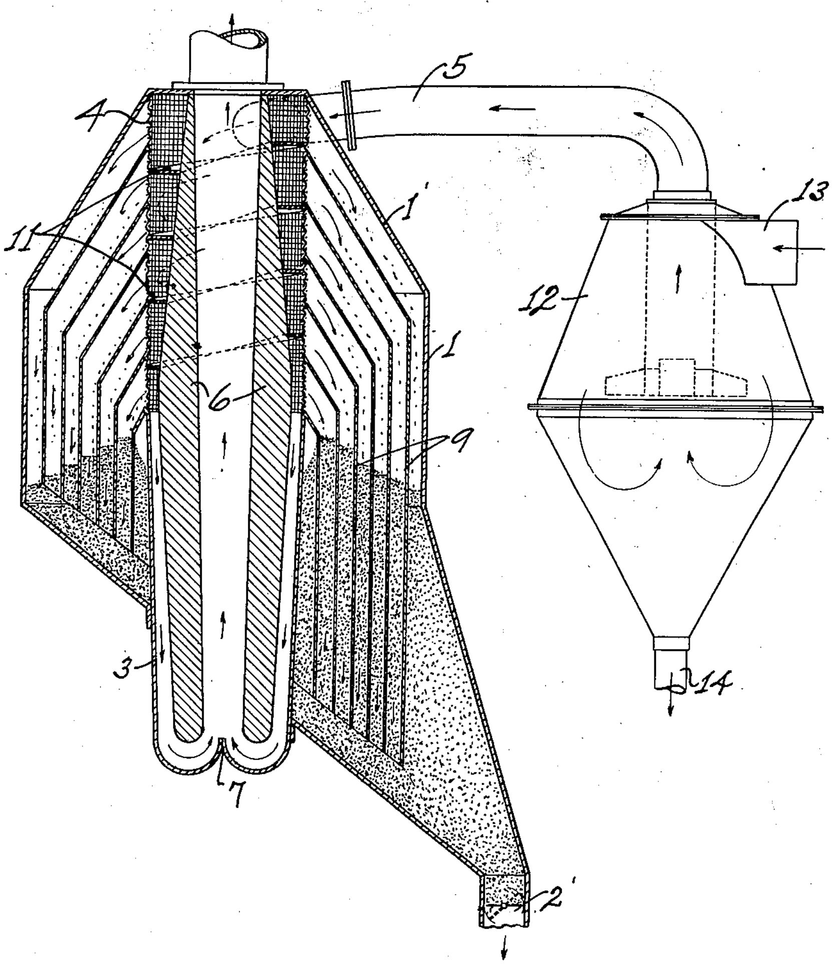
Fig-4

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# UNITED STATES PATENT OFFICE

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## SEPARATOR

Application filed August 7, 1928. Serial No. 297,956.

This invention relates to a separator. By this invention dust or solid particles may be separated from gas, air, or vapor or the like, or solids may be separated from liquids by centrifugal force without causing a large draft loss or pressure drop due to friction through the separator. Liquid drops may also be separated from vapors or gases. The word "dust" will be used to include both fine and coarse particles.

The invention will be understood from the description in connection with the accompanying drawings, in which Fig. 1 is a vertical section through an illustrative embodiment of the invention; Fig. 2 is a section along the line 2—2 of Fig. 1; Fig. 3 is a section along the line 3—3 of Fig. 1; and Fig. 4 is a vertical section through a modification.

In the drawings reference character 1 indicates a cylindrical casing that is provided with an upper conically shaped portion 1′ and the bottom portion is also preferably reduced and a valve 2 is located in an outlet leading away from the bottom of the casing. A cylinder 3 extends downwardly from the upper end of the casing 1 and the upper portion thereof is perforated, as indicated at 4. The upper portion may be made of a wire mesh, for example, to provide the perforations. An inclined tangential inlet 5 passes through the conical upper portion 1′ of the casing and enters the upper end of the perforated portion 4 of the cylinder 3, so that the incoming material will follow a helical path, and fill the space between the walls when it is introduced into the separator through a nozzle of proper size and position. A hollow core 6 is located in the cylinder 3 and is tapered from near the middle portion toward both ends to provide annular spaces of changing cross-sectional area between the core and the cylinder 3. The lower end of the cylinder 3 is closed, as shown at 7. An outlet 8 extends from the top of the casing 1 and is connected to the upper end of the opening through the core 6.

Concentric partitions 9, that are circular in cross-section, are located between the casing 1 and cylinder 3. These partitions are of different sizes and the upper ends 9′ are conically shaped and terminate in contact with the outside surface of the perforated portion 4 of the cylinder 3, thus providing annular conduits from the perforated portion 4 that extend downwardly in the casing 1. Radial partitions 10 are also provided between the cylinder 3 and casing 1. The partitions 9 and 10 terminate approximately at the same level as the lower end of the cylinder 3, leaving a space for the collection of dust in the lower portion of the casing 1.

The dust may be permitted to accumlate to a sufficient depth to close the lower ends of the dust conduits formed by the partitions 9 so as to provide dead zones in which the dust settles by stopping all movement of the gas, air, vapor or steam, from which the dust or solid material is being separated and preventing currents leaving perforations at one level and re-entering at another level.

In the modification shown in Fig. 4 the lower ends of the partitions 9 are made sloping to correspond to the sloping lower end of the casing 1 and the valve 2′ is located in an outlet from the casing.

In this modification the cylinder 3 extends through the sloping bottom of the casing 1. Also a helical partition 11 is located in the space between the perforated portion 4 of the cylinder 3 and the core 6, so that the dust laden gas that enters through the inlet 5 follows a spiral path in this space and fills the passage.

In either modification of the invention the dust laden fluid may be passed through a cyclone separator of well known type 12 before it enters the pipe 5. The dust laden gas enters the cyclone separator 12 through the inlet 13 and the major portion of the coarser solid particles are separated and withdrawn through the outlet 14. The pipe 5 extends into the cyclone separator 12 some distance below the upper end thereof and the gas that has been partially freed from solid materials enters this pipe from the cyclone separator and then passes to the dust separator above described.

The operation is as follows:

Dust laden fluid such as gas, or air, or the like, enters tangentially from the pipe 5 into the widest portion of the space between the perforated portion 4 of the cylinder 3 and the core 6, filling the space, and passes spirally around in this space with a whirling motion so that the coarsest particles are thrown out through the perforations into the uppermost dust conduit, the next smaller size of dust or solid particles is thrown into the next lower conduit and so on toward the bottom of the perforated portion where the finest dust is thrown out. The fluid passing helically downwardly through the space that is decreasing in size and filling the space, has its velocity increased, so that it is greatest at the point where the wall of the core 6 is thickest; the result is that the finest particles are thrown out at the narrowest space where the velocity is greatest. After the fluid passes the most restricted space or smallest flow area between the cylinder 3 and core 6, it enters a space of gradually increasing cross-section and fills the space, thus permitting its velocity to decrease. The velocity is thereby converted into pressure to minimize the over-all pressure drop. In this way the flow passage is made equivalent to an annular Venturi tube. The cleaned fluid then passes through the opening in the core 6 and out through the outlet 8.

The increasing velocity of the whirling fluid over the perforated walls may be secured by using a cylindrical core 6 with a conical tube 3, or by other geometrical combinations, without departing from the invention. Also the decreasing velocity following completion of dust separation at the maximum velocity may be omitted when the overall loss of pressure through the apparatus is of no consequence.

When liquid drops suspended in vapors or gases or fogs, are passed through the separator, they are removed in a similar manner.

I claim:

1. A separator comprising a casing, intersecting partitions in said casing with portions extending longitudinally of said casing, and having alined openings into the spaces between the partitions, and means to project material at different velocities into the spaces between said partitions.

2. A separator comprising a casing, intersecting partitions in said casing, some of which are concentric with each other, having aligned openings into spaces between the partitions, and means to project material at different velocities into the spaces between said partitions.

3. A separator comprising a casing, circular and radial partitions in the said casing, some of which are concentric with each other, having aligned openings into spaces between the partitions, and means to project material at different velocities into the spaces between said partitions.

4. A separator comprising a cylindrical casing having a conically shaped end portion, intersecting partitions in said casing having aligned openings into spaces between the partitions, and means to project material at different velocities into the spaces between said partitions.

5. In a separator, a casing, a perforated cylinder in said casing, circular partitions around said cylinder with reduced ends contacting with said cylinder at different points, and means to project tangentially into said cylinder fluid in one phase laden with particles in another phase.

6. In a separator, a casing, a perforated cylinder in said casing, a core in said cylinder tapered in two directions, and means to project tangentially into said cylinder fluid in one phase laden with particles in another phase.

7. In a separator, a casing, a perforated cylinder in said casing, a hollow core in said cylinder tapered in two directions, and means to project tangentially into said cylinder fluid in one phase laden with particles in another phase.

8. In a separator, a casing, a perforated cylinder in said casing, a core in said cylinder providing a restricted annular space intermediate the ends of the cylinder, and means to project tangentially into said cylinder fluid in one phase laden with particles in another phase.

9. In a separator, a perforated wall, means forming a fluid passage decreasing in size along one side of said wall, and separated chutes along the other side of said wall, and partitions in said chutes.

10. In a separator, a perforated wall, means forming a fluid passage decreasing in size along one side of said wall, and then increasing in size to produce a Venturi effect and separated chutes along the other side of said wall, and partitions in said chutes.

11. In a separator, a cylindrically shaped perforated wall, means to pass fluid in one phase laden with particles in another phase at an increasing velocity along one side of said wall, and separated chutes comprising cylinders concentric with said wall and with each other along the other side of said wall.

CHARLES E. LUCKE.